A Text Book
of

GEOGRAPHY

For
CLASS X

The Jammu and Kashmir State Board of School Education
Srinagar/Jammu

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Foreword

The Jammu and Kashmir State Board of School Education initiated the process of review and revision of the school curriculum to make it as per the demands of society in the light of the recommendations of National Curriculum Framework-2005. The richness of school curriculum makes the social fabric healthy which in turn is indispensable for the growth of the society. As the societies are always evolving and are dynamic, therefore, continous updation and modification in the school curriculum is essential to be in tune with the paradigm shift in the exposition of knowledge and changing demands of the society. With this idea at the core the textbook of Geography for class 10th is reviewed and redeveloped. This is an effort at our end to promote academic standards constantly by ensuring the books that infuse the children with the zest to explore knowledge.

It gives me immense pleasure that his book is written from perspective that it will surely facilitate the learners in appreciating the delicate balances between human and physical elements that bind people to this planet. This book will excite the curiosity of the students and they will be able to explore and understand why communities are located where they are how people have shaped them into distinct places and how in turn they have affected peoples' lives. The content in this book will sensitize the students to use the geographical knowledge to solve problems and make desisions in their daily life.

It will provide the knowledge to locate suitable places to grow food and to organize natural resources to provide clothing and shelter. Thus the learners will be able to comprehend the earth and its environment and more specifically the geographical conditions of our own state as the content has been contextualized with respect to the state of J&K.

The text book is conceived in such a way that it will ameliorate the problems of curricular burden. The greater consideration for child psychology, use of simplified language and keeping the original spirit of the NCERT textbook intact has added to the beauty of the book.

The Jammu and Kashmir Board of School Education gratefully acknowledges the active support and encouragement offered by the Hon'ble Education Minister Shri Naeem Akhtar, in its efforts to revise the curriculum. It is also grateful for the use of the textbook of Geography entitled "Contemporary India" published by NCERT, New Delhi as benchmark for preparation and construction of the textbook with local specific touch and infusion.

I am grateful to all the experts who were involved in the development of this textbook and especially Dr. Mohammad Shafi Bhat, Sr. Assistant Professor, Kashmir University but for his guidance this book would not have seen the light of the day. I also acknowledge the support of Prof. Veena Pandita Secretary, JKBOSE. I place on record my deep appreciation to Ms. Kaneez Fatima, Director Academics, and her team Mrs. Aliya Qayoom and Mrs. Monica Sharma, Academic Officers for their efforts in bringout the book.

The contribution made by Prof. Sheikh Mehraj-ud-din, S.P. College, Srinagar for reviewing and editing the book, is also acknowledged and appreciated.

As an organization committed to systemic reforms and continous improvement in the quality of its products, JKBOSE welcomes comments and suggestions which will enable us to undertake further revision and refinement.

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1

Resources: Concept, Classification and Management

Dear Students! When you feel hungry you eat something like a banana or an apple, and when you are thirsty you drink something like juice or water. Whenever you feel fatigue you try to relax yourself by visiting a garden. Therefore a banana, a glass of water, and a visit to a garden are the things which help you in satisfying your needs, constitute what we call as resources. ***Therefore a resource has been defined as any means of attaining given ends***. A resource is a source or supply from which benefit is produced. Typically **resources** are materials, energy, services, knowledge, or other assets that are transformed to produce benefit and in the process may be consumed or made available. Resource is needed to satisfy human wants. Water, air, sunlight, land soil, forests, wildlife, fish and minerals are resources all useful to mankind.

Fig.1.1 *Resources*: minerals, forest, water, crops

The vast deposits of mineral resources were unknown to pre-historic man. He knew little about them or their uses; therefore, to him they were mere natural substances which did not affect his life. Until someone invented the sailing ship, and later, the windmill, the wind was of little use. Coal had no real significance before the invention of the steam-engine. Waterfalls have long been used to turn wooden-mill wheels but became very valuable when harnessed to generate electricity. Uranium was of no use until the discovery of radioactivity.

In brief, whether a natural object is useful depends upon man's ingenuity and the level of his technology and scientific advancement. Resources which are developed for satisfying human wants are produced by an interaction of nature, man and man's culture. But human wants continue to multiply. With the passage of time man improves his knowledge and develops new resources to meet his increasing demands.

Changing Concept and Definition of Natural Resource

The term 'Natural Resource' has undergone an expansion in meaning as a result of man's greater understanding of his relationship with the world he lives in. Early in the twentieth century natural resources were viewed primarily as sources of valuable and useful commodities. They were mostly the raw materials present in the environment that man could use, e.g., minerals and fuels, forests and grazing resources, wildlife, and fish. More recently the concept of a natural resource has been broadened to include the total natural environment. In real sense it encompasses the entire surface layer of the earth, because all parts of the earth's surface are of some use to man as they contribute to the production of necessities and amenities that people demand. Thus from this point of view all living and non-living elements of the Atmosphere, the Oceans, the Deserts, the Polar, Tropical and Temperate regions, and the interior of the earth, too have become valuable resources. All these resources are to be utilised scientifically and managed with care to provide necessities and comforts to the present as well as future generations.

Classification of Resources

The environment we live in has ample and enormous reserves of natural resources. These resources, for a systematic study, may be classified into the following types as per the table1.1

1	Classification based on origin of resources	Biotic	Abiotic
2	Classification based on renewability	Exhaustible	Inexhaustible
3	Classification based on state of development	Potential	Developed
4	Classification based on nature of resources	Energy	Mineral

1. Classification based on the origin of resources:

Biotic Resources

The most clearly recognizable natural resources are those consisting of living things. Forests, agricultural crops, wild and domestic animals, birds and fish are all biotic resources. ***They can continue to reproduce and regenerate their population as long as environmental conditions remain favourable and an adequate seed source is maintained***.

Fig,1.2 Biotic Resources: paddy field, forest, sheep, fish

All biotic resources are therefore, renewable. The renewability of a living resource varies with the species and the area involved. Agricultural crops mature within a year and dieback and hence they are annually renewable. Perennial plants and trees may have much slower rates of renewability. The maple trees in the valley of Kashmir, locally called as Chinar grow at a very slow rate and therefore, government has imposed strict ban on cutting of chinars to

preserve them. Many species of wild animals e.g., the lion and the tiger are endangered species consequently their preservation and conservation has become essential for their survival.

Abiotic Resources:

Abiotic resources consist of non-living things. In general, they may be considered mostly non-renewable. Minerals and fossil- fuels, such as coal, petroleum, and natural gas are abiotic and hence least renewable resources.These resources are exhausted by reckless use, while their rate of formation is exceedingly slow. All minerals are abiotic resources and they are non-renewable. Certain abiotic minerals such as iron and aluminum are widely distributed throughout the earth's surface. Other minerals such as gold, silver, and platinum are much more limited in their distribution and quantity. The usefulness of the abiotic resources (rocks and minerals) depends upon their accessibility and concentration.

Fig1.3, Abiotic Resources: iron, copper, coal and petroleum

Past experience shows that abiotic resources are exhaustible. The gold deposits of the Kolar gold mines (Karnataka) and the iron ore deposits of the Mesabi Range (U.S.A) have been considerably depleted.

Some abiotic resources, however, are renewable. Manganese ore, for example, is relatively scarce on the land surface but it is continuously being formed in nodules on the ocean floor, just as cobalt nickel and copper are. The rate at which the nodules of manganese, cobalt, and nickel are growing through chemical precipitation from sea-water exceeds the rate at which these minerals are being used, although the efficient technology for the recovery of these minerals from the ocean floor is yet to be evolved. Attempts in this direction are being made with the development of ocean floor mining technology, with the help of which these minerals will be considered renewable.

2. Classification based on Renewability Exhaustible Resources:

The metals and minerals obtained from earth are exhaustible. ***Once these minerals are taken out they cannot be replaced***. All non-living things obtained from the earth by mining to satisfy human wants are exhaustible by nature. Coal, petroleum, natural gas, iron ore, copper, aluminum, bauxite, uranium, thorium, and sulphur are some examples of exhaustible resources. Continuous mining of a given mineral will exhaust the ore and therefore, mining and extraction of minerals is called a 'robber industry.' Men may apply the latest techniques to extract every bit of valuable ore, but they cannot replace the minerals that are mined. The natural replacement of minerals through geological events and processes

Fig.1.4 Exhaustible Resources: LPG, gold, copper, aluminum

are exceptionally slow, and can not compensate the current rate of mineral extraction. All minerals are, thus, a finite and declining resource available to man,

Fossil-fuels, e.g., coal, petroleum, and natural gas are those organic materials that have been converted from living organisms into fossil fuels through physical and chemical processes within the earth's crust. If these substances are completely burned as fuel they cannot be renewed and therefore, they are the most rapidly exhaustible resources.

On the basis of existing knowledge about the fossil- fuels in the earth's crust, it has been estimated that the supplies of petroleum and natural gas may be exhausted by the end of twenty first century at the current and anticipated rate of extraction. Although coal supply is greater, the rate of its use indicates that it cannot be expected to last for more than a few centuries. Although nuclear fuels are inorganic in nature, like fossil-fuels they are destroyed when 'used in the production of heat energy. The supplies of uranium and thorium though relatively abundant, are also exhaustible and non-renewable.

Metallic minerals such as Iron, Copper, Lead, Tin, Zinc, Aluminum, Silver, Gold, Antimony, Platinum, Nickel, Manganese, Cobalt, Uranium, Thorium, and Titanium, and **non-metallic minerals**, ***e.g***., Mica, Graphite, Asbestos, Sulphur, Phosphate, Gypsum and Potash deposits are fixed in quantity, they cannot be increased or replaced. In fact, the known mineral deposits are decreasing so rapidly, that in future civilisations may be threatened by their shortage, unless the situation is improved by new discoveries of deposits and use of substitutes. In the developed countries of Europe and America, already a shortage of mineral resources is being felt. India is favourably placed in many of the exhaustible resources; their use, however, needs to be carefully made to preserve them for our future generations.

Inexhaustible Resources

Resources which can be renewed by reproduction or by physical, mechanical, or chemical processes are known as inexhaustible resources. Solar energy, air, water, wildlife, forests and human beings are examples of inexhaustible resources.

Solar energy is an almost inexhaustible resource with respect to the human use and time scale. Solar energy due to its tremendous potential especially in tropical and subtropical regions of the globe is being considered as vital source of alternative and clean energy. Solar lighting and solar heating is fast gaining currency and technology is rapidly improving in this regard.

Fig 1.5: Inexhaustible Resources: air, water, sunshine, soil

Air is also an inexhaustible resource in the sense that its use by man and other living organisms such as plants and animals have little effect on its total quality. The quality of air, however, as measured in terms of its chemical composition, is subject to human interference. For life to exist on the earth there must be a proper balance among nitrogen, oxygen, carbon dioxide, water vapour and other components of the atmosphere

Water is regarded as an inexhaustible resource, because the total supply of water on the surface of the earth and the atmosphere is hardly affected by the activities of man. Water is not destroyed by most human uses, although it may be held for a time in combination with other chemicals. Water that falls from the atmosphere in the form of rain and then runs off the land surface to form streams and rivers that eventually reach the oceans or lakes, generally operates

on a one-year renewal cycle. The cyclic movement of water from hydrosphere to atmosphere and then to lithosphere and finally back to oceans is known as the hydrologic cycle. It is the renewal cycle that determines the amount of water available for human use and for all other purposes in any particular location.

However, we should note that air and water despite being in abundance, pollution caused by reckless use and mismanagement occasionally renders it unfit or unusable for further human consumption and thereby causing scarcity. Exceedingly high levels of water pollution and contamination in rivers such as Ganga,Yamuna, Jehlum, Amu Darya, Huang-Ho and Rhine are glaring examples of human interference with hydrological systems. This brings out the lesson that it is very necessary to make a proper use of nature's 'free' gifts.

Resource Development

There are some natural resources, which cannot be used directly to satisfy human needs. One has to make an effort and develop them to enable their utilization. Land has to be cleared of unwanted materials and ploughed in order to grow crops. Water has to be taken to fields to irrigate lands. Minerals have to be taken out from the earth and smelt before they are used for making machinery and implements. Resource development, thus, is a necessary exercise for its utilisation.

While using the natural resources, we should keep in mind the nature, type and the size of these reserves. If the reserve is limited, we have to preserve a part of it for future use and future generations. Resources like ocean water, solar energy, wind energy and climate are inexhaustible resources. These are good gifts of nature. We must see that they are not contaminated. Our birds and animals should be protected from human exploitation. If we use land for cultivation, we should also see that its fertility is maintained. Some resources, like iron, tin, copper, gold and silver, are exhaustible, but reusable as well. We must emphasize **Reuse** and **Recycling** of these resources. Resource development is not only the exploitation of the gifts of nature; it isalso concerned about preservationand reuse of natural resources.

Resource Planning

As the resources are limited and unevenly distributed over the country, their planning is essential.Resource planning is a technique or skill of proper utilisation of resources. Resource planning is comprised of three stages:

(i) Preparation of inventory of resources,

(ii) Evaluation in terms of availability for development,

(iii) Planning for exploitation of resources.

The first stage includes surveying, mapping and measurement of the characteristics and properties of resources.The second stage examines resources from the points of view of technology, economy and need.The third stage is related to action-oriented planning which emphasises use and reuse of the resources.

Important natural resources in the country are land, forest, wildlife, water and minerals. Agriculture is based on proper utilisation of land resources. Industries use forest, wildlife, water, mineral, agriculture and power resources to provide goods. Transport, communication and trade provide infrastructure for development of resources. Humans play a significant role in the process of resource development and its management. Economic development of a nation depends to a great extent on the richness, development and management of resources. Over-exploitation and excessive use of resources due to over-population leads to the problems of waste generation and pollution. Attempts to increase agricultural production by excessive use of fertilisers and insecticides cause pollution and affect plant and animal life. Unscientific exploitation of minerals releases dust, inorganic effluents and smoke which leads to degradation of crop lands. Resource planning, thus, helps people in several ways. It reduces wastage, keeps the environment pollution free and takes care of future needs.

Environmental degradation and depletion of natural resources

Environmental degradation can change potentially renewable resources into nonrenewable resources which ultimately leads to the depletion of these precious gifts of nature. Some of the main practices which lead to the environmental degradation and the subsequent depletion of the resources are:-

1. ***Covering productive land with water, concrete, or buildings so that plant growth declines and wildlife habitats are lost.***
2. ***Cultivating land without proper soil management, causing soil erosion and depletion of plant nutrients. Every year about 25 Billion tons of top soil is being eroded because of unscientific farming practices.***
3. ***Irrigating crop land without proper drainage, causing water-logging of fields. About 10% of the crop land of the world is affected by such unscientific agronomic practices.***
4. ***Taking fresh water from underground sources, streams and lakes faster than it is replaced by natural processes.***

5. ***Destroying wetlands like Anchar and Hokersar in Kashmir. One third of the world wetlands have been drained, built upon, or severely polluted***.
6. ***Cutting from large areas (Deforestation) with inadequate replanting. Almost 1/3rd of world's tropical forests have been cleared. Each year about 170000 Km^2 of these forest are cleared worldwide***.
7. ***Overgrazing of grasslands by livestock, which convert productive grass land into unproductive land or deserts (desertification). Each year 60000 Km^2 of new deserts are formed throughout the world***.
8. ***Eliminating wild life species through destruction of habitats, commercial hunting, pest control and pollution***.
9. ***Polluting renewable air, water and soil so that they are unusable***.

What should be done: - Management and conservation of resources.

Our survival, quality of life, and economic life are totally dependent on the sun and the earth. Earth can get along without us, but we cannot get along without the earth,

What should we do to manage and conserve those riches of the earth which form what is known as the **Earth Capital**. The following principles of management and conservation are very important to sustain this earth capital:-

1. Locally available renewable resources should be used where possible, and renewable resources should not be used faster than their replacement by natural processes. This is known as **the Principle of Sustainable Yield**.
2. High quality energy should not be used to do something that can be done with lower quality energy. For example, we do not need to use a chain saw to cut butter. This is known as **the Principle of Energy Efficiency**.
3. Pollution prevention and waste reduction are the best and cheapest ways to sustain the earth. The best way to control pollution and waste is to produce minimum possible waste. This is known as **the Principle of Pollution Prevention and Waste Reduction**.
4. ***Reducing*** Resource consumption and waste production should be top priority, followed by ***Reusing*** items and ***Recycling*** key minerals resources. This is known as **the Principle of Three "R"s of Earth Care**.
5. Products or wastes that can be recycled or reused should not be dispersed, mixed, burned, or buried. This is termed as **the Principle of Resource Conservation**.

6. Last but not least we should consider that everyone is downwind or downstream from everybody. Therefore we should leave all the **Global Commons** like fresh water and fresh air to our next generation as good as we have received them from our ancestors if not in a better position. This is known as **the Principle of Global Commons**.

So, dear students we should follow all these principles in our day to day life so that we could pass this earth and its riches as good as we have received it, if not the better, to our future generations so that the idea of **Sustainable Earth** prevails.

Glossary

1. **Resource:** A source or supply from which benefit is produced.
2. **Biotic Resource:** A resource which continues to reproduce and regenerate its population e.g. fish.
3. **Abiotic Resource:** A resource consisting of non- living things e.g. Coal and petroleum etc.
4. **Exhaustible Resources:** Those resources which cannot be replaced once they are used e.g. coal, Natural Gas.
5. **Inexhaustible Resources:** Those resources which can be renewed by reproduction or by physicochemical process e.g. sunshine, water and Soil etc.
6. **Fossil Fuels:** Coal, petroleum, and natural gas which are made after natural processing of the plants and animals inside in the earth's surface.
7. **Potential Resources:** Those resources whose entire quantity may not be known and or not being used at present.
8. **Reserve Resource:** That part of the actual resource that can be developed profitably with available technology.
9. **Natural Resources:** Those resources which are taken from natural environment e.g. Forests and water.

Exercise

A. Very short answer type questions

Q. No. 1

i) Any means of attaining desired ends can be designated as a_____

ii) The most clearly recognizable natural resources are those consisting of _____things.

iii) The renewability of a living resource varies with the _____and the_____ involved.

iv) The usefulness of abiotic resources depends upon its _____and_____

v) _____energy is an inexhaustible resource relative to the human use and time scale.

B. Short answer type questions

Q. No. 2

i. Define a Resource? Give some examples of Resources.

ii. Which three things interact to develop resources for human satisfaction?

iii. How is manganese ore a renewable resource despite of abiotic nature?

iv. Define inexhaustible resources, give some examples?

v. Difference between the biotic and abiotic resources?

vi. Write a short note on resource development?

vii. What is the principle sustainable yield?

C. Match the following

Q. No. 3

Mesabi Range	Central Asia
Kola Mines	China
Amu Darya	USA
Rhine River	Karnataka
Hwang HO	Europe

D. Long answer type questions

4. The Definition of natural resource has changed over time. Discuss?

5. What are exhaustible resources and how are they different from in exhaustible resources?

6. What is resource planning? Discuss in detail about its various stages.

7. What are various methods which help in managing and conserving the resources?

Activity

1. On the outline map of India show the rivers like the Jhelum & Chenab
2. Name any five things and material used in your day to day life and classify them into various resources groups with the help of following table.

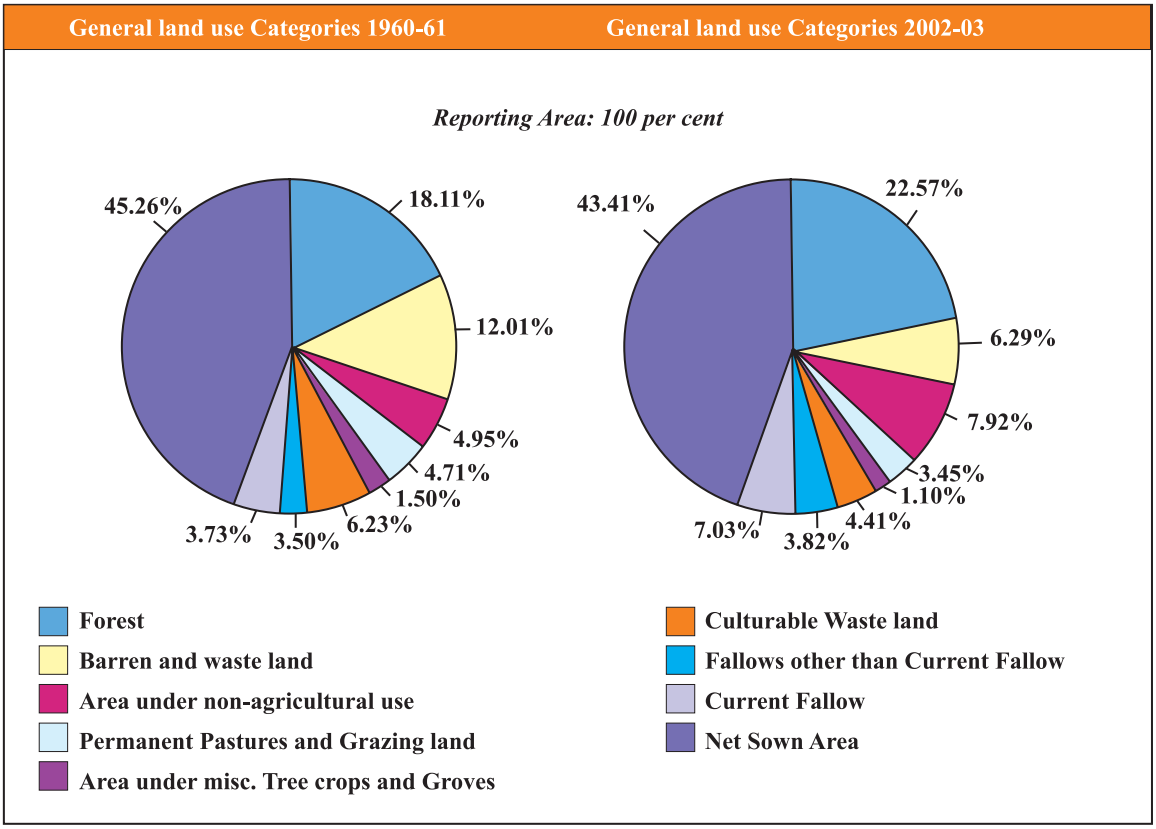
S.No	Name	Biotic	Abiotic	Exhaustible	In- Exhaustible	Material	Abstract

Chapter
2

Land Resources

India is a vast country with variety of relief features like mountains, plateaus, plains, and deserts. We live and perform our economic activities on land and use it for different purposes. Thus land is a natural resource of utmost importance. It supports natural vegetation, wildlife, and provides resources for humans for most of their needs. Land is an asset of a finite magnitude; therefore it is necessary to use it with careful planning.

Although India has a total geographical area of about 328.73 million hectares but the total reported area is only 93%, which accounts for 304.92 million hectares. About 43% land area of India is plain which provide facilities for agriculture and industry. Mountains occupy 30% of total surface area of the country and provide natural resources in the form of fauna and flora (wildlife and forests). Mountains ensure perennial flow of rivers and provide facilities of



Source: Directorate of Economics and statistics, Ministry of Agriculture, GOI , 2010-11

Figure:2.1 Pie diagram showing change in major land use categories from1960-2003

tourism and also render ecological services. About 27% area of the country is plateaus which possesses rich reserves of minerals, fossil fuels and forests.

Land Utilization

Land is used for different purposes such as agriculture, forestry, and mining, construction of houses, roads, railways and setting up of industries. This is commonly termed as Land use. The use of land is determined by physical as well as human factors which include topography, soil, climate, resources, population and available technology. Land utilization statistics provide the figures, showing distribution of the total geographical area of the country into its various uses. The land area in India is classified into various categories. In 1949-50, the land classification in India was adopted which classified the use of land into five major categories. Table 2.1 provides a detailed account of various land use categories during year 2010-11.

Table 2.1 Major Land use in India

S.No	Classification	In million hectares	% of total
	Geographical area	**328.93**	
	Total reported area	**304.92**	**100**
1	Forest area	70.01	22.9
2	Area not available for cultivation	43.56	
a)	Barren and uncultivable land	17.05	5.6
b)	Land under non agricultural use	26.51	8.7
3	Other uncultivated excluding fallow		
a)	Permanent pastures and other grazing lands	10.30	3.3
b)	Land under miscellaneous tree crops and groves	3.21	1.0
c)	Culturable waste land	12.66	4.1
4	Fallow lands	24.59	
a)	Current fallow land	14.27	4.7
b)	Other fallow land	10.32	3.3
5	Net sown area	141.58	46.4
a)	Area sown more than once	57.0	
b)	Gross cropped area	198.58	
c)	Net irrigated area	54.57	
d)	Gross irrigated area	72.78	

Source: Directorate of Economics and Statistics, Ministry of Agriculture, GOI, 2010-11

1. Forests

A forest is best defined as an ecosystem or an assemblage of ecosystems dominated by trees and other woody vegetation. The area of crops raised in the forest and grazing lands or areas open for grazing within the forests remain included under the forest area. India has 70.01 million hectares (22.9%) of total reported area under forests. Forests are classified into three main categories:

(a) Reserved Forest: An area notified under provisions of Indian Forest Act having full degree of protection. In reserved forests, all activities are prohibited unless permitted.

(b) Protected forest: An area notified under provisions of Indian Forest Act having limited degree of protection. In protected forests, all activities are permitted unless prohibited.

(c) Unclassified Forest: An area recorded as forest but not included in reserved or protected category. Ownership status of such forests varies from state to state.

It is important for the government and people to ensure that they increase the area under forests for reasons more than one. A bigger area under forests is an obligation to maintain the ecological balance and for absorption of carbon dioxide, the assemblage of which is likely to enhance the green house effect. This in turn would raise atmospheric temperature at the global stage. It may lead to thawing of ice caps and equivalent rise in sea level, jeopardizing low-lying densely populated parts of the world. Forests provide home to wildlife and also help in its

Fig 2.2 Wildlife, river flow, timber, home of tribal's as different forest resources

continuation. Forest lands also help in permeation of rainwater in the subsoil and regulating the flow of river waters in both rainy and dry seasons. Forests safeguard water and protect the soil from erosion. By retarding the runoff /down slope movement of rainwater, forests help in minimizing ferocity and intensity of floods.

Forests serve various purposes such as:

1. Habitat to flora and fauna
2. Source of livelyhood to the local tribes
3. Source of wild medicinal herbs
4. Source of fire wood, timber, bamboo, fodder, honey, beedi leaves, etc.
5. Forests act as a sink to the greenhouse gasses

Forest land in India is far less than usually accepted scientific norm. For a self-sufficient economy and accurate ecological balance, at least one-third of the total land area must be kept under forests and natural vegetation. In India, forest cover in real terms is only 19.27%. Photographic proof, gained from satellites has confirmed that only about 46 million hectares come under real forests, as opposed to the estimated 70 million hectares, according to the figures of land use pattern.

2. Land not Available for Cultivation

This category consists of land area which is not available for cultivation. India has a total of 43.56 million hectares under land not available for cultivation. It consists of two major categories of land areas:

a. Land put to non agricultural uses

b. Barrenanduncultivated land

Fig:2.3, Land under non agricultural uses: city, railway, highway, reservoir

Land put to non agricultural uses includes all lands occupied by buildings, industries, roads, railways, air ports/strips, under water (e.g. rivers, streams, canals, reservoirs, water tanks), etc. which are put to uses other than agriculture. The land under this category is unfit for cultivation and accounts for 26.51 million hectares (8.7%) of total reported area of the country.

Barren and unculti-vated land the land which cannot be brought under cultivation except at an exorbitant cost, whether such land is in isolated blocks or within cultivated holdings. Rocky mountains/hills, rocky outcrops, deserts, saline lands such as Rann of Kutch, alkaline lands in UP, sandy coastal beaches, weed infected ravine lands of MP, etc fall in this category.

Barren land is the area of land where due to rugged terrain and harsh environmental conditions the plant growth is sparse and poor. Although these lands are unfit for cultivation but are considered as valuable source of many construction materials such as gravel, sandstones, etc. The total amount of barren land in India is 17.5 million hectares which is 5.6% of total reported land area.

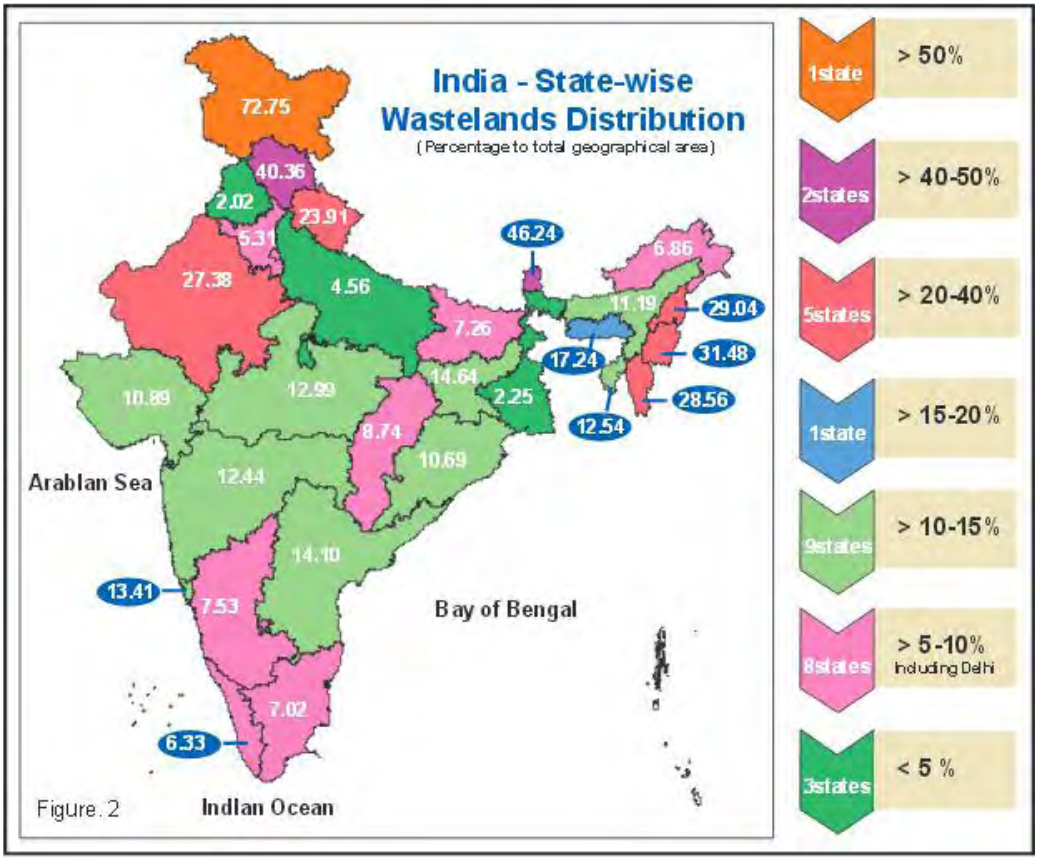


Figure. 2

Source: Wasteland Atlas of India by NRSA

Fig:2.4 State-wise distribution of wastelands

3. Other Uncultivated Land Excluding Fallow Lands

This includes the land area which is included in uncultivated category but which cannot be categorized as fallow lands. In India 26.17 million hectares (8.5%) of land area is under this category, which includes

a. Permanent pastures and other grazing lands

b. Miscellaneous tree crops and groves not included in the net sown area

c. Culturable waste land

Permanent pastures and other grazing lands are used for grazing. Pasture lands are enclosed tracts of farmland grazed by domesticated livestock, such as horses, cattle, sheep etc. the vegetation of pasture lands consists mainly of grasses. These lands are only 3.3% of total area. India has only 0.5% of worlds grazing lands with 18% of global live stock population. Less than one third of feed requirements of live stock are met from Permanent Pastures and other Grazing Lands due to enormous loss of green cover in the country side. Open grazing of live stock is detrimental to plant growth as it makes afforestation efforts unsuccessful. Permanent Pastures and other Grazing Lands could be easily converted in to cattle farms / bird sanctuaries. 10.30 million hectares (3.3%) of land area in India is under permanent pastures and other grazing lands.

Miscellaneous tree crops include all cultivable land which is not included in Net Sown Area but is put to some agricultural uses. Lands under Casurina trees, thatching grasses, bamboo bushes and other groves for fuel etc., which are not included under 'Orchards' are classed under this category. Around 3.21 million hectares (1.0%) land area in the country is under miscellaneous tree crops. This category has also shown marginal decrease during the last fifteen years.

Culturable waste includes land available for cultivation, but not cultivated during the last five years or more in succession including the current year for some reason. Such land may be either fallow or covered with shrubs and bushes which are not put to any use. They may be accessible or inaccessible lying in isolated blocks or within cultivated holdings.

Land once cultivated but not cultivated for five years in succession is also included in this category at the end of the five years. About 12.66 million hectares of land area in India is under cultivable waste land category which is 4.1% of whole reported area.

4. Fallow Land

This includes all lands which were taken up for cultivation but are temporarily out of cultivation for a period of not less than one year and not more than five years. India has 24.59 million hectares of land area under fallow land category. The reason for keeping such lands fallow may be one of the following:

a. Inability of farmers to cultivate
b. Inadequate water supply
c. Malarial climate
d. Silting of canals and rivers
e. Soil erosion
f. Un remunerative farming

These are of two types

a) Current Fallow- the land area which is left without cultivation for one year or less than one year. This category includes 14.27 million hectares of total land area in the country which accounts for 4.7% of the total area.

b) Other than current fallow- land area left uncultivated for the past 1 to 5 years. India has 10.32 million hectares under other than current fallow category which is 3.3% of total land area.

5. Net Sown Area

This represents the total area sown with crops and orchards. Area sown more than once in the same year is counted only once. Around 141.58 million hectares (46.4%) land in India is under net sown area out of total reported area. Good and timely rainfall, weather conditions, prices of agricultural commodities, political stability, security of tenure and tenancy conditions help in increasing the net sown area.

Fig :2.5 Fallow land, Pastures, Crop land

Gross cropped area represents the sum total of area under the crops. The difference between the gross cropped area and net sown area is accounted for by the area sown more than once on the same land during the same year with the same or different crops. For example if a state has ten million hectares of cultivable land (net sown area) and out of which two crops are grown on five million hectares in a calendar year, the gross copped area of the state would be 15 million hectares.

Land Degradation

Land degradation is a process in which the quality as well as quantity of the land is affected by a combination of human & natural factors. It is the gradual destruction or degeneration of the land resource by human activities, animals or natural means for example water and wind. It is also viewed as any change or disturbance to the land perceived to be harmful or undesirable to living organisms. The major agent of land degradation is the human being itself.

Land degradation is the burning topic of the 21st century due its implications upon agricultural productivity, the environment and food security. It is estimated that up to 40% of the world's agricultural land is seriously degraded. Land degradation is caused by water, wind and unscientific agricultural practices. Chemical degradation results from agricultural, industrial, mining or commercial activities. Biological degradation (loss of arable land) is induced by urban sprawl, land use constraints due to armed conflicts.

Land degradation is a serious problem in India. An estimated 107 million hectares was affected by land degradation as per 2010 estimate of ministry of environment and forestry.

Causes

Land degradation is a global problem and is caused by a host of activities mainly induced by humans:

- Land clearance, such as clear cutting and deforestation
- Depletion of soil nutrients through poor farming practices
- Overgrazing and overdrafting
- Inappropriate irrigation
- Urban sprawl and commercial development
- Soil contamination
- Vehicle off-roading

- Quarrying of stone, sand and minerals
- Increase in field size, and reducing shelter for wildlife
- Exposure of soil to heavy equipment in post harvesting period
- Monoculture, destabilizing the local ecosystem
- Dumping of non-biodegradable trash, such as plastics in the feilds.

Measures to Control Land Degradtion:

The mounting population and advanced standards of living have resulted in an ever increasing demand for residential land both in villages and towns. Cities and towns should grow vertically rather than horizontally. Land is needed to develop industry, commerce, transport and recreational facilities.

In view of mounting pressure on land for numerous purposes, it is customary to plan appropriate use of all the obtainable land. This may be done by following measures to control soil erosion, desertification etc.

Fig 2.6 Various forms of land degradation: Deforestation, Erosion, Alkalization and Desertification

In addition, some of the barren lands may be brought under different uses. Likewise, with the help of up-to-date and scientific methods of farming, productivity of land can also be increased. All endeavors should be made to strike a balance amongst diverse use of land. For the maintenance of ecological balance and combating land degradation government of India has already formulated several policies and programmes.

The steps that need to be taken to reclaim the lost land are:

1. Integrated land and water use management
2. Comprehensive approach for formulation of policies in different areas such as food security, forests, soil conservation, and water resources
3. Involvement of the local communities at every stage in the implementation of the projects
4. Judicious management of irrigation with reduction in wastage
5. Prevention strategies- mitigating the erosional impact of rain and wind
6. Wasteland reclamation
7. Social awareness.

Programmes initiated by the government to control the further land degradation:

1. *Integrated Watershed Management in the Catchment of Flood prone area- 1980-81*
2. *National Wasteland Development Board – 1985*
3. *National Watershed Development Projects for Rainfed Areas 1985-86*
4. *Reclamation and Development of Alkali & Acidic soil 1985-86*
5. *Integrated Wasteland Development Project*
6. *Desert Area Development Programme*
7. *Hill Area Development Programme*
8. *Drought prone Area Development Programme*
9. *Command Area Development Programme*

Glossary

1. **Barren and uncultivated land:** Land which cannot be brought under cultivation except at an exorbitant cost.
2. **Urban land use:** It includes all land occupied by building, industries, roads, railways and other such land uses.
3. **Permanent Pastures:** These are enclosed tracts of farm land grazed by domesticated livestock, in which vegetation consists mainly of grasses.
4. **Culturable Wastes:** These include land available for cultivation, but not cultivated during the last five years or more in succession including the current year for some reason.
5. **Fallow Land:** This includes all lands which were taken up for cultivation but are temporally out of cultivation for a period of not less than one year and not more than five years.
6. **Net Sown Area:** This represents the total area sown with crops or orchards.
7. **Land Degradation:** A process in which the quality as well as quantity of the land is affected by a combination of human and natural factors.
8. **Deforestation:** The process of unplanned clearing of tress by human beings, which adversely affects the quality and quantity of forest resource.
9. **Erosion:** The process by which the surface of the earth is worn away by the action of water, wind and glacier etc.
10. **Alkalization:** The process in which subsurface salt comes to the surface through capillary action and adversely affect the quality of the soil. It is usually the result of excessive irrigation in the arid regions of India.
11. **Desertification:** Simply means the expansion of desert into semi arid zones due to loss of vegetation and water bodies mainly because of anthropogenic activities.

Exercise

A. Very short answer type questions

Q. No.1.

i) Total geographical area of India is _____ million hectares.

ii) India covers _____% of global land area and contains_____% of the global population.

iii) About _____ % land area of India is plateau which possesses rich reserves of minerals fossil fuels and forests.

iv) The use of land is determined by physical as well as_____ factors.

v) Cultivable waste includes the land available for cultivation, but not cultivated during the last _____ year.

B. Short answer type questions

Q. No.2.

i) What is the importance of land as a resource?

ii) What are the two major categories of land not available for cultivation?

iii) Differentiate between gross cropped area and net sown area?

iv) Write about four measures that control land degradation?

v) Define a protected forest?

vi) Highlight various factors which are helpful in increasing net sown area?

VII. Name four ways of urban land utilization?

C. Long answer type questions

3. Forests play an important role in the ecology and economy of India. Discuss.

4. What is land degradation and what are its major causes?

5. What is fallow land? What are the various reasons for keeping land fallow?

6. Highlight various programmes that have been initiated by the government to control further land degradation?

Activity

On an outline map of India show the following regions with special attributes:

1. Punjab Plains — Highest Net Sown Area
2. Thar Dessert — Barren land
3. Rann of kutchh — Waste land
4. Northern Rajasthan — Salinisation

Enlist at least 5 States of India and with the help of the following table, mark which of the land degradation type is most prominent in each state.

S.No	Name of state	Deforestation	Erosion	Salinization	Desertification

Chapter 3

Water Resources

Earth is called a "Blue Planet" as most of its surface is covered with water. The total mass of the Earth's hydrosphere is about 1.4×10^{18} tonnes, which is about 0.023% of the Earth's total mass. In spite of the presence of the enormous amount water on earth, the actual utilizable water resource is small and unevenly distributed throughout the globe. Approximately 71 percent of the earth's surface is covered with oceans accounting for 97 % of the global water; which is saline and almost unfit for direct consumption. Fresh water constitutes only about three percent of the total water present on the earth's surface. Out of these three percent approximately two percent is locked in the ice sheets and ice caps of Greenland, Alaska, Siberia, Antarctica and other glaciers around the world. The remaining 1 percent is distributed between ground water (0.30%) atmospheric moisture (0.35%) and the total surface water flowing through streams, rivers and lakes which is easily available for the human consumption is only (0.35%). In fact, a very small proportion of fresh water is effectively available for human use. The availability of fresh water varies over space and time. The tensions and disputes on sharing and control of this scarce resource are becoming contested issues among communities, regions and states. The assessment, efficient use and conservation of water, therefore, becomes necessary to ensure harmony and sustainable development at local, regional and global level.

Water Resources of India

India accounts for about 2.45 percent of world's land area, 4 percent of the world's water resources and about 17 percent of global population. As per the statistics of (India-WRIS-2011) Water Resources Information System of India, the total water available from precipitation in the country in a year is about 4,000 cubic km. It is estimated that out of the 4000 km^3 water, 1869 km^3 is Average annual potential flow in rivers, which is available as water resource. Out of this total available water resource, only 1123 km^3 is utilizable (690 km^3 from surface water resources and 433 km^3 from ground water resources). The water demand in the year 2000 was 634 km^3 and it is likely to increase to 1093 km^3 by the year 2025 which technically means 97 % of India's utilizable potential is to be harnessed to meet the growing demand.

As per the latest reports of Food and Agricultural Organisation (FAO), agriculture is the major user of water in India as it consumes 90% of the replinishable yield of water. Domestic

water-supply uses 8% while as industry consumes 2% of the available water resource. The enormous population size of India (1.25 bn), along with the rapid expansion of agriculture to feed the growing population has increased the demand of water throughout the country. Various global studies as per the FAO have revealed that on an average to produce one kilogram of rice at least 2500 liters of water is used. Furthermore as per the norms of major municipal corporations of India (Mumbai) every person is entitled to at least 50 liters of portable drinking water per/ day. Going by this logic every person, who consumes 500 grams of rice/day, is virtually using around 1500 liters of water on daily basis. Rapid industrialization in India also demands large amount of water for washing, cooling and dying purposes. Widespread contamination and pollution of water bodies at various places have rendered fresh water unusable or unfit for human consumption. All these factors are directly or indirectly contributing to the emerging water crises in India, which can be tackled by adopting various water conservation measures at domestic and industrial level. Furthermore efficient and innovative means of irrigation such as sprinkle and drip irrigation can also be helpful in reducing the pressure on our water resources.

Surface Water Resources

Water that flows on the earth's surface in the form of streams, rivers, lakes or reservoir, etc. is known as surface water resource. There are four major sources of surface water, which includes rivers, lakes, ponds, and tanks. In the country, there are about 10,360 rivers and their tributaries longer than 1.6 km each. The mean annual flow in all the river basins in India is estimated to be 1,869 cubic km. However, due to topographical, hydrological and other constraints, only about 690 cubic km (32 percent) of the available surface water can be utilized.

Groundwater Resources

Water beneath the surface of earth which saturates the pores and fractures of sand, gravel and rock formations is termed as ground water. The total replenishable groundwater resources in the country are about 432 cubic km. The Ganga and the Brahmaputra basins, have about 46 percent of the total replenishable groundwater resources. The level of groundwater utilisation is relatively high in the river basins lying in north western region and parts of south India.

The groundwater utilization is very high in the states of Punjab, Haryana, Rajasthan, and Tamil Nadu. However states like Chhattisgarh, Orissa and Kerala utilise only a small proportion of their groundwater potentials. Gujarat, Uttar Pradesh, Bihar, Tripura and Maharashtra are utilising their ground water resources at a moderate rate.

Irrigation

Water is an important input for successful agriculture. Water may be available to the crops naturally through rainfall or it may be supplied to the agricultural fields artificially by human efforts. The process of supplying water to crops by artificial means such as canals, wells, tube-wells, tanks, etc. from various sources of water is called irrigation.

Importance of Irrigation

1. Water is basic input for agriculture. Cultivation of crops depends on the availability of water. Water dissolves minerals and other nutrients in the ground. The roots of the plants draw this nutritious water from the soil.
2. Water is must for commercialization of agriculture.
3. Irrigation played a major role in the success of Green Revolution in India.
4. Many regions like Punjab, Haryana have become leading producers of rice because of irrigation.
5. Many crops are grown in Rajasthan and other arid regions of India because of irrigation.

Need for Irrigation

The need for irrigation in India arises from the following reasons:

(i) Variability in Rainfall: Rainfall in India is very uncertain, which increases the element of risk and makes crop production rather difficult. Normal rainfall is marked by wide fluctuations in different parts. It also varies from season to season and year to year in its quantity, incidence and duration. This uncertainty demands irrigation facilities to offset the negative impact on agriculture.

(ii) Unequal Distribution of Rainfall: In most parts of the country, 80% of the annual rainfall is received from June to September from the south-west monsoon. Saurashtra-Kutch region of Gujarat, western half of Rajasthan and parts of Punjab and Haryana are in the arid zone, where there is a constant deficiency of water with average annual rainfall less than 35 cm. Conditions very close to aridity prevail in the rain shadow tracks along the leeward side of the Western Ghats (from Karnataka to Andhra Pradesh).The inadequacy of rainfall in these areas has to be made good by irrigation.

(iii) To Meet Crop Requirements and Soil Needs: Different crops require different quantities of water supply. For example crops such as rice, sugarcane, jute, cotton chilies, etc. require more water and need irrigation even in areas of heavy rainfall.

To Maximise Production: To get high yields and maximum production from land and to facilitate double and triple cropping, irrigation is a must.

(iv) To get Efficient Use of Utilizable Flow: Many of the Indian rivers are not perennial and they carry insignificant flows during the rabi season. In central and south Indian rivers 80 - 90 % of the annual run off takes place during the four months of monsoon rains. It is therefore, imperative to make use of a sizable portion of the utilizable flow.

(v) To Supplement Supply Even in Good Rainfall areas: In good rainfall areas irrigation is required mostly as a supplemental need to protect single crop agriculture against occasional drought.

Means of irrigation:

Different sources of irrigation are used in India depending upon the topography, soils, rainfall, availability of surface or ground water, and requirement of crops. Following are the main source of irrigation used in different parts of the country.

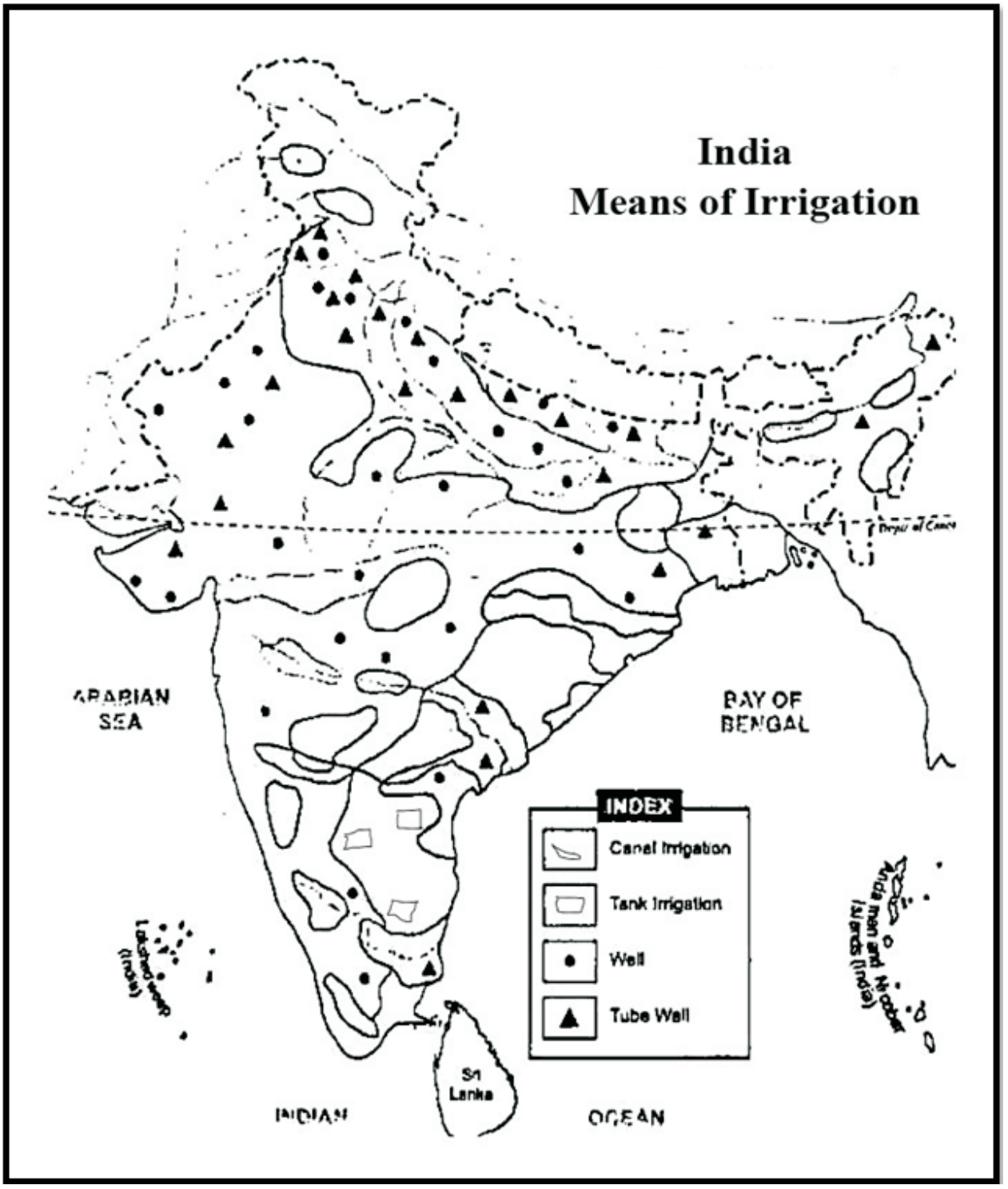
Means of irrigation:

Wells: A well is a hole dug in the ground to obtain the subsoil water. Canals used to be the most important source of irrigation up to 1960's but now they have been replaced by tube-wells which irrigate more than 50% of total irrigated area of India.

Fig: 3.1 Sources of irrigation: Well, Tubewell, Canal, Tank

Wells are of three types

1. **Unlined wells:** These are also known as Kuchha wells. These wells are dug by the farmers near the field.
2. **Lined Wells:** A lined or pucca well is one which is



Map showing different means of irrigation in India

lined with bricks or stones. Most of the lined and unlined wells are driven by ox. Lined and unlined wells are suited to the poor Indian cultivators because of their cheapness, simplicity and their ease in operation.

3. **Tube-wells:** A tube-well is a deeper well (generally over 15 metres deep) from which water is lifted with the help of a pumping set operated by an electric motor or a diesel engine.

Suitable Conditions for Well Irrigation

1. The water table should be high.
2. Cheap power should be available.
3. The area must be an alluvial formation.
4. Sufficient quantity of ground water.

Advantages of Wells

1. Cheapest source of irrigation.
2. They can be dug at a convenient place.
3. Indispensable source of irrigation.

Drawbacks of Wells

1. They tend to be shallow & may dry up.
2. They can irrigate only a small area.
3. They need high water table.
4. At some places well water contains a high percentage of minerals,which makes the water unsuitable for irrigation.

Tamil Nadu with 11 lakh tube-wells has the largest number in the country followed by Maharashtra (9 lakh), Andhra Pradesh (6.7 lakh), Uttar Pradesh (5.3 lakh), Madhya Pradesh (4.6 lakh), Karnataka (4.4. lakh), &Punjab (3.9 lakh). Thus more than three- fourths of Indian's tube-wells are functioning in Tamil Nadu, Maharashtra, Andhra Pradesh, Uttar Pradesh, Madhya Pradesh, Karnataka and Punjab.

Canals

Canal irrigation is still one of the most important sources of irrigation in India covering 40% of the total irrigated area.

Canal irrigation is more widespread in northern India because of:

1. Leveled relief

2. Deep fertile soil which helps in recovering the cost of construction of canals.
3. Alluvial formations due to which digging of canal is easy.
4. Perennial flow of rivers which originates in the snow covered Himalayan ranges.

Drawbacks of canal irrigation

1. Excessive irrigation has caused environmental degradation
2. Excessive irrigation causes water logging and creation of waste lands
3. Unregulated canal irrigation causes salinisation and rise in water table
4. The cost of construction is very high.

Tank Irrigation

A tank is a water storage system which is developed by constructing a small bund of earth or stones across a stream. The water impounded by the bund is used for irrigation, drinking and for other purposes. Some tanks are built partly as dug-outs and partly by enclosing bunds. Tanks are of varying size but most of the tanks are of small size and are built by individual farmers or groups of farmers. Undulating topography, hard and impermeable bedrock &

IMPORTANT CANAL SYSTEM OF INDIA

Name of the canal	State	River	States irrigated
Upper Bari Doab Canal	Punjab &Haryana	Ravi	Punjab and Haryana
Sirhind canal	Punjaband Haryana	Sutlej	Punjab and Haryana
Nangal canal	Punjab and Himachal	Sutlej	Punjab, Himachal, Haryana, Delhi, Rajasthan
Lower ganga canal	Uttar Pradesh	Ganga	Uttar Pradesh
Upper ganga canal	Uttar Pradesh	Ganga	Uttar Pradesh
Agra canal	Uttar Pradesh	Yamuna	U.P, Haryana, Rajasthan And Delhi, Rajasthan (Jaisalmer, Barmer, Jodhpur)
Rajasthan canal	Rajasthan	Sutlej, Beas, Ravi	
Mettur canal	Tamil Nadu	Kaveri	Tamil nadu
Tungabhadra project	Karnataka	Tungabhadra	Karnataka
Hirakud project	Orissa	Mahanadi	Orissa

seasonal nature of peninsular rivers are the main factors favouring tank irrigation in peninsular region. There are about 5 lakh big and 50 lakh small tanks irrigating over 31 lakh hectares of agricultural land. The tank irrigated land is decreasing primarily due to increase in canal and well irrigation. Tank irrigation is widely prevalent in Tamil Nadu, Andhra Pradesh, Karnataka and Orissa.

Modern techniques of water conservation

Archaeological and historical records show that from the ancient times we have been constructing sophisticated hydraulic structures like dams, reservoirs or lakes, embankments and canals for irrigation. Not surprisingly, we have continued this tradition in modern India by building dams in most of our river basins. A dam is a barrier across flowing water that obstructs, directs or retards the flow, often creating a reservoir, lake or impoundment.

In conserving and managing water, dams were traditionally built to impound rivers and rainwater that could be used later to irrigate agricultural fields. Today dams are built not just for irrigation but for electricity generation, water supply for domestic and industrial uses, flood control, recreation, inland navigation and fish breeding. Hence, dams are now referred to as multi-purpose projects, where many uses of the impounded water are integrated with one another. For example in the Sutlej-Beas river basin, the Bhakra- Nangal Project, water is being used both for hydel-power production and irrigation. Similarly, the Hirakud Project in the Mahanadi basin integrates conservation of water with flood control. Similarly Damodar Valley project was built to enhance power generation and flood control besides boosting irrigation and domestic water supply in the region.

Multipurpose Projectects

A multipurpose project is a large scale integrated hydraulic systems designed to serve several purposes simultaneously. Multipurpose projects are used for irrigation, flood control, hydroelectric power generation, navigation, fisheries and tourism.

Main Objectives

(i) **Generation of hydel-power:** Multipurpose projects are the main source of power generation. According to Economic Survey 2005-06 these produce more than 30,000 MW power. They provide us neat, pollution free and cheap energy which is the back bone of industry and agriculture.

(ii) **Flood control:** These projects control the floods because of their huge water storing

Major Rivers and Dams of India

capacity. These projects have converted many 'rivers of sorrows' into rivers of boon, e,g,. Kosi & Damodar Rivers.

(iii) **Soil conservation:** These projects help to conserve the soil as they slow down the speed of water thereby reducing its erosive intensity.

(iv) **Irrigation:** These projects are the main source of irrigation for our country. These irrigate the fields during the dry seasons. Many canals have been dug and they irrigate dry areas across the country.

(v) **Afforestation:** Trees are systematically planted in and around reservoirs. This helps in preserving 'wildlife' and natural ecosystem.

(vi) **Water Navigation;** Multipurpose river valley projects often provide for inland water navigation through main rivers and canals. They help to raise the level of rivers and there tributaries which makes them navigable. It is the cheapest means of transport for heavy goods.

(vii) **Fisheries:** These provide ideal condition for the breeding of fish. Chosen varieties of fish are allowed to grow. Such well developed fish farms can be the cheapest source of protein for our people.

(viii) **Tourist Centers:** These projects are well cared and are scientifically developed. So these become the centers of tourist attraction and also offer recreational avenues to the adjoining villages and towns

Drawbacks of multipurpose projects

In recent years multipurpose projects and large dams have come under great scrutiny, and opposition due to following reasons:

1. **High cost:** The initial cost of building the dams is very high. It requires huge capital and engineering skills and modern machinery which are usually not available with poor and developing countries.
2. **Adverse impact on environment:** A vast variety of flora and fauna (plants and animals) as well as human settlements get submerged in the water of reservoir formed by the dam. Submergence causes huge loss of agricultural land forest land and large scale displacement of people.
3. **Adverse effect on the fertility of the soil:** Due to construction of dams there are no annual

floods in the river, due to which the soil of the downstream region gets deprived of the nutrient rich "silt", ultimately leading to decrease in the fertility of the soil.

4. **Adverse impact on aquatic life:** Due to construction of dam on the river, the fish in the downstream area do not get sufficient nutrient supply. Regulating and damming of rivers affects natural flow of water causing poor sediment flow downward and excessive sedimentation at the bottom of reservoir, resulting in rockier stream beds and poorer habitats for the rivers aquatic life. Dams also fragment rivers making it difficult for aquatic fauna to migrate for spawning i.e., to produce eggs.
5. **Non-availability of water throughout the year:** Most of the rivers in India flow only for few months. So water is not sufficient to build a dam.
6. **Disputes between different states:** This is one of the major causes of delay in the compeletion of many projects. There are number of dispute over sharing of water, height of the dam and so on between various states.
7. **Displacement of local communities:** Building of large dams results in displacement of local communities. The local people often had to give up their land and livelihood for the greater good of the nation.
8. **Change in the cropping pattern:** Multipurpose projects are responsible for providing assured means of irrigation to farmers. Consequently most of the farmers have changed the cropping pattern, shifting to water intensive and commercial crops, which leads to salinisation of soil especially in the semi-arid and arid regions of the country.

Rainwater Harvesting

"It is a technique of increasing the recharge of groundwater by capturing and storing rain water by constructing structures such as percolating pits, check dams, etc." India has had a tradition of water harvesting which is more than two millenia old. Evidence of this tradition has been found in ancient texts & inscriptions. The Kuhals of Jammu, Kuls of Himachal Pradesh, Guls of Uttarakhand Pats of Maharashtra, Zings of Ladakh, Zabos of Nagaland Eris of Tamil Nadu, Keres of Karnataka, Tankas, Kundis, Bawdis, Jhalaras, etc. of Rajasthan are but a few of the traditional rain harvesting systems which existed in India but now, dying a slow death. Thar Desert of Rajasthan provides a unique example of water harvesting system. A rooftop water harvesting system is widely prevalent in Thar Desert. Rain water that falls on the roof is taken through a pipe to an underground tank known as kundi. A kachha structure known as kui is dug next to the tank to collect the seepage. Since water is scarce, every drop

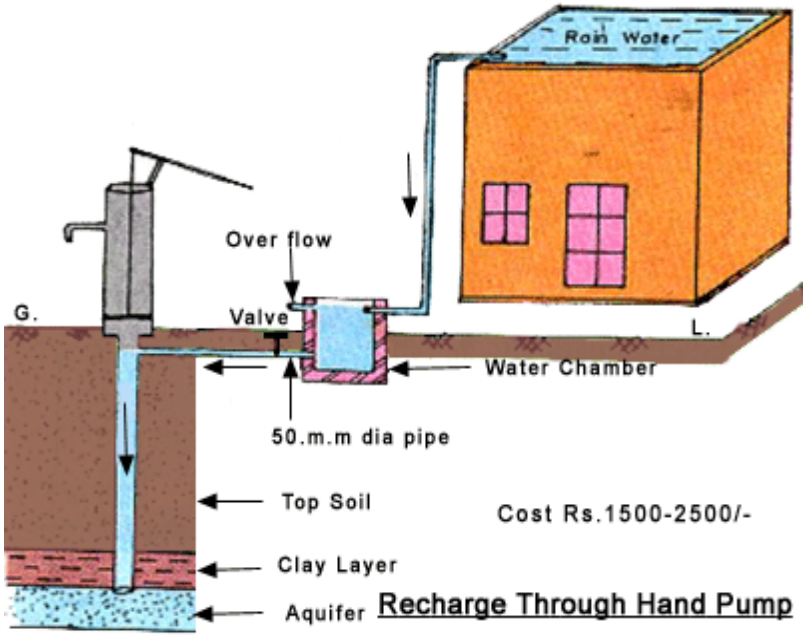
must be preserved and used judiciously. At places people bathe on a stone block, from which water drains into an animal water tank.

How to harvest rainwater:

Broadly there are two ways of harvesting rainwater: (i) Surface runoff harvesting (ii) Rooftop rainwater harvesting.

Surface runoff Harvesting : Surface runoff is the water flow which occurs when soil is infiltrated to full capacity and excess water from rain, snowmelt, or other source flows over the land. The excess water can be harvested.

Rooftop Rain Water Harvesting is the technique through which rain water is captured from the roof catchments and stored in reservoirs. Harvested rain water can be stored in sub-surface ground water reservoir by adopting artificial recharge techniques to meet the household needs through storage in tanks.



Rooftop Rainwater Harvesting and its Components

The main objective of rooftop rain water harvesting is to make water available for future use. Capturing and storing rain water for use is particularly important in dry, hilly, urban and coastal areas.

Advantages of Rain Water Harvesting

1. *Provides self-sufficiency in water supply.*
2. *Provides high quality water, soft and low in minerals*
3. *Reduces the cost of pumping of ground water.*
4. *Boosts ground water recharge. Reduces soil erosion.*
5. *It is less expensive & easy to construct,operate and maintain.*

6. *Preferred on islands due to scarcity of fresh water*

Components of a Rainwater Harvesting System

A rainwater harvesting system comprises of various components:

Catchments: The catchment of a water harvesting system is the surface which directly receives the rainfall and provides water to the system. It can be a paved area like a terrace or courtyard of a building, or an unpaved area like a lawn or open ground. A roof made of reinforced cement concrete (RCC), galvanised iron or corrugated sheets can also be used for water harvesting.

Coarse mesh: Coarse mesh is required at the roof to prevent the passage of debris with the water.

Gutters: Gutters include channels all around the edge of a sloping roof to collect and transport rainwater to the storage tank.

Conduits: Conduits are pipelines or drains that carry rainwater from the catchment or rooftop area to the harvesting system.

First-flushing: A first flush device is a valve that ensures that runoff from the first spell of rain is flushed out and does not enter the system. This needs to be done since the first spell of rain carries a relatively larger amount of pollutants from the air and catchment surface.

Filter: The filter is used to remove suspended pollutants from rainwater collected over roof. A filter unit is a chamber filled with filtering media such as fiber, coarse gravel and reed etc.

Glossary

1. **Surface water:** Water that flows on earth's surface in the form of streams, rivers and lakes etc.
2. **Ground Water:** Water beneath the earth's surface which saturated the pores and fractures of sand gravel and rock formations.
3. **Irrigation:** An artificial application of water to the soil usually for assisting growing crops.
4. **Well:** A hole or an opening created in the ground by digging or drilling to excess water from underground aquifers.
5. **Tube well:** Is a well in which water is pumped out by an electric pump through a tube.
6. **Canal:** a channel which is constructed to carry the water of a river to irrigate the fields.
7. **Tank:** An artificial lake used for supplying water to the people or irrigation to the field through a system of pipes.
8. **Multipurpose project:** A project that serves several purposes at the same time i.e irrigation, flood control and power generation etc.
9. **Rain water Harvesting:** A technique of increasing the recharge of ground water by storing rain water by constructing structures like percolating pits and check dams.

Exercise

A. Very short answers type questions

Q. No. 1

i) The percentage of water locked in the ice caps and ice sheets of world is _____.

ii) India possesses _____ % of water resources and _____ % of population of the world respectively.

iii) The ground water utilization is very _____ in the states like Punjab and Haryana.

iv) In most parts of India, 80% of annual rainfall is received form _____ monsoons.

v) Irrigation is the most important sources of irrigation _____ in India.

B. Short answer type questions

Q. No. 2

i) Define surface water and highlight its major sources?

ii) Mention sector wise major users of water in India?

iii) Name any three states where groundwater utilization is very high. Give reasons?

iv) What are the major sources of irrigation in India?

v) Highlight merits and demerits of well irrigation?

vi) Canal irrigation is widespread in northern India. Give reasons?

vii) Name the states were tank irrigation is widespread in India. Give reasons?

C. Match the following canals with their source rivers:

Q. No. 3

Upper Bari Doab Canal	Yamuna River
Agra Canal	Kaveri River
Sirhind Canal	Ravi
Mettur Canal	Nagarjuna Sagar Dam
Jawahar Canal	Sutlej

D. Long answer type questions

4. Name the major users of water in India and also suggest measures to solve the emerging water crises in the country?
5. What are multipurpose river projects? Highlight their merits and demerits?
6. Define irrigation and highlight its importance?
7. Highlight the advantages and disadvantages of tub-wells as a source of irrigation?
8. What is rainwater harvesting .Mention various components of rainwater harvesting system?

Activity

1. On an outline map of India highlight the regions with highest density with respect to: Wells and tube wells, Tanks and Canals
2. On an outline map of India carve out the important river systems flowing in the Himalayan and peninsular parts of India.

Chapter
4

Agriculture

The word agriculture is derived from Latin word (**agr** – field + **cultura** – growing or cultivation). It is the science or practice of farming, including cultivation of the soil for the growing of crops and the rearing of animals to provide food, wool, and other products (Oxford dictionary).

Land is the most basic of the world's vast and varied resources from which human masses are fed, clothed and sheltered. Primitive men must have begun as food gatherers, eating whatever fruits, leaves and roots they could obtain. Nature must have been bountiful in those days when human numbers were so small and wild plants grew everywhere. As time passed and human population grew, it was realized that some form of food production was necessary for food security and enhancing longevity of life. Animals were tamed for meat, milk, skin and labour. Seeds were sown in ploughed fields and men started to live in settled communities and got time to develop the various arts, crafts and skills that formed the basis for modern agriculture.

Civilization simply would not have advanced to the present state, if the people had not explored efficient ways to grow and distribute foodstuffs. Agriculture ensured food security and reduced starvation. Furthermore during the last 250 years the advancement in science and technology, promoted tremendous population growth by reducing the death rate and fueling the growth rate of population across the globe. As per the global population projections of World Bank on 01-02 -2015 global population stands at 7.3 billion which demands 2.5 billion metric tonns of foodstuffs annually to meet the unprecedented demand. According to Food & Agriculture Organization (FAO) the total global food production in year 2014 is 2.54 billion metric tons. Although there is not much difference between the production and demand of foodstuffs on global scale, still a large number of people suffer from malnutrition and starvation in Africa, Latin America and Asia, mainly because of poverty and deprivation, rather than the non availability of food.

Global crop production has expanded threefold over the past 50 years, largely through higher yields per unit of land and crop intensification. Global per capita food supply rose from about 2200 kcal/day in the early 1960s to over 2800 kcal/day by 2009. At 3370 kcal/person/day, Europe currently has the highest average per capita food supply. Cereals occupy more

than half of the world's harvested area and are the most important food source for human consumption. Of the 2.5 billion tonns of cereals produced each year, 1 billion are destined for human consumption; 750 million tonns are used as animal feed and 500 million tonns are processed by industry, used as seed, or wasted. As per FAO almost 870 million people, or 12.5 percent of the world's population, were undernourished in 2010 -2011; the vast majority of them (852 million) live in developing countries.

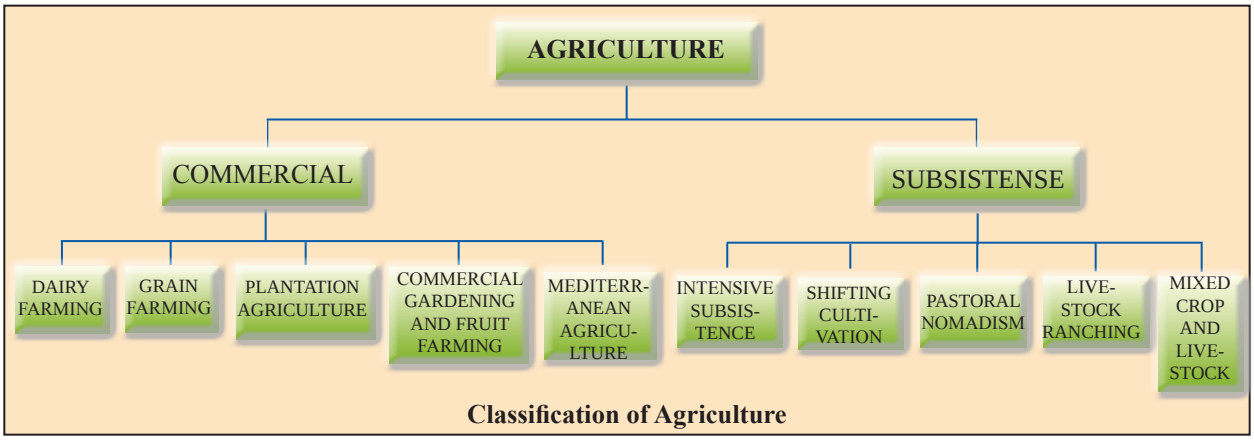
TABLE 4.1 LEADING CEREAL PRODUCERS OF THE WORLD

CEREAL	FIRST	SECOND	THIRD
Millet	India	Nigeria	Niger
Rice	China	India	Indonesia
Wheat	China	India	United States
Maize	United States	China	Brazil
Barley	Russia	France	Germany
Rye	Russia	Poland	Germany
Sugarcane	United States	India	Mexico

***Source: Food and agriculture organization, statistics*-2013**

Types of Agriculture:

Agriculture even today employs a large number of people and provides all food requirements of the world. A number of physical, economic and cultural factors influence the nature of agricultural land-use in a region. Due to variations in the physical and cultural environment of various regions, different types of agricultural systems have evolved in different parts of the world. There are two main types of agriculture (a) Subsistence agriculture, and (b) Commercial agriculture which are illustrated in the following diagram.



Classification of Agriculture

Subsistence Agriculture

It is a farming practice prevalent in developing and underdeveloped parts of the world. In subsistence agriculture crops are cultivated for the local consumption and little or no surplus for the market is produced. Farms are small and usually food crops like Rice, Wheat and Maize are cultivated with old tools and implements. There is extensive use of manpower and agriculture is largely rainfed without any assured means of irrigation. Subsistence agriculture is widely practiced in the tropical and subtropical belt across various countries of Asia, Africa and Latin America.

Commercial Aagriculture

Commercial farming is typically done on a very large scale, often by agricultural corporations. Goods produced are mainly for the market to get cash. The goal of commercial farming is to make profits, which is done through maximizing crop yields through labor-saving techniques and technology. Use of synthetic fertilizers and hybrid seeds is common on commercial farms, along with heavy farming machinery and sophisticated irrigation technology. Commercial farms typically grow one crop in large quantities. Some of the main crops grown on commercial farms include bananas, coffee, corn, cotton, nuts, tea, sugar cane and wheat. This type of farming is mostly practiced in temperate parts of North and South America, Europe and Russia.

Agricultural Scenario of India

Despite making significant progress in industrial and economic development in post independence period, agriculture in India still provides livelihood to more than half of population. According to Economic survey (2013-14) agriculture in India supports around 55 % of the population, as against about 75% at the time of independence. In the same period, the contribution of agriculture and allied sector to the Gross Domestic Product (GDP) has fallen from 61 to approximately 14%. Currently India supports 17% of world's population having 4.2% of world's water resources and 2.3% of global land. Per capita availability of land resources is about 4 to 6 times less as compared to world average. This will decrease further due to increasing demographic pressure and consequent diversion of the land for non-agricultural uses.

Around 50% of India's geographical area is already under cultivation as compared to 11% of the world average. The present cropping intensity of 136% has registered an increase of only 25% since independence. Further, rain-fed drylands constitute 65% of the total net sown

area. Unprecedented degradation of land has affected (107 million ha) across the country. Groundwater resource is fast depleting and there is stagnation in the productivity of food stuffs. This deceleration needs to be arrested and agricultural productivity has to be doubled to meet growing demands of the population by 2050. Efficiency-mediated improvement in productivity is the most viable option to raise production.

The country recorded impressive achievements in agriculture during three decades since the onset of green revolution in late sixties of twentieth century. This enabled the country to overcome widespread hunger and starvation; achieve self-sufficiency in food; reduce poverty and bring economic transformation in millions of rural families. The situation, however, started turning adverse for the sector around mid-nineties, with slowdown in growth rate which then resulted in stagnation or even decline in farmer's income leading to agrarian distress. However concerted efforts are being made at the national level to address the challenges and multipronged strategies are being devised by the government to boost the productivity.

According to recent figures of 2012-13 the total area under food-grains in India is approximately 200 (Million hectares) and net sown area 141 (Million hectares) with a production of 255.36 (Million tons). Among the states Uttar Pradesh is the leading producer of foodgrains followed by Punjab, Madhya Pradesh.West Bengal, Haryana and Andhra Pradesh are other important producers.

Cropping seasons in India

Due to enormous size, diverse geo-physical and climatic characteristics, India is bestowed with many growing seasons. However in the Northern and North-western region, the prevalence of winter restricts the farmers to grow more crops in a year. Major Indian cropping seasons are Kharif, Rabi and Zaid. The terms Kharif, Rabi and Zaid originated from Arabic language which literally mean; autumn, spring and increase respectively.

Kharif Season: The crops sown in this season are better known as monsoon crops or summer crops as they are sown at the beginning of the south-west monsoon. The crops are water intensive and any fluctuation in the monsoon can affect the yield and production of the crops.

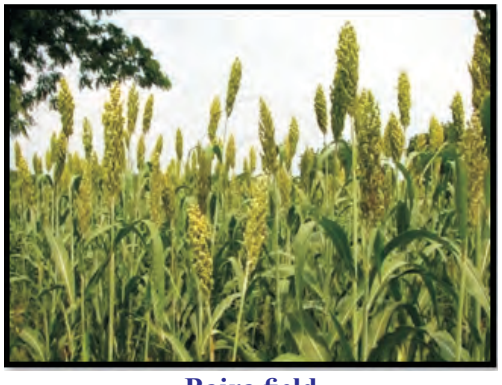
Rice field

Jowar field

Wheat field

The sowing season is from May to July and harvesting season is from September to October. Important crops grown in this season are Jowar, Bajra, Rice, Maize, Cotton, Groundnut, Jute, Hemp, Sugarcane, Tobacco, Arhar (Pulses), Soyabean, Groundnut (Oilseeds), Cotton etc.

Mustard field

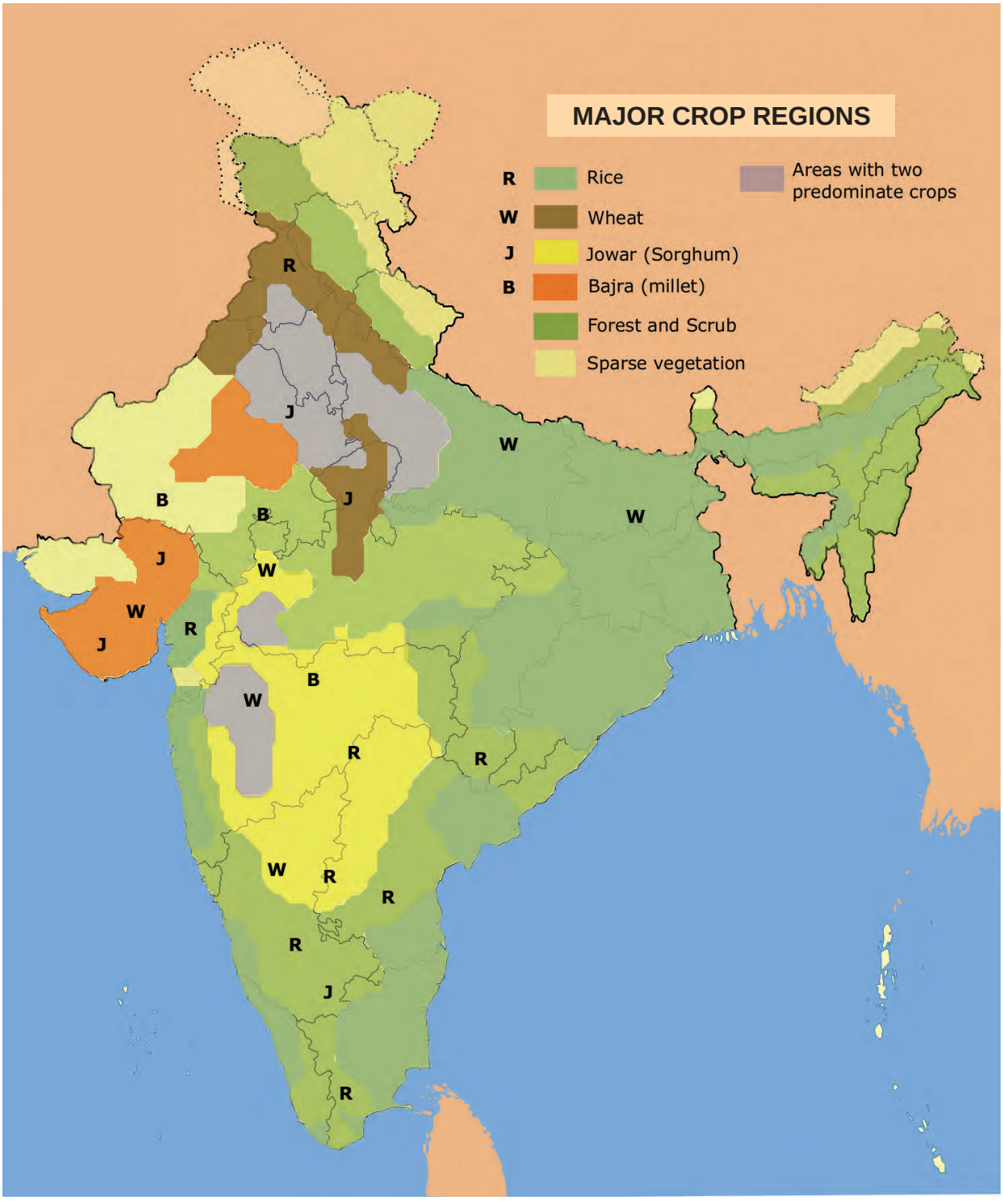


Bajra field

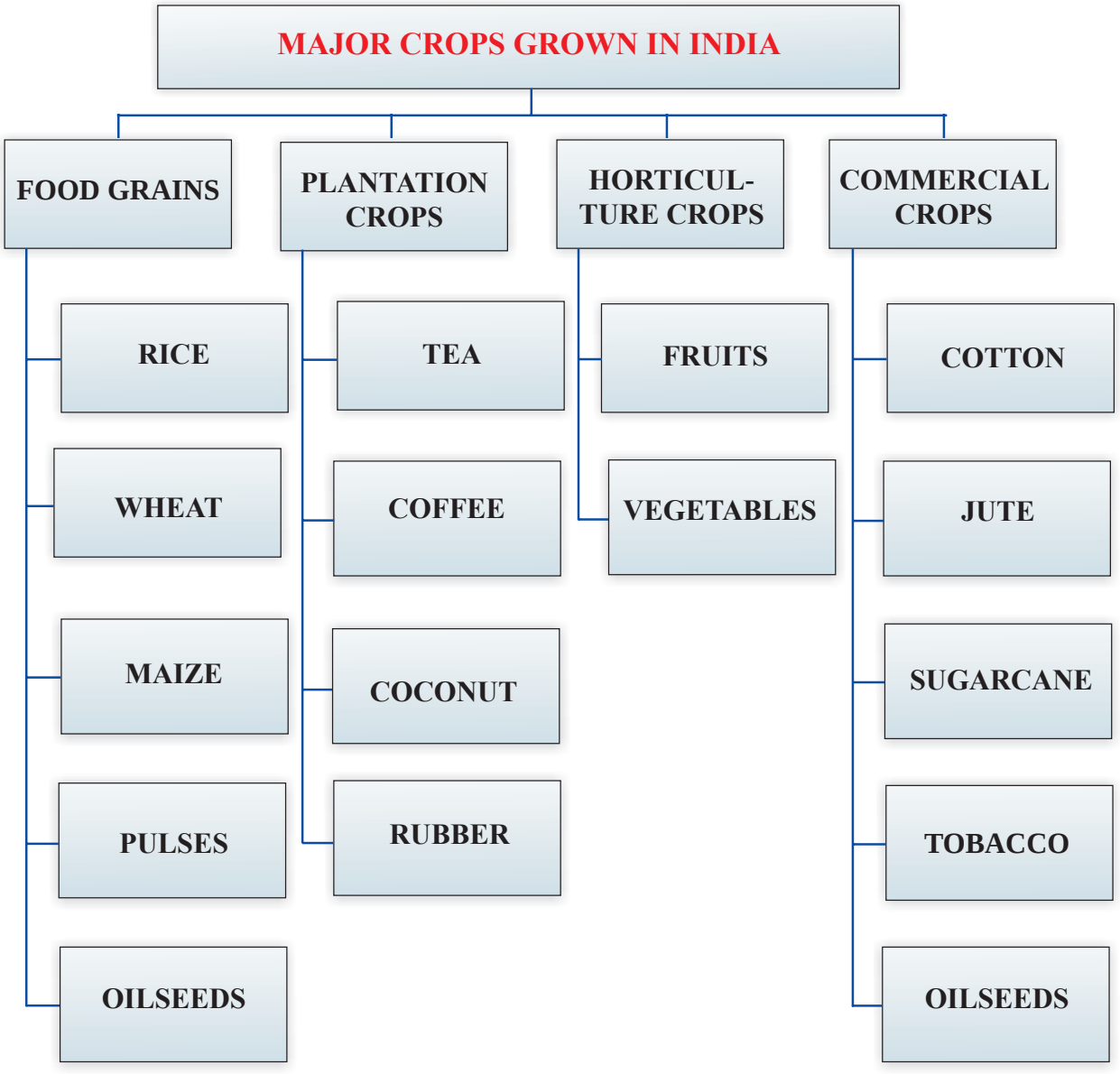
Rabi Season: The crops grown in this season are also known as winter crops as they need relatively cool climate during the period of growth but warm climate during the germination of their seed and maturation. The sowing season is from October to December and harvesting season is from February to April. Important crops grown in this season are Wheat, Barley, Gram, Linseed, Mustard, Masoor, Pea and Potatoes.

Watermelon field

Zaid Season: These crops are raised throughout the year deploying artificial irrigation system; however in major parts they are grown in the short duration between Rabi and Kharif crop seasons, mainly from March to June. Important crops of this season are watermelon, Toris, Cucumber and other leafy vegetables.

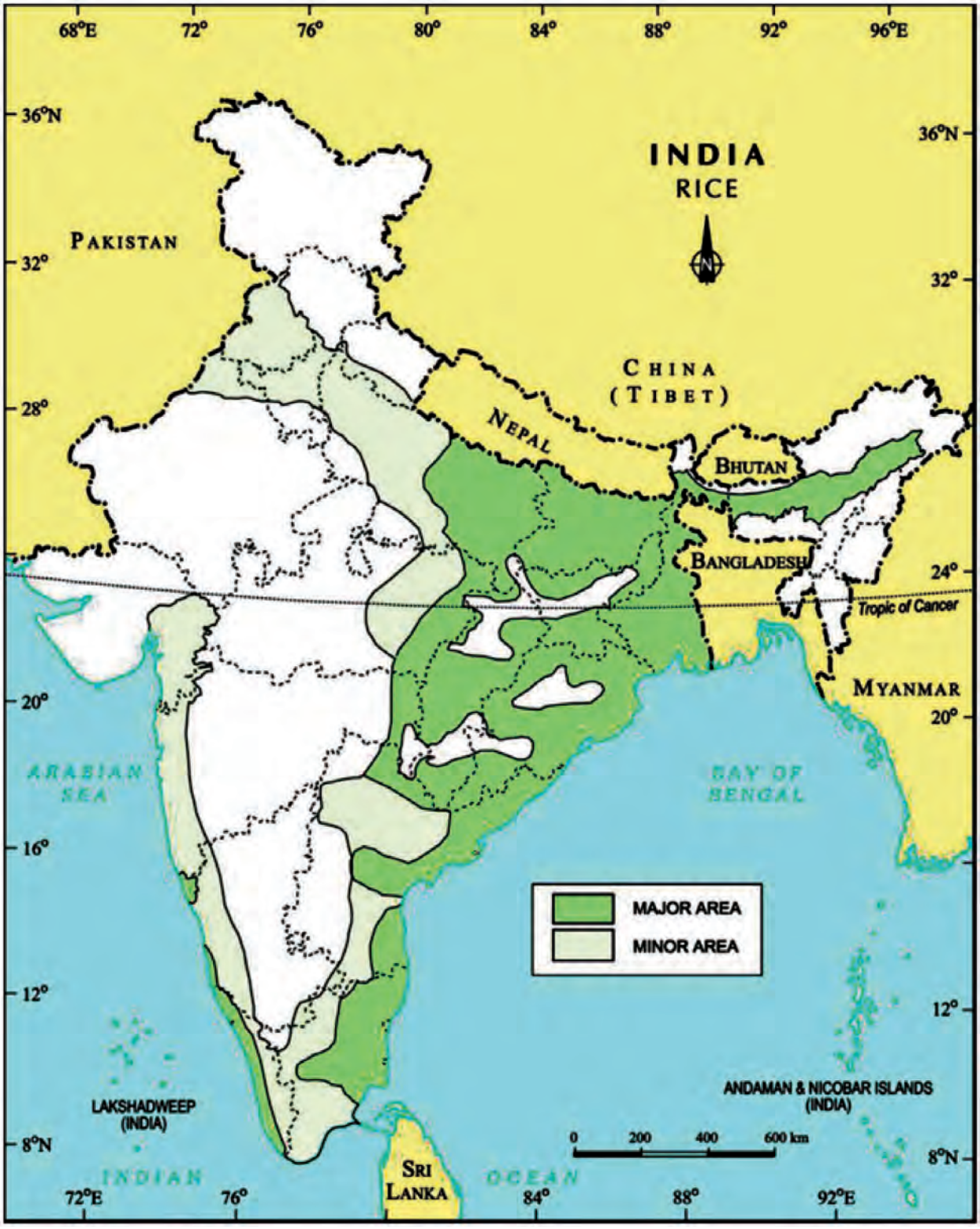


MAP SHOWING MAJOR CROP REGIONS OF INDIA



Cereal Crops

Rice: It is predominantly a Kharif or summer crop and is a staple food of majority of people in India. Covering approximately 22.5% gross cropped area, rice is the staple food of more than half of the Indian population. Rice needs a hot and moist climate with a temperature ranging between 16°C and 27°C and a rainfall between100- 200 cm. Rainfall at the time of harvesting can be disastrous as it can harm the standing crop. Rice is a labour intensive crop hence requires cheap labour from sowing to harvesting supplemented with high yielding variety seeds, plenty of chemical fertilizer manure and assured irrigation.



MAP SHOWING MAJOR AND MINOR RICE PRODUCING REGIONS OF INDIA

Rice also produces many byproducts. Rice husk is used as cattle feed on large scale. Rice bran is obtained from the outer layers of the brown rice and is a good source of edible oil. The crude rice bran oil is used in soaps, paints, enamels, varnishes, wax and de-oiled bran is used as cattle and poultry feed.

According to 2013 data West Bengal is the leading producer of rice followed by Punjab, Uttar Pradesh and Andhra Pradesh.

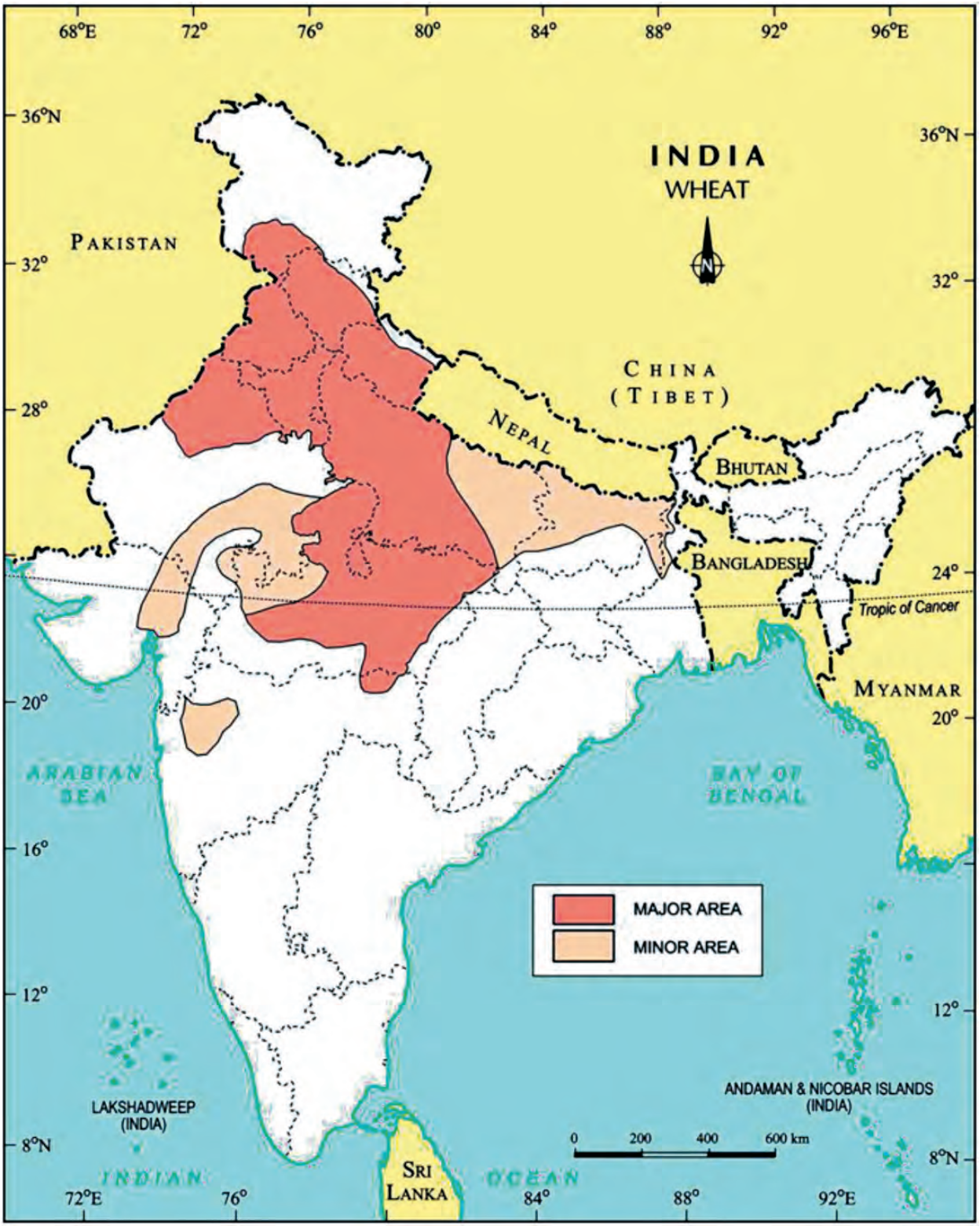
Wheat: Wheat is the second most important food crop of India next to rice. With the beginning of green revolution the production was increased multifold between 1970 and 1990. Wheat is a Rabi or winter crop sown from October to November and harvested between February and April.

Wheat thrives well with cool winters and the hot summers. The required monthly average temperature ranges between 10°-15°C during sowing and between 21°- 26°C during ripening; nevertheless the temperature at maturity must not fall below 21°C. An annual rainfall of 50-100 cm is suitable for the cultivation but below 50cm of rainfall needs artificial means of irrigation.

There are so many products and byproducts of wheat used in day today life like Whole wheat flour, Maida, Macaroni products, Wheat germ and Wheat bran. Additionally its byproducts are used in adhesives, Cosmetics, Pharmaceuticals and furniture. Uttar Pradesh is the largest producer of wheat in India followed by Punjab and Haryana.

Maize: Maize is known as queen of cereals due to highest yield potential and adaptability over a wide range of agro-climatic conditions. In India, maize is the third most important food crops after rice and wheat. Maize crop is primarily a Kharif crop but can also grow during Rabi season. The water stagnation can harm the crop Therefore; the fields having provision of proper drainage should be selected for cultivation of maize. Maize needs an annual rainfall of 60 to 100 cm distributed throughout its growing period and a temperature ranging between 21°C -27°C. Loamy sand to clay loam soil is best suited but maize can be grown on variety of soils.

Besides being a staple food for humans and feed for animals, maize provides basic raw material for many industrial products like starch, oil, protein, alcoholic beverages, food sweeteners, pharmaceuticals, cosmetic, textile, gum, package and paper industries etc. Now it is also being used as bio-fuel. In India the predominant maize producing states are Karnataka, Andhra Pradesh, Maharashtra & Bihar.



MAP SHOWING MAJOR AND MINOR WHEAT PRODUCING REGIONS OF INDIA

Plantation Crop

Tea: Tea cultivation is believed to have originated in the Yangtze valley of china as early as the sixth century A.D. Tea is the world's most popular beverage, being favored by at least half of the world's population.Tea can be cultivated in a wide range of physical and climatic conditions, but it grows best in monsoon lands of the tropics and the sub-tropics. Most tea cultivation occurs in Asia, with India, China and Sri Lanka being the most important producers. The chief tea growing region of India lies in the north-eastern parts of the country, especially Assam and West-Bengal.Another region extends in the Nilgiri Hills in Tamil Nadu.

Green tea field

The best temperature for the tea cultivation is 25°C- 30°C but it can grow even at 16°C. It requires an annual rainfall of 150cm; frequent rains promote rapid leaf growth and increase the number of annual picking. Both fog and dew are favourable for tea cultivation but drought is harmful. The land should be fertile containing iron, gently rolling so that there is no water stagnation. Tea cultivation also requires cheap labour and market facility

Commercial Crop

Sugarcane: It is as a perennial plant that can be reproduced from stem cuttings. Once harvested, the cane grows again from the roots in the soil. However, the productivity keeps decreasing with each passing year. Therefore, it is planted fresh after a varying interval in different regions. Although India grows sugarcane over large areas in the northern plains where winters are quite cold, the higher productivity is obtained in the peninsular plateau region. Sugarcane is grown mainly in Satluj-Ganga plain from Punjab to Bihar, black soil belt from Maharashtra to Tamil Nadu, along the eastern slopes of the Western Ghats and Coastal Andhra Pradesh and Krishna river valley.

Sugarcane

Sugarcane thrives best in the rainy tropics and monsoon climate with temperature of above 25°C and rainfall of above 100 cm or assured irrigation facilities. Very cold winters and frost is said to be harmful for the crop. Deep fertile alluvial soils or the nutrient rich volcanic soils with a good drainage are considered ideal for sugarcane. It is the main source of Sugar, Gur and Khandsari. It also provides raw material for the manufacturing of alcohol, paper and other chemical products. Some parts of sugarcane are also used as fodder.

Cotton: Cotton is both the leading fiber and the most widely used of all fibers. It has a large market both for clothing and for industrial uses. Its cheapness and lightness make it an ideal material for clothing in the tropics, and in summer, in the temperate areas as well. Cotton is strong, durable, absorbent and easy to launder.

Cotton field

It is primarily a tropical crop and requires a growing season of about 200 frost free days. Temperature requirement is above 20°C; however plant activity becomes three times faster when temperature is above 32°C. The growth of cotton stops if the temperature falls below 16°C. Cloudy weather retards ripening of cotton balls and it also has as adverse impact on the quality of cotton. A rainfall of above 50 cm is necessary for a healthy crop, conversely excess moisture increases the incidence of attack by fungus and pests. It can be grown on a variety of soils including alluvial, black and chernozem soils with good aeration. India is a major producer of cotton and the chief growing area lie in the western part of the southern plateau and the western part of the northern plains. The cotton grown in the northern plains of India is irrigated. The main states for cotton production are Maharashtra, Gujarat, Punjab and Haryana.

Jute: Jute grows well in hot, tropical conditions with plenty of moisture and heavy rainfall. A temperature of 25°C is ideal for jute cultivation with an annual rainfall between 150 cm to 200 cm. Jute requires rich soils and thrives on river alluvium, especially where annual floods renew the fertility of the soil. Most of the Jute in India is cultivated at the mouth of the Ganges and Brahmaputra rivers where all the major geographical requirements are present.

Jute Field of West Bengal

Green Revolution in India

The term Green Revolution refers to the renewal of agricultural practices that started in Mexico in the 1940s. The beginnings of the Green Revolution are often credited to Norman Borlaug, an American scientist who developed new disease resistance high-yield varieties of wheat. In India, Dr. Swaminathan played a major role in the initiation and propagation of Green Revolution. With the advent of green revolution the period between 1967 and 1978 was marked with use of improved seeds of high yielding varieties, adequate and assured supply of water for irrigation, and appropriate application of chemical fertilizers. There were three basic elements in the Green Revolution: Continued expansion of the farming areas, Double-cropping in existing farmland and Use of high yielding variety seeds which lead to increased production and made India self sufficient in food stuffs.

Merits of Green Revolution:

1. Enhancement in agricultural productivity & increase yield per hectare.
2. Change in approach of the peasants.
3. Employment opportunities both in agricultural and non-agricultural sectors.
4. Shift from customary agriculture.
5. Emergence of new cropping patterns, improved economy and standard of living

Demerits of Green Revolution

1. Environmental degradation
2. Soil and water pollution
3. Loss of bio diversity
4. Decrease of Water table.
5. Loss of local variety of crops.
6. Promoted weed & pest resistance

Agriculture of Jammu and Kashmir

Jammu & Kashmir is the 11th largest state accounting for 3.20 per cent of total area of the country with a reported geographical area of 103187 sq. kms. Agriculture occupies an important place in the economy of the state. The share of Agriculture and allied sectors in the Gross State Domestic Product for the year 2010-11 as per estimates stands at 20.59 per cent.

Nearly 70 per cent of the population in the state derives its livelihood directly or indirectly from the agriculture sector.

In spite of increase in food grain production from 4.52 lakh tonnes in 1950- 51 to 15.21 lakh tonnes, the demand is still deficit by around 40 percent. The deficiency in cereals is nearly by 40 per cent, 70 per cent each in pulses and oil seeds and 30 per cent in vegetables. The State still meets its demand by procuring large quantities from other states even after 6 decades of our independence. The state is also confronted with negative production growth rates in most of the food crops. In the state of Jammu and Kashmir, 58 per cent of the area under agriculture is rainfed and the remaining 42 per cent is irrigated.

Economically the biggest constraint of the agriculture in the state is small land holding size of 0.66 hactares with more than 77.97 percent farmers having less than one hectare of land against 1.33 hectare holding size on National leval. In Jammu and Kashmir State, 56 %, 92% and 96% per cent area under wheat, maize and barley, respectively is cultivated as rainfed crop which attributes to low productivity in comparison to National yields. Net sown area in Jammu and Kashmir ranges between 30-35 % which is again lower than the national average of 46% which needs to be increased to boost the productivity in the state. A brief account of the major corps of Jammu and Kashmir is given in the following paragraphs.

Rice: Jammu and Kashmir has witnessed a significant increase in the area under rice, wheat and maize cultivation from 1955-56 to 2011-12. As per the data in 2012 in J&K area under rice cultivation was 2.6 lac hectares, wheat 2.9 lac hectares and maize 3.1 lac hectares. Jammu district has reported highest area under rice cultivation followed by Kathua, Anantnag, Budgam and Baramulla. In Jammu region the rice is grown extensively over the alluvial plains formed by Tawi River and partly in the Chenab and Ravi basins below an altitude of 320 meters above mean sea level. In Kashmir region Kulgam is called as the Rice Bowl for its quality and quantity of rice. However owing to rapid conversion of paddy land into orchards and settlements during the last 10-15 years the area under paddy cultivation is shrinking at an alarming rate in the state in particular and valley of Kashmir in general. Rice production is showing persistent decline, which is a cause of concern for the food security of the state.

Jammu district also has the highest area under wheat cultivation in the year 2011-12 followed by Kathua, Rajouri, Udhampur and Samba. Rajouri leads in the area sown under maize followed by Udhampur, Doda, Kupwara, Kathua and Poonch.

Horticulture: Jammu and Kashmir is known worldwide for its fresh fruits like apple,

mango, pear, plum, cherry and apricot and dry fruits like walnut and almond. Apart from this, some major vegetables like onion, potato, tomato, turnip, peas, radish and carrot along with spices like chilies, garlic and turmeric are also grown at minor scale.

Apple Orchard Snopian

As per the official record of 2011-12 data, the total area under fruit cultivation is 3, 41,372 hectares in which fresh fruits occupy 2, 30,409 hectares and dry fruits occupy 1, 10,963 hectares. Among the fresh fruits apple leads with 1,54,721 hectares followed by citrus fruits 13655 hectares, pear 13219 hectares, mango 12295 hectares. Horticulture is major contributor to the GDP of the state with approximate annual turnover of 5000 crore rupees. Saffron is another prominent commercial crop which is mainly cultivated in the karewas of Pampore and adjoining table lands. It earns valuable foreign exchange for the country.

Saffron field in Pampore

Horticulture in Jammu and Kashmir also provides direct and indirect employment to large number of people and plays a crucial role in poverty alleviation.More than seven crore boxes of apple are exported from the state every year. The export of apple, walnut, almond and saffron earns valuable foreign exchange for the country. Jammu region produces some of the famous varieties of mango owing to its sub-tropical climate.Ladakh region is famous for the production of apricot throughout India.Owing to diverse geo-climatic set up of the State, horticulture has got tremendous scope and potential, as it can help in the establishment of a vibrant agro-based industry which will help in the diversification of the economy.

Glossary

1. **Agriculture:** The practice of growing crops and rearing of animals.
2. **Subsistence Agriculture:** The type of agriculture in which crops grown are consumed by the former and his family without producing any surplus for the market.
3. **Commercial Agricultural:** A type of agriculture in which farmer produce for the market, through mechanized forming.
4. **GDP:** Gross Domestic Product
5. **Plantation agriculture:** In this type of agriculture generally a single crop is grown on large farms.
6. **Shifting agriculture:** An agricultural practice in which a patch of land is cleared of forest, crops are grown and the patch is then abandoned until the soil regains its fertility.
7. **Kharif :** The season of cropping which starts in early June and lasts till the end of October.
8. **Rabi :** The season of cropping which starts with the beginning of winter and continues till the spring season.
9. **Zaid:** An extra cropping seasons which starts at the end of Rabi and ends till Kharif starts.
10. **Crop rotation:** Raising of various crops on a farm cyclically in a way that fertility and productivity of land is maintained.
11. **Multiple cropping:** When two or more than two crops are grown simultaneously in the same field.

Exercise

A. Very short answer type questions

Q. No. 1

i) Slash and Burn type of farming is a characteristic feature of ----------.

ii) People moving seasonally along with their herds between mountains and lowlands are known as…….....

iii) Olives and grapes are most important commercial crops of ---------- agriculture.

iv) Which crops are better known as monsoon crops or summer crops?

v) Coffee is a…….....…….. crop.

B. Short answer type questions

Q. No. 2

i) India is bestowed with variety of crops & multiple cropping seasons. Give some reasons?

ii) Highlight the importance of agriculture in india?

iii) Name some commercial crops grown in India?

iv) What are the climatic conditions required for the cultivation of wheat?

v) What is the utility of by products of rice?

vi) Name the three main components of green revolution?

vii) Define Zaid crops?

C. Match the following

Q. No. 3

Food grain	Apple
Commercial crop	sugarcane
Plantation crop	wheat
Horticultural crop	cotton

D. Long answer type questions

4. Food production in India is showing signs of stagnation. Give reasons?
5. What are the geo-environmental conditions for the cultivation of sugarcane in India and also give its production and distribution?
6. Highlight the importance of horticultural in the agriculture sector of Jammu and Kashmir?
7. Write a note on green revolution, its merits and demerits?

Activity

In an outline map of India, highlight major cotton and jute producing areas.

In an outline map of India, highlight major rice producing areas.

In an outline map of Jammu and Kashmir, show major saffron producing areas.

Chapter
5

Forests and Wildlife

Natural vegetation refers to plant life that grows naturally in an area, without human intervention; while as wild life refers to the animal life found in an area that has not been tamed or domesticated. Natural vegetation and wildlife are renewable natural resources. The trees in forests, along with a wide variety of animals that they support, form the largest terrestrial community or earth. The growth of vegetation depends upon several factors like temperature, rainfall, sunlight, soil, height above sea level, etc. Forests account for 75% of the Gross Primary Productivity of the Earth's biosphere. Forest ecosystems can be found in all regions capable of sustaining tree growth, at altitudes up to the tree line, except where natural fire frequency or other disturbances are too high, or where the environment has been altered by human activity.

DO YOU KNOW? FORESTS ARE LIKE THE LUNGS OF THE EARTH.

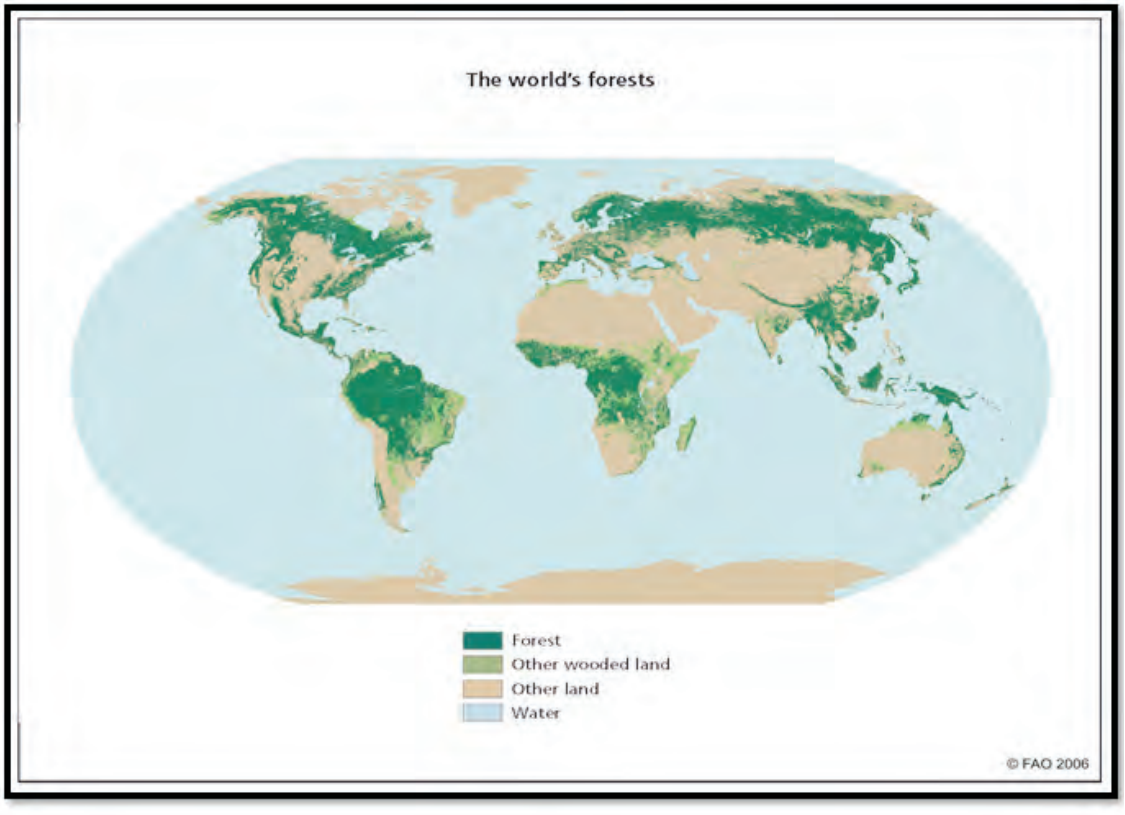


Fig. 5.1 Global Distribution of Forests

The latitudes 10° north and south of the equator are mostly covered by tropical rainforest, and the latitudes between 53°N and 67°N have boreal forest. As a general rule, forests dominated by angiosperms (broadleaf forests) are more species-rich than those dominated by gymnosperms (conifer, montane, or needle-leaf forests), although exceptions exist.The world's forest area is just over 4 billion hectares, covering about one-third of the total land area. As per the (FAO) Food and Agricultural Organizations 2015 report forests cover approximately 31% of total land area of the world. This corresponds to an average of 0.6 hectare of forest per person. The most forested countries – Russia, Brazil, Canada, United States and China – account for more than half of the global forest area.

Forest is the assemblage of various plants bushes, shrubs, grasses, creepers in a given set of environmental conditions. Forest is a ***Protector*** and ***Provider***. Forest is a renewable resource. It has the property of regenerating by seeds, and roots.

Direct advantages:

- Forests support animal kingdom by providing suitable habitat.
- They supply a number of products such as lac, tanning material, herbs, medicines and resins etc.
- Large number of people are employed in lumbering, sawing, furniture making, forest produce collecting etc.
- Export of forest products helps in earning foreign exchange.
- Grazing of cattle in the forest helps in dairy farming and cattle rearing.
- Many forest reserves have been developed into tourist centers.

TREE LINE:
The height above which it is too cold and windy for trees to grow is called a tree line.

Indirect advantages:

- They help in maintaining ecological balance.
- They reduce the fury of flood.
- They regulate stream flow.
- They protect soil from erosion.
- They also enrich underground water resources.
- They act as sound absorbers.

- Forests moderate temperature.
- They produce oxygen and control pollution.
- They help in causing rain.
- Decay of plant leaves provide humus to the soil.

BIODIVERSTY:
It means the varied species of plant & animal life which form eco-system.

Forest Cover in India:

According to the official records such as forest survey report 2013, the total forest area covers about 22.5% of the total land area of the country, which is much below the world average of 31 percent. India with about 17% of the world's population has nearly 2% of the total world's forests. According to National Forest Policy (NFP), the minimum desired forested area which is considered safe for a tropical country like India is about 33%. Thus the forest resources are extremely inadequate in India.. The 2013 Forest Survey report of India reveals that the forest cover had increased to 69.8 million hectares by 2012, as per satellite measurements. However, the gains were primarily in northern, central and southern Indian states, while north-eastern states witnessed a net loss in forest cover from 2010 to 2012.

As per the report, the forest cover in top five states has increased, with the exception of Arunachal Pradesh. Area wise Madhya Pradesh is having largest area under forests while as percentage wise Mizoram tops the list with 82.7% of its land area under the forest cover. Haryana is the least forested state of India with an overall forest cover of 3.5% followed by Punjab and UP with 6% & 7% respectively. Out of the total forest cover dense forest constitutes 2.5%, moderately dense forest occupies 9.5% and open forest covers 9% of the India's land area. Scrub also occupies 1.5% of land area however it is not included in the forest area. Altitude wise maximum (82%) forest cover is found between 0-1500 meters above sea level.

Vital Statistics about forests in India:

Leading States	Area hectares
Madhya Pradesh	7.75 million
Arunachal Pradesh	6.73 million
Chhattisgarh	5.6 million
Maharashtra	5.06 million
Orissa	5.03 million

State	Forest cover %
Mizoram	82.7
Arunachal Pradesh	81
Nagaland	80
Manipur	75
Tripura	67

Altitudinal Zone Above Sea Level	% of Forest cover
0-500 mts	54.44
500-1000 mts	28.10
1000-2000 mts	11
2000-3000 mts	5.83
3000-4000 mts	2.49
4000 & above	0.14

Forest type	% of total	Canopy cover
Very dense forest	2.5	70%+
Moderately dense forest	9.5	40-70 %
Open forest	9	10-40 %
Scrub/degraded forest	1.5	Below 10%
Non forest land	77.5	

Source: (Forest survey report: 2013)

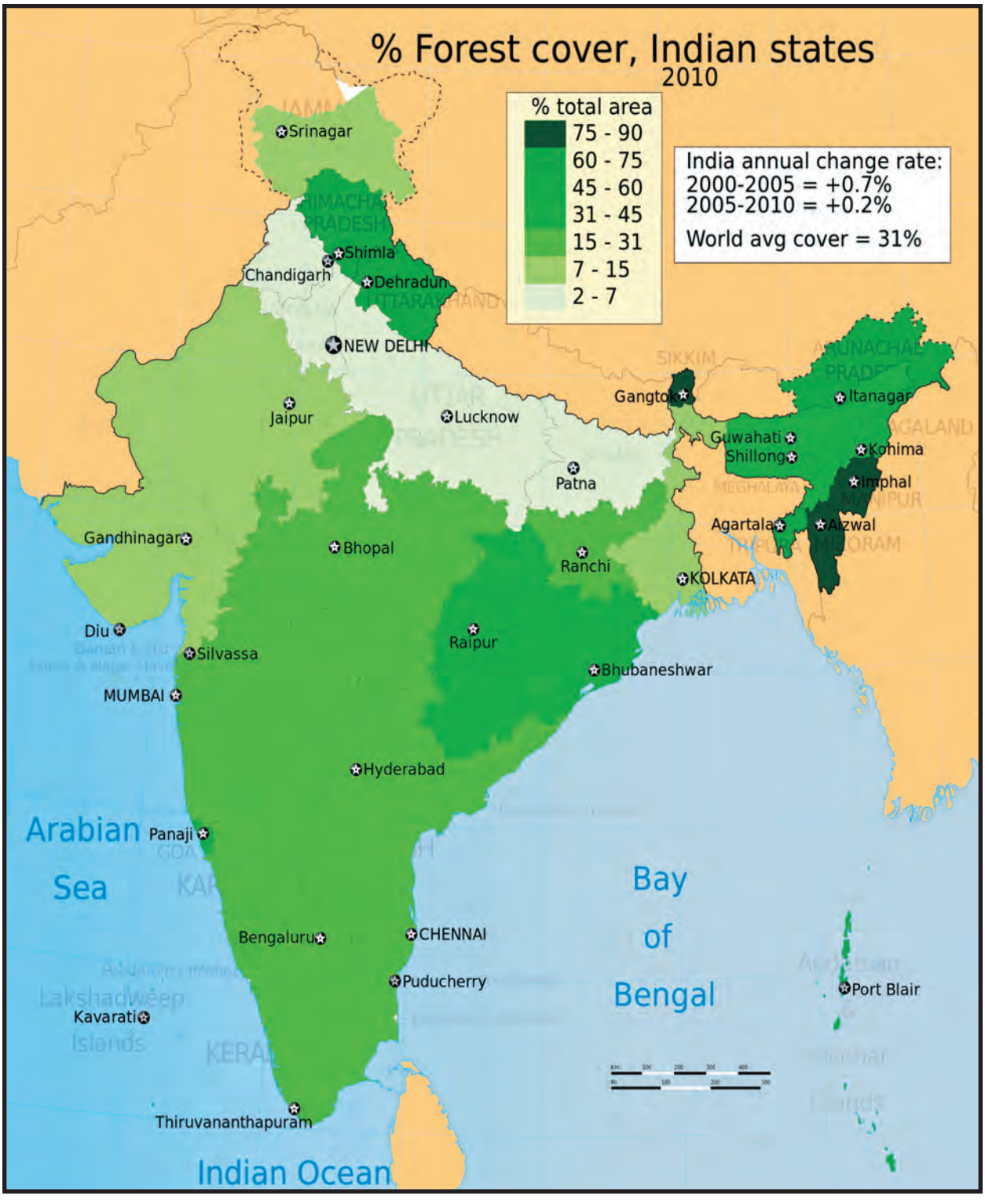
Indian is one of the 18 mega-bio diverse Countries of the world & consists three among the 34 biodiversity hotspots on earth. India is home to 12% of world's recorded flora, some 47000 species of flowering and non-flowering plants. Over 59000 species of insects, 2500 species of fishes, 17000 species of angiosperms live in Indian forests. About 90000 animal species, representing over 7% of earth's recorded faunal species are found in Indian forests. Over 4000 mammal species are found here. India has one of the richest varieties of bird species on earth, hosting about 12.5% of known species of birds. Many of these flora and fauna species are endemic to India. Indian forests and wetlands serve as temporary home to many migrant birds.

India is a vast country with diverse geophysical and climatic conditions. Though, our forest cover does not commensurate with the scientific norm of 33% area under forest, we have extensive forest lands. It is a difficult task to manage, control and regulate them. The Forest Department of the Government manages and owns them.

Forests of India are classified under three broad categories:

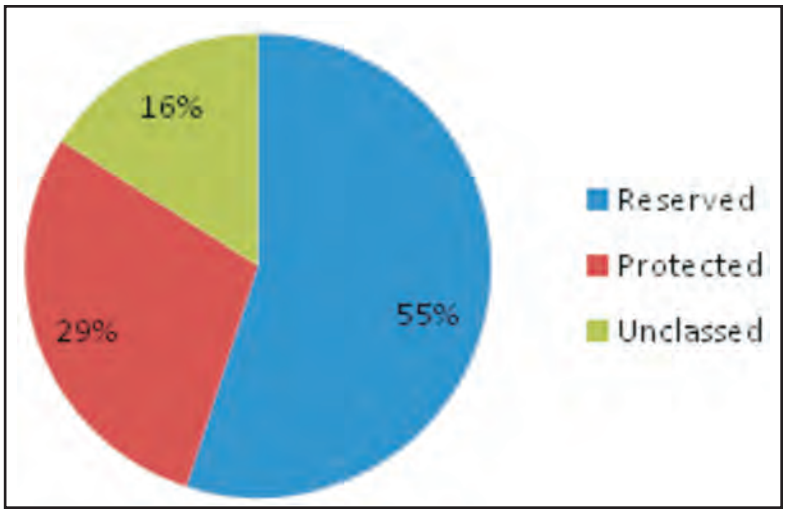
1. Reserved forests
2. Protected forests
3. Un-classed forests

Reserved Forests: These forests account for the largest share of 55% in the total forest cover. The reserved forests are a permanent forest area. The timber and other forest produce is exploited according to the species of plants. The right of grazing for domestic animals and the use of land for cultivation of crops is seldom allowed.



Classification of Forest Based on Conservation and Administration

Protected Forests: These account for 29% of the total forest cover. In spite of minor restrictions, the grazing of animals and cultivation of crops in certain areas on selective basis is allowed.



Unclassed Forest: These are inaccessible areas or wastelands. These constitute about 16% of the total forest cover. The forests are managed by the local community.

Natural Vegetation of India:

Much of the Natural Vegetation cover has been removed because of the intense need to bring more land under cultivation and for human settlement. The natural vegetation, generally, grows well where there is enough rainfall. It is conserved where the land is not fit for cultivation. The natural vegetation of India changes from one region to another due to the variations in the climate and soils. On the basis of climate and relief the natural vegetation of India can be divided into the following types.

Tropical Evergreen Forests:

These forests are found in areas with 200-300 cm of rainfall. They need high humidity and even temperatures throughout the year. Forests are dense with thick undergrowth. These forests yield hard wood trees. like Rose wood, Ebony and Sisam.

Tropical rainforest, Andaman Nicobar Islands

These forests are very dense and composed of tall trees reaching upto the height of about 60 metres. The trees have a multi-storeyed structure with good canopy. They look like a green carpet when viewed from above.

Due to dense growth of trees, the sunlight does not reach the ground. Thus, the under growth consists of canes, bamboos, climbers, ferns etc. The passage through these forests is difficult and consequently these forests are difficult to exploit. Elephant, Monkey, Rhinoceros are important animals.

Distribution: They are found on the wind ward side of the Western Ghats and in the hills of N.E. India, West Bengal, Orissa and Andaman Nicobar Islands.

Tropical Deciduous Forests:

This is the most dominant vegetation belt of India and is spread over the vast areas of the country. These are the mostly typical forests of the Monsoon region. Hence, these forests are also known as Monsoon Forests.

- These forests are found in areas with an annual rainfall of 100-200 cms.
- The trees shed their leaves for six to eight weeks during summer in order to survive the dry season.
- Although the trees shed their leaves in summer, each species has its own time. As a result of this, the forests never look absolutely bare at anytime.
- These forests are of economic importance to India.
- Teak and Sal are the most important trees of the Monsoon Forests.

  Sandalwood, Rosewood, Ebony, Shisam and Mahua are other trees of economic importance.

These forests are further divided into Moist and Dry Deciduous.The tropical deciduous forests are commercially most important as they yield valuable timber and a variety of other forest products.

These forests are commercially most exploited. Large tracts of these forests have been cleared to provide land for agricultural purposes. These forests have also suffered from severe biotic factors, such as over-cutting, over-grazing, fires etc. These forests urgently need scientific management and conservation.

Tropical deciduous Forest, Bandipur Karnataka

Thorn Forests (Xerophytes):

Thorn forest: Sasan, Gir, Gujarat

These forests are found in areas with under 70cm of annual rainfall. The trees of these forests are only 6-10mtrs high. Trees have long roots and sharp spines as a protection from animals. There is not much scope for thick and tall forests due to the shortage of moisture. The trees are scattered and have long roots. The roots penetrate deep into the soil to get moisture. The leaves are mostly thick and small, which retards transpirations. The trees have thick bark and there wood is generally used as fuel.

Distribution: These forests are found in, Rajasthan & parts of Gujarat, Punjab, Jharkhand, Chhattisgarh and eastern slopes of Western Ghats. These forests consist of stunted trees and bushes which are widely scattered. Babul, kikar & Wild Palms are common trees.

Mangrove Forests:

These forests are also known as Mangrove or littoral forests.Tidal forests are found on the estuaries and fringes of Deltas along the East Coast. The roots of the plants are submerged under water. The most important tree is the ***Sundari*** tree and is used for building boats and boxes. The dense mangrove forests occur along the coast line in the sheltered estuaries, backwaters, salt marshes and mud flats. The mangrove can attain the height of about 30 meters. Sundarban West Bengal contains 50% of India's mangrove forests. The Deltas of the Ganga, the Mahanadi, the Krishna and the Kaveri are covered by such vegetation. The other types of trees found in the tidal forests are Palm, Coconut, Canes, Nipa etc. The epiphytes (plants growing on other plants) are predominant all over the region. India has about 7% of the world's total tidal forests.


Sunderban Mangrove Forest

Mountain Vegetation

Montane forest in Himalayas

Vegetation in the Himalayas varies with altitude due to changes in temperature and rainfall.The Shiwaliks at the foothills of the Himalayas are covered with Tropical Deciduous Forests. Sal is the most important tree in this belt. Above the Shiwaliks, the Temperate Deciduous forests are found. This forest consists of Oak, Chestnut, and Chir. At a higher altitude, Coniferous Forests are found. The important trees are pine, fir, cedarous and spruce. Above 3,500 mtrs which is the tree line, alpine vegetation is found which consists of grasses and flowering bushes.

Deforestation

The cutting down of trees due to increasing population and consequent pressure on land has led to rapid deforestation all over the country.

Forests are primarily cut down to:

- Clear land for agriculture.
- For putting up industries.
- For laying roads and railways lines
- For other infrastructure projects and settlement.

Effects of Deforestration

Depletion of forests by over utilization has affected eco-system very badly. According to the Forest Survey report, between 1951-1980 26,200 sqkm of forest areas were cleared for agriculture. A large part of forest cover in North East India has been destroyed by shifting cultivators since 1951. More than 5,000 sqkms of forests were cleared for large scale developmental projects, such as river valley projects like Tehri Dam in Utturakhand and Narmada Sagar Projects in Madhya Pradesh. High consumption of forest resources by richer communities has caused more ecological and environmental damage to the eco-system. Along

with plants and animals, man also gets affected by deforestation on several accounts.

1. It accelerates soil erosion.
2. It affects ground water recharge.
3. It promotes fast melting of glaciers.
4. It leads to loss of biodiversity.
5. It aggravates severity of floods.
6. It leads to lowering of water table.

For a healthy environment, we must protect our forest resources. It is mandatory to formulate strict laws and strategies to conserve this precious resource.

Deforestation

Conservation of Forests:

The forests have a close relationship with the existence of life and environment on the earth. They provide many direct and indirect advantages. Thus, all forms of natural vegetation, including forests must be protected and conserved for the survival and prosperity of economy and human beings.

The national goal of bringing about 33% of the geographical area of the country under forests must be achieved. This can be done by taking several bold decisions like ban on encroachment of forest land in discriminate cutting of trees, and restrictions on grazing.

A massive aforestation programme with emphasis on fuel wood, & fodder should be launched. The green belts should be developed around the urban tourist industrial and historical areas. Villagers should be encouraged to plant trees on community lands.

India's Forest Policy

India is one of the few countries having a forest policy since 1894. It was revised in 1952 and again in 1988. Main objective of the national forest policy of 1988 is protection, conservation and development of forests. Under the scheme of forest conservation following measures have been adopted.

1. Bringing 33% of the area under forest.
2. Conserving the biological diversity of the country.

3. Maintenance of environmental stability through preservation and restoration of ecological balance.
4. Check on soil erosion.
5. Check on the extension of sand dunes.
6. Conservation of Natural Heritage.
7. Promotion of Afforestation and Reforestation programmes.
8. Steps to meet requirements of fuel-wood, fodder, timber and forest produce of rural and tribal areas.
9. Steps to create massive people's movement with involvement of women to achieve the objectives.

The Chipko Movement:

In 1974, the women in Northern India took a simple but effective action to stop tree felling. They threatened to hug the tree if timber traders attempted to cut them. This initiative highlighted the issue and forced the authorities to abandon the cutting of forests in this region.

Wildlife:

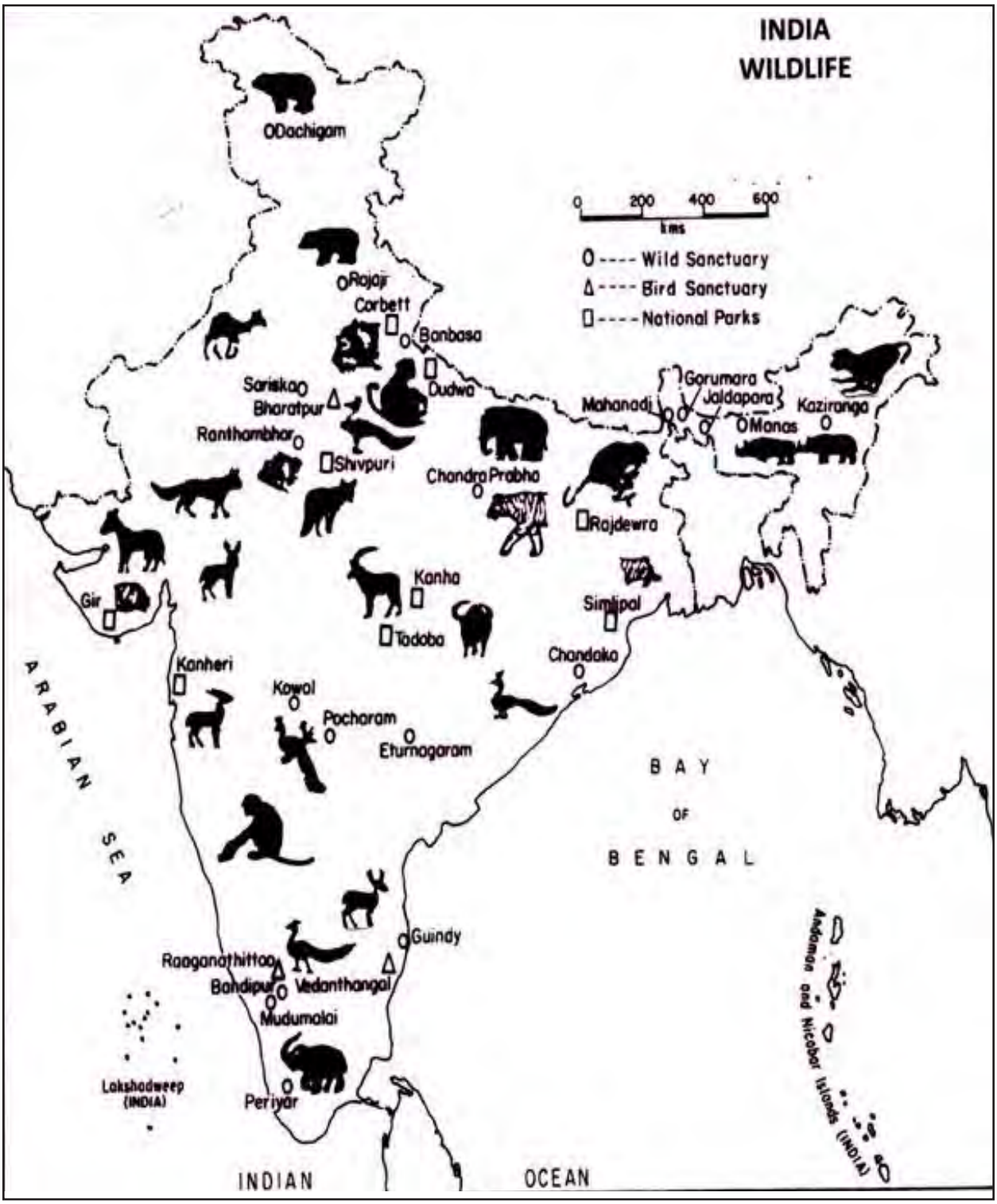
Wildlife refers to all the non-domesticated animals found in an area. It comprises of all types of animals like mammals, reptiles, amphibians, birds and insects. Wildlife is an important natural resource and there exists a close relationship between vegetation and wildlife in a given area. Animals maintain the ecological balance in nature. Birds feed on worms and thus, protect crops from pests. Birds like vultures and crows feed on dead animals and thus, act as scavengers.

India's Wildlife

The forests, plains, hills and mountains of India are inhabited by a variety of animal life. Some of the important animals are lions, tigers, leopards, elephants, bears, languor and rhinoceros.

The extensive Sundar-ban forest is the habitat of tigers, wild pigs, the spotted deer, salt water crocodiles, the Indian python and king cobra. During the monsoon storks, herons and other water birds nest here in huge colonies. Alongside them, in the sandy beaches south of the sunderbans, hundreds of thousands of marine ridley turtles come to nest each year.

Westwards, Rajasthan (Bharatpur, Ranthambhore) offers a spectacular congregation. Ducks, geese, storks, herons, cranes, Kingfisher, and Wagtails gather in large numbers. Among



India: Wild Life

the mammals are the sambhar, spotted deer, the black buck and once upon a time, the tiger. The dry – far western Rajasthan is the realm of the great Indian Bustard, Indian Gazelle and the Black buck. To the south of the desert, in the Gir forests of Gujarat, live the Asiatic lions.

Conservation of Forests and Wildlife:

For a healthy environment, we must protect our forests and wildlife resources. Conservation preserves the ecological diversity and the quality of our support systems i.e, air, water and soil. It preserves the genetic diversity of plants and animals.Therefore, the Indian Wildlife protection Act was implemented in 1972. Conservation of biodiversity can be divided into two categories: **In-situ** Conservation and **Ex-Situ** Conservation. In **In-situ** conservation, the animal kingdom is protected within their natural environment, such as National Parks and sanctuaries. On the other hand, in the **Ex-situ** conservation, the entire biodiversity is protected outside their natural living environment in zoo; Botanical Gardens, etc.

National Parks, Zoological Parks, Sanctuaries, bio-reserves were established by central and state governments for the protection of plants and animals. For protecting endangered animals, the Central Government with its technical and financial support launched Project Tiger, Project Elephant and several other projects for saving animals like one horned rhinoceros, the Kashmir Stag, freshwater and salt water crocodiles, Gharials, Asiatic lions, vultures, snow leopards, bustards, chinkara etc. Hunting has been banned. Trade in animal products has been restricted. It is a crime to sell tusk of Elephant, Tiger & Leopard skin.

PROJECT TIGER

Tiger is one of the important wildlife species in the category of fauna. In 1973, the Government felt that the tiger population has decreased to 1,827 from an estimated 55,000 in 1901. The reasons behind the declining tiger population include; Poching for trade, shrinking habitat, depletion of pray base species, ever increasing human population. The trade of Tiger skins and the use of their bones in traditional medicines are also major threats to tiger population.

The project Tiger was launched in 1973. It is one of the well publicised wildlife campaigns in the world. Initially, the project showed signs of success as the tiger population went up to 4,002 in 1985 and 4,334 in 1989. In 1993, however, the population of the tiger declined to 3,600.

There are 27 tiger reserves in India covering 37,761 sq. Km area. Corbett National Park in Uttrarankhand, Sunderbans National Park in West Bengal, Bavghavgarh National Park in Madhya Pradesh, Sariska Wildlife Sanctuary in Rajasthan, Manas Tiger Reserve in Assam and Periyar Tiger Reserve in Kerala are some of the Tiger reserves of India.

Most conservation projects are now focusing on Bio-diversity rather than its individual components. A National environmental Awareness Campaign (NEAC) is organized everywhere.

National Parks, Wildlife sanctuaries and Bio reserves are made to protect our Natural vegetation and wildlife.

- **A National Park** is a large area of land preserved in its natural state as public property, and there are laws that protect the Wildlife. There are 102 National Parks in India. Periyar National Park Kerala, Kanha National Park Madhya Pradesh, Kaziranga National Park Assam are some examples
- **A Wildlife Sanctuary** is a vast area set aside by the state to protect characteristic wildlife, especially migratory bird communities, or to protect threatened animal or plant species. All forms of hunting, killing or capturing of wildlife are prohibited except for scientific research authorised by the Government. There are 490 wildlife sanctuaries.
- **Biosphere** reserves are specially protected natural areas on very large scale. Biosphere Reserves (BRs) are representative parts of natural and cultural landscapes extending over large area of terrestrial or coastal/marine ecosystems or a combination thereof and representative examples of bio-geographic zones/provinces. As on January 2014 there are 18 biosphere reserves in India. The purpose of developing bio-reserves is to promote environmental research and to conserve plant and animal species in their respective eco-systems. It also provides opportunities for education and training to local people regarding biosphere and its conservation.

Forest Resources of J & K:

The state of J & K is bestowed with lofty snow crested mountains, fascinating valleys sparkling streams, rushing rivers and emerald forests. The state is blessed with diverse ecosystems. Its natural vegetation has great diversity, ranging from the lush evergreen conifers on the gentle slopes at high altitudes to deciduous forests on the southern slopes of the Shiwaliks. Forests of the state are spread over three broad geo-climatic zones covering Jammu, Kashmir and Ladakh regions of the State. Vegetation and climate can broadly be categorized into sub-tropical, temperate and alpine zones with wide diversity of fauna and flora. Literature indicates that 572 plant species belonging to 109 different families have medicinal value.

As per the Annual Report of J&K Forest Department 2011-12, the recorded forest area is 22539 Square Kilometres, which constitutes 22.5 % of geographical area of the State.

Approximately 51% of forests are found in Kashmir Valley and Jammu Regions contains 49% of state forest cover. Leh and Kargil are devoid of Vegetation as the region is cold desert. In terms of forest canopy, the state has 4140 sq.kms of very dense forests, 8760 sq.kms of moderately dense forest and 9639 sq.kms of open forest. There are five forest types occurring in the State Viz. Sub tropical, Dry, Evergreen, Himalayan Moist Temperate, Himalayan Dry Temperate, Subtropical Pine Sub-Alpine and Alpine Forests.

The state of J&K has fairly rich diversity of plant life and on which people depend for their daily needs of food, medicine, fuel, fiber etc. The varied plant life also contributes to food and habitat needs of wild and domesticated animals in the state. The environmental, social and economic value of plants are very well known. On the other hand, the faunal component of biodiversity of the state is rich with interesting and unique forms both in the forest zone and above forest line. The variety of animal forms ranges from higher groups like vertebrates, including mammals, birds, reptiles, amphibians and lower groups like invertebrates including insects and even unicellular micro organisms.

Flora of Kashmir Himalayas comprises of about 3054 species. About 880 species are found in Ladakh and 506 species found in Jammu. These figures only include the angiosperms, gymnosperms and pteridophytes. The plants of western Himalayas are well known for their medicinal properties. This area is store house of medicinal and aromatic plants which are used in pharmaceutical and perfume industries. The list includes 55 species of important medicinal and aromatic plants.

Faunal diversity of J&K is diverse due to its unique location and climatic condition. 16% of Indian mammals are present in state including birds, reptiles, amphibians and butterflies. Carnivores represent 32% of the total mammalian fauna of the state. In terms of wildlife conservation lot of steps have been taken by the Govt. to ensure growth and survival of wildlife. As per the annual forest report of J & K forest department 2011-12, J &K has got 5 National Parks, 14 Wildlife Sanctuaries, 21 Conservation Reserves 14 Wetland Reserves and 4 Ramsar Sites.

Rare Mammals:

The rare mammals of the region include the Kashmir stag or Hangul, Musk Deer, Gazelle, Serow, Markhor, Ammon, Wild yak ,the Tibetan Wild Ass, the Snow leopard ,the Brown Bear, Ibex to name a few. During the year 2002, the number of Hangul in Dachigam National Park has been reported as 483.

Rare Birds:

Some of the rare and threatened birds found in the area include exotic species like the Himalayan Golden Eagle, the Bearded Vulture, the Monal Pheasant, the Koklas, the western Tragopan, the Black necked Crane, the Himalayan Snow cock and the Bar – Headed goose.

Water Birds:

Migratory Water Birds include Duck, Geese and Swans. The most common water birds which visit the state during winter months are Mallard ,Common Teal , Pintail, Red Crested Pochard, Greylag goose & Wigeon etc.

Glossary

1. **Natural vegetation:** It refers to plant life that grows naturally in an area without human intervention.
2. **Forest:** an assemblage of various plants, bushes, shrubs, grass, creepers in a given set of environmental conditions.
3. **Protected Forests:** In these forests there are minor restrictions, but the grazing of animals and cultivation of crops in certain areas on selective basis is allowed.
4. **Reserved forests:** These forests represent permanent forest area where right of grazing and use of land for cultivation crops is seldom allowed.
5. **Un-Classed forest:** These forests represent the in accessible areas are wasteland.
6. **Epiphytes:** These are plants which grow on other plants.
7. **Wildlife :** it refers to the animal life found in an area that not been tamed or domesticated

Exercises

A. Very short answer type questions

Q. NO. 1

i) Natural vegetation refers to plant life that grows_____ in an area.

ii) Wild life refers to _____ life found in an area that has not been domesticated.

iii) Tropical forests are found in areas with _____ cms of rainfall.

iv) The species whose population has declined to dangerously low level are known as _____.

v) The two type of conservation are _____ and _____.

B. Short answer type questions.

Q. NO. 2

i) Name the main geographical factors which influence the type and distribution of vegetation?

ii) What is a Biosphere reserve?

iii) Name different types of vegetation in India?

iv) Define tropical deciduoces forests and their concernes?

v) Define Mangrove forest and their distribution in India?

vi) Write a note on the main objectives of the National Forest Policy.

vii) Write a note on Project Tiger?

C. Long answer type questions.

3. Human activities affected the depletion of Flora and Fauna? Explain.

4. What steps have been taken by the Government for the conservation of flora and fauna?

5. Forests are very important. Explain.

6. Give a detailed accounts of the forests of Jammu and Kashmir.?

Activity

1. Collect more information on the National Parks and Wildlife sanctuaries of India and mark there locations on the map of India.
2. On an outline map of India show major vegetation belts.

Chapter
6

Mineral Wealth

Minerals are naturally occurring substances, uniform in chemical composition and have an ordered atomic Structure. Minerals are derived from rocks and ores. Man has been using minerals since pre-historic times. The importance of minerals in human civilisation is reflected from the fact that many stages in the history of economic development are named after minerals used in those days. Minerals occur in different types of rocks. Some are found in igneous whereas others in sedimentary rocks. Almost all metals are found in the form of ore.

Mineral resources in India are adequately rich, widespread and varied which provide the nation with a strong industrial base. The most important mineral resources which India possesses include Manganese, Coal, Bauxite, Mica, Iron and Salt. However Petroleum, Gypsum, Tin, Mercury, Copper, Nickel, Lead and Zinc are not found in sufficient quantity. India is mostly rich in iron resources. Iron and coal, actually forms the basis of the machine age. As per the estimations, India possesses virtually world's one fourth of iron ore resources. A further significant mineral required by the ferrous industries is manganese and in India it is found in abundance. It is used to manufacture steel alloys. Although the country has substantial coal reserves, but the high grade coal reserves and output is inadequate to meet the domestic demand.

As per the 2014 report of Indian Bureau of Mines Nagpur, the value of mineral production in India covering fuel, metallic, non- metallic and minor minerals rose spectacularly during the last 6 decades since 1951. It touched the peak level of Rs. 255677 crore in 2011-12. The increase in the value was attributable to both rises in mineral production as well as in mineral prices.

Fuel minerals contributed a major share (69%) in the value of mineral production in 2011-12, followed by 18% metallic minerals and 13% non-metallic minerals (including minor minerals). Offshore regions continued to be in leading position, in terms of value of mineral production in the country and had the share of about 24% in the value of national output. Next in order is Orissa with a share of 11% followed by Rajasthan and Andhra Pradesh (9% each); Chhattisgarh (7%); Jharkhand and Gujarat (6% each), Assam (5%); Madhya Pradesh (4%); West Bengal, Goa, Uttar Pradesh and Maharashtra (3% each); Tamil Nadu, Meghalaya

and Karnataka (2% each) in the total value of mineral production.The other 16 States/Union Territories having nominal share in the mineral output of the country.

Classification of Minerals

Minerals are classified in two classes; namely metallic minerals and non metallic minerals. The difference between the two classes of minerals is discussed in the following table

Metallic minerals:	Non-metallic minerals:
Are those minerals which can be melted to obtain new products? Iron, copper, zinc, and manganese are some examples.	Are those minerals which do not yield new products on melting? Coal, salt, clay and marble are some examples.
They are generally associated with igneous rocks.	They are generally associated with sedimentary rocks.
They are usually hard and have shine or luster of their own.	They are not so hard and have no shine or luster of their own.
They are ductile and malleable. When hit, they don't break.	They are not ductile and malleable. When hit, they may break.

Importance of Minerals:

1. The country earns foreign exchange from the export of minerals.
2. More than 20 Lakh people are employed in the mining sector.
3. Minerals account for nearly 12% of country's industrial output.

Important Minerals and their Distribution in India.

1. Iron Ore

Importance of Iron

India is the largest producer and exporter of iron ore in South Asia. The total reserves of iron ore in the country are about 12,317 million tonnes of Hematite and 539.5 million tonnes of Magnetite. Although iron ore is found in several parts of the country, the major reserves are concentrated in the north-east of Peninsular India. Orissa, Jharkhand Karnataka and Goa are the major producers of iron.

There are four main varieties of iron ore:

(i) **Magnetite:** This is the best quality of iron ore and contains about 72% iron.

Map Showing Distribution of Important Minerial Resoruces of India

(ii) **Hematite:** It contains 60% to 70% of pure iron.

(iii) **Limonite:** It contains 40 to 60% of pure iron.

(iv) **Siderite:** It contains many impurities and has got below 40% of pure iron.

Magnetite

Hematite

Limonite

Siderite

Major Producers

Orissa: Orissa has emerged as the leading producer of iron ore. India's richest hematite deposits are located in Barabil-Koira valley where these deposits are spread over 530 sq km. The ores are rich in hematite with 60 percent iron content. The most important deposits occur in Sundargarh, Mayurbhanj, Cuttack, Keonjhar and Koraput districts.

Karnataka: Karnataka is another leading producer of iron ore. The high grade deposits belonging to the hematite and magnetite categories are found in **Kemmangundi** in Bababudan Hills of the Chikmagalur District. The other important iron ore producing districts of Karnataka are Chitradurga, Dharwar, North Kannad, Shimoga, and Tumkur.

3. Goa: Goa is the third largest producer of iron ore. It contributes approximately 17% to the total production of India. The richest ore deposits are in North Goa. Sahqualim, Sanguem, Satari, Ponda and Bicholim districts are the major producers.

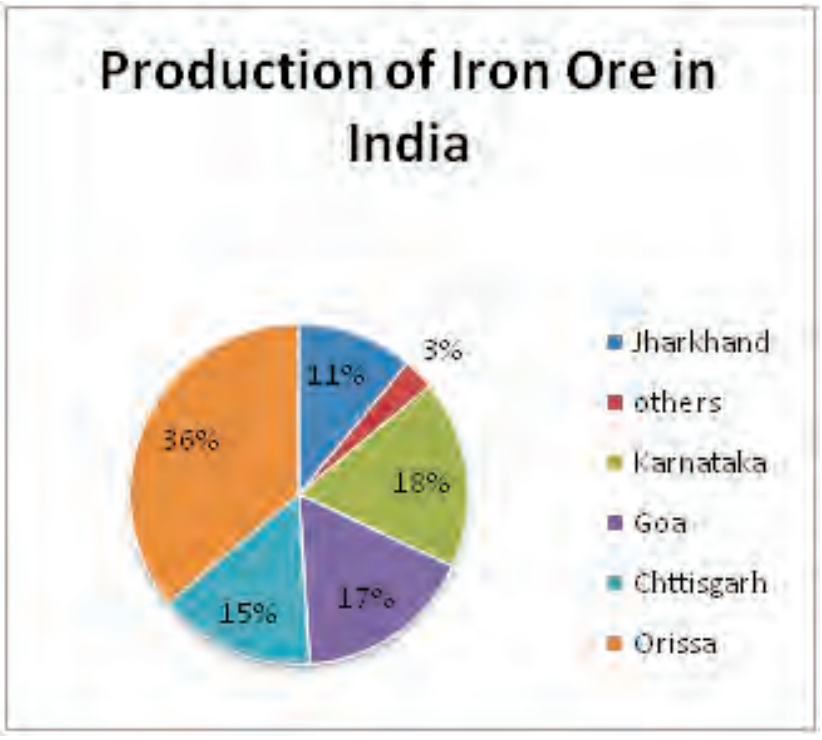


Fig. Production of iron ore showing state wise share in percent, 2010-11 (Indian Bureau of mines)

4. Chhattisgarh: Bastar and Durg districts are the major producers. Bailadila in Bastar district and Dalli Rajhara in Durg district are the major ore mines. Bailadilla produces high grade ore which is exported through Vishakhapatnam to Japan. Dalli Rajhara provides iron ore to Bhilai Steel Plant.

5. Jharkhand: Jharkhand is another major producer of iron ore. Singhbhum and Palamau districts are the leading producers. Iron ore of Singhbhum is of high quality. India's major iron and steel plants like Jamshedpur, Durgapur, Bokaro, Rourkela and Asansol fulfil their iron ore demand from Singhbhum and Palamau deposits.

6. Other producers

(i) **Andhra Pradesh** - Krishan, Kurnool, Warangal and Guntur districts.

(ii) **Tamil Nadu** - Salem, North Arcot, Coimbatore and Tiruchirapalli

(iii) **Maharashtra** - Chodrapur, Ratnagiri and Sindhudurg.

2. Manganese

Manganese is an important mineral which is used for making iron and steel and serves as a basic raw material for manufacturing steel alloys. It increases the strength of steel. It is also used for making paints, glass, chemicals, etc. India is one of the leading producers of manganese. Manganese of India is of high quality and is in great demand. Japan is the leading

importer of India's manganese. Orissa is the largest producer of manganese. It accounted for one-third of the country's total production. Orissa, Maharashtra, M.P, Karnataka and Andhra Pradesh are the leading producers.

3. Bauxite (*Aluminum Ore*)

Bauxite is the main ore of aluminum. Bauxite deposits are formed by the decomposition of rock rich in aluminum silicates. Aluminum is a very light, yet strong metal with many uses. It is used for making pots and pans because it is a good conductor of heat. Aluminum being a good conductor of electricity is widely used to make electrical wires. Aluminum is also used to make cans for various beverages and other liquids. It can be pressed into a thin foil that is used both commercially and in homes for wrapping foods for storage. Because aluminum is light and strong, it is widely used in aeroplanes and spacecrafts. It can be made even stronger by mixing it with other metals to form alloys. Duralumin is such an alloy. It is used on the outer surface of many aeroplanes. The bodies and parts of some automobiles, trucks, boats and trains are made from aluminum alloys.

Bauxite

India is the largest producer of bauxite in South Asia. Orissa, Madhya Pradesh, Chhattisgarh and Maharashtra states are the leading producers of bauxite. Orissa is the largest producer of bauxite. It produces more than 40% of the total production of India. Panchpatmali deposits in Koraput district are the most important bauxite deposits in the state.

Energy Resources of India

Coal and petroleum are the two important energy resources of India.

Coal is a major energy source of the world. It is a conventional source of energy. Due to its high utility as a source of energy, and as a raw material for a large number of industries, it is often called black gold.

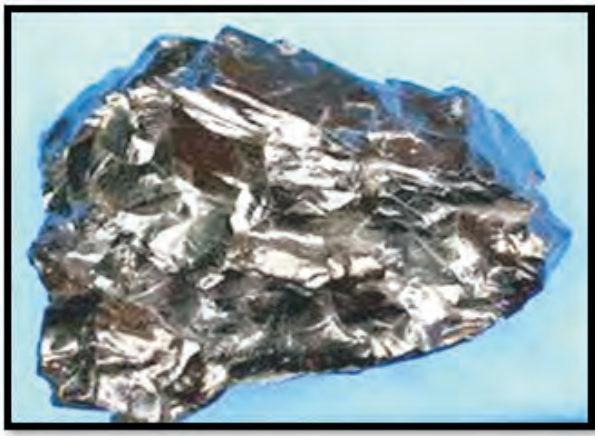
Formation of Coal: At various times in the geologic past, the Earth had dense forests in low-lying wetland areas. Due to natural processes such as flooding, these forests were buried underneath soil. As more and more soil deposited over them, they were compressed. The

temperature also rose as they sank deeper and deeper. As the process continued the plant matter was protected from biodegradation and oxidation, usually by mud or acidic water. This trapped the carbon in immense peat bogs that were eventually covered and deeply buried by sediments. Under high pressure and high temperature, dead vegetation was slowly converted to coal. As coal contains mainly carbon, the conversion of dead vegetation into coal is called carbonization. The wide, shallow seas of the Carboniferous Period provided ideal conditions for coal formation, although coal is known from most geological periods.

Importance of coal:

1. Coal is the main source of power generation in India.
2. It is the prime source of energy in the manufacturing of iron and steel.
3. It is also used as raw material in the chemical and other industries.

TYPES OF COAL			
Variety	**Major Producers**	**Carbon**	**Mainfeature**
Anthracite	Jammu and Kashmir	80%-90%	It is the best quality of coal. Highly efficient & less ash content
Bituminous	Jharkhand Orissa, and West Bengal	60% - 80%	It is used for production of coke and gas.
Lignite	Rajasthan, Neveli of Tamil Nadu and Assam	40%-60%	It is also known as brown coal.
Peat	Bihar and Madhya Pradesh	Below 40%	It burns like wood, least efficient, leaves a lot of ash.



Anthracite

Bituminous

Lignite

Peat

4. It is also used by railway as a source of power.

Distribution of Coal

India: India is the major producer of coal. Jharkhand, Orissa, Chhattisgarh, West Bengal, Maharashtra, and Andhra Pradesh are the main producers.

1. Jharkhand: Jharkhand is the leading producer of coal in India. Jharia, Bokaro and Giridih are the main mines. Jharia which lies to the south-west of Dhanbad city is one of the richest and oldest coalfields of India.

2. Orissa: Orissa has rich coal reserves. Most of the deposits are found in Dhenkanal, Sambalpur and Sundargarh districts. The Talcher field stretching eastward from Talcher town to Rairkhol in Dhenkanal and Sambalpur districts rank third in reserves after Raniganj and Jharia coalfields. The Rampur-Himgiri coalfields in the districts of Sambalpur and Sundergarh spread over an area of 520 sqk.m.

3. Chhattisgarh: Chhattisgarh also has large coal reserves. Singrauli, Tatapani and Koragarh are the major coal producing areas.

4. West Bengal: Although West Bengal produces only 8 percent of India's coal, the state has nearly 13 percent of the coal reserves of the country. Burdwan, Bankura, Purulia, Birbhum, Darjeeling and Jalpaiguri are the chief coal producing districts. Raniganj is the largest coalfield of West Bengal. It covers an area of 1,500 sq km mainly in Burdwan, Bankura and Purulia districts. This field produces mainly non-coking steam coal, which is used by railways and thermal plants. In Darjeeling district, coal reserves are found in Dalingkot coalfield.

5. Andhra Pradesh: Most of the coal reserves of Andhra Pradesh are in the Godavari valley in the districts of Adilabad, Karimnagar, Warangal, Khammam, East Godavari and West

Map showing distribution of important conventional energy resources of India

Godavari. The working collieries are situated at Tandur, Singareni and Kothagudam.

Petroleum or Mineral Oil

The word 'petroleum' has been derived from two Latin words-Petra meaning (rock) and Oleam (oil). Thus petroleum is oil obtained from rocks, particularly sedimentary rocks of the earth. Therefore, it is also called mineral oil.

Significance of Petroleum

1. It is used as a fuel and has revolutionized transportation on land, in air and on water.
2. It can be easily transported from the production areas to the consumption areas with the help of tankers and more conveniently, efficiently and economically by pipelines.
3. It emits very little smoke and leaves no ash,
4. It provides the most important lubricating agents and is used as an important raw material for various petro-chemical products.

Distribution of Petroleum in India

SHARE OF EACH STATE	
State / Area	**Percentage of Total Production**
Mumbai High	62.27
Gujarat	20.06
Assam	16.49
Tamil Nadu	1.04
Arunachal Pradesh	0.14
All India	100.00

Source: Statistical Abstract of India.

At present, oil is obtained both from onshore and offshore areas of India.

The major oil producing areas of India are divided into (i) North-East India and (ii) Western India.

Oilfields in North-East India

The major oilfields in North-East India are those of Assam and its neighboring areas including Arunachal Pradesh, Nagaland, Meghalaya, Tripura, Manipur and Mizoram.

1. Assam: Assam is the oldest oil producing state in India. The main oil bearing strata extend

for a distance of 320 km in upper Assam along the Brahmaputra valley. Following are some of the important oilfields of Assam.

(i) **The Digboi field**: It is located in Dibrugarh district of upper Assam. The Digboi is the oldest oilfield of India.

(ii) **The Naharkatiya field**: It is located at a distance of 32 km south-west of Digboi.

(iii) **Moran-Hugrijan field**: It is located about 40 km south-west of Naharkatiya. The Moran-Hugrijan field started production in 1956.

Other fields have been discovered at Ludrasagar, Sibsagar, Lakwa, Galeki, Badarpur, Barholla and Anguri.Oilfields of Assam are relatively inaccessible and are distantly located from the main consumption areas. Oil from Assam is, therefore, refined mostly in the refineries located at Digboi, Guwahati, Bongaigaon, Barauni and Nomaligarh.

2. Arunachal Pradesh: Arunachal Pradesh has oil reserves at Manabhum, Kharsang and Charali.

3. Tripura: In Tripura promising oilfields have been discovered at Mamunbhanga, Baramura, Deotamura, Subhang, Manu, Ampi Bazar, Amarpur, Dambura areas.

Oilfields in Western India

These include the oilfields of Gujarat and the offshore oilfields of Mumbai High and Bassein structure in Arabian Sea.

1. Gujarat: The main oil belt extends from Surat to Amreli. Vadodara, Bharuch, Surat, Ahmedabad, Kheda, Mehsana, etc. are the main oil producing districts.

Ankleshwar: Oil from this field is refined at Trombay and Koyali refineries.

Ahmadabad and Kalol field: It lies about 25 km north west of Ahmedabad. This field and a part of Khambhat basin contain 'pools' of heavy crude oil trapped in chunks of coal. Nawgam, Kosamba, Mehesana, Sanand Kathana, etc. are important producers.

Fig . Bombay High oil field Platform

Offshore Oilfields

Extensive surveys have been conducted by ONGC in the offshore areas of Kuchchh, Khambhat, Konkan, Malabar Coast, Coromandal coasts, Krishna-Godawari delta and

Sunderbans. Success on commercial scale has been achieved at Mumbai High, Bassein and Aliabet.

1. Mumbai High: The greatest success achieved by the ONGC with respect to its offshore surveys for oil was that of Mumbai High in 1974. It is located on the continental shelf off the coast of Maharashtra about 176 km north-west of Mumbai. Oil is taken from a depth of over 1,400 metre with the help of a specially designed platform known as SagarSamrat. There are several platforms or oil rigs in this region.

2. Bassein: Located to the south of Mumbai High, this is a recent discovery endowed with reserves which may prove to be higher than those of the Mumbai High. Huge reserves have been found at a depth of 1,900 metres. Production has started and is expected to pick up fast.

3. Aliabet: It is located at Aliabet Island in the Gulf of Khambhat about 45 km off Bhavnagar. Huge reserves have been found in this field.

Refineries in India

To meet the growing demand of petroleum products, the refining capacity in the country has gradually increased over the years by setting up of new refineries in the country as well as by expanding the refining capacity of the existing refineries. As of June, 2011 there are a total of 21 refineries in the country comprising 17 (seventeen) in the Public Sector and 3 (three) in

Petroleum refinery

the Private Sector and one as joint venture. The country is not only self-sufficient in refining capacity for its domestic consumption but also exports petroleum products substantially.

Conservation of Minerals

Measures to conserve the minerals:

(i) The minerals should be used in a planned way in a judicious manner.

(ii) Wastage of minerals should be minimised.

(iii) Modern technology should be used for the exploitation of minerals.

(iv) Export of minerals should be minimized.

(v) We should think about the use of substitutes in order to save minerals.

(vi) We should encourage recycling of metals.

Minerals of Jammu and Kashmir

The state of J&K does not possess adequate reserves metallic and non metallic minerals such as iron, copper, zinc, coal and petroleum. However the state is having certain reserves of bauxite, borax, coal, gold, gypsum, lignite, limestone, manganese, marble, and sapphire. A brief survey of these precious minerals is as follows:

- **Bauxite:** It is significant aluminum ore, which is used in the manufacture of utensils and refractory bricks. Millions of tons of this mineral can be found in Jammu.
- **Borax:** This mineral is used in boric acid and other medicines. It is found in Sokar Lake in Ladakh and experts have revealed that tons of borax are annually deposited in this lake, which needs attention.
- **Coal:** It is a valuable fuel and industrial mineral and is found in the form of anthracite and bituminous coal. Rich deposits of coal can be found in Rajouri district, where a thermal power plant has been set up to use coal wealth of the state to generate power.
- **Gold:** It is present on the banks of Indus River in the form of Placer gold in Ladakh region.
- **Gypsum:** It is extensively used in the cement industry, dentistry, sculpture, and in the manufacture of sulphuric acid. This is derived from a sedimentary rock consisting of mainly calcium sulphate. Quality gypsum exists in Jammu area.
- **Lignite:** Lignite is a low quality fuel and has been reported from Handwara region in millions of tons, as well as in Jammu region.

- **Limestone:** It is a carbonate rock of sedimentary origin, which caps most of the exquisite hill-rocks surrounding Anantnag, Pulwama, Baramulla and Ladakh districts. Limestone is the primary material from which $CaCO_3$, lime and Portland cement are manufactured. The well-known sites in the valley are Verinag, Mattan, Achabal, Shopian, and Khalsi in Ladakh.
- **Magnesite:** It is mostly composed of $MgCO_3$, which is used in the manufacture of glass. Millions of tons of Magnesite are found in Anantnag.
- **Marble:** This is a carbonate rock, which originates from the metamorphosis of limestone over a long period of tie. Marble, used for decorations and in buildings, has substantial market. Excavated from the marble mines situated at Kupwara, this marble is of high quality and possesses variety of shades and colours.
- **Sapphire:** It is a gemstone, a precious one, found in Padder, (Kishtwar). Kashmir. Sapphire is famous throughout the world for its wonderful shades, variety and quality.

Glossary

1. **Mineral:** A natural compound which is uniform in chemical composition and atomic structure and is found in the rocks of earth.
2. **Metallic Minerals:** These can be melted to obtain new products like iron and copper.
3. **Nonmetallic Minerals:** These do not yield new products on melting like salt and clay.
4. **Magnetite:** The best quality of iron ore containing 72% iron.
5. **Hematite:** An ore of iron which contains 60-70% iron.
6. **Limonite:** This ore iron of iron contains 40-60% iron.
7. **Siderite:** This ore contains 40-50% of iron in it.
8. **Energy Resources:** Resources like coal and petroleum which produce energy when burnt.
9. **Conventional Sources of Energy:** These are nonrenewable source of energy which once used cannot be used again like coal.
10. **Anthracite:** The best quality of coal, highly efficient and ashless containing 80-90% of carbon.
11. **Bituminous:** A type of coal used for production of coke and gas and contains 60-80% carbon.
12. **Lignite:** A Brown colored coal of low quality containing 40-60% carbon.
13. **Peat:** Least efficient type of coal with less than 40% carbon content.
14. **Ore:** A naturally occurring deposit which contains a mineral in sufficient concentration for commercial use.

Exercise

A. Very short answer type questions

Q.No.1

i) Naturally occurring substances with uniform chemical composition and orderd atomic structure are known as _____.

ii) Coal is a _____ source of energy and is used as a _____ for a large number of industries.

iii) Lignite is a type of coal which contains _____ % of carbon.

iv) The oldest oil field of india is _____ oil field.

v) Sapphire is found in the _____ area of J & K state.

B. Short answer type questions

Q.No.2

i) Define minerals and their importance?

ii) What are the various purposes for which bauxite is used?

iii) Name important petroleum producing states of India?

iv) Highlight the contribution of Orrisa in the national mineral production?

v) Discuss any three measures of conservation of minerals?

vi) Distinguish between metallic and non-metallic minerals?

C. Match the following:

Q.No.3

Coal type	Distribution
Anthracite	Rajasthan, Tamil Nadu and Assam
Bituminous	Bihar and Madhya Pradesh
Lignite	Jammu and Kashmir
Peat	Jharkhand Orissa and West Bengal

D. Long answer type questions

4. India is adequately rich in mineral wealth? Discuss?

5. Discuss in detail the production & distribution of iron ore in India?

6. Elaborate in detail the distribution of coal in India?

7. Discuss in detail the mineral wealth of Jammu and Kashmir?

Activity

a. On an outline map of India show the distribution of:

1. Iron ore
2. Coal
3. Petroleum
4. Manganese

b. Prepare a list of minerals resources found in Jammu and Kashmir and classify them into metallic and non-metallic minerals.

Chapter
7

Manufacturing Industries

Manufacturing is the processing of primary products into more refined and usable products. Many of the natural resources cannot be utilized directly without processing. Therefore we manufacture cloth from cotton, sugar from sugarcane, paper from wood pulp, and petro chemicals from mineral oil. By doing so, we make the primary products more valuable and usable. In other words, *manufacturing means transformation of natural material endowments into commodities of utility by processing, assembling and repairing.*

Manufacturing is vital for our very existence. It is an activity that works as an engine of economic growth, helps in removing poverty, unemployment and transforms a traditional society into a modern industrialized society. The economic strength of a country is judged by the development of its industries. All the developed countries of the world are highly industrialized.

The Rise of Modern Industry in India

The rise of modern Industry in India is attributed to the establishment and growth of cotton and Jute textile Industry. The cotton Industry in India grew tremendously in 1870s due to a spurt in demand in the wake of the American Civil War. By 1875-76, the number of cotton textile mills rose to 47. The first jute mill was set up at Rishra near Kolkata in 1855. Since the geographical conditions were very much favourable for jute industry in the Hugli basin, this industry flourished well and there were 64 mills in 1913-14, providing employment to over two lakh persons. Among the other industries which appeared on the industrial scene of India

Traditional Industry of 19th Century

Modern Industry of 21st Century

before the outbreak of World War I in 1914 were woolen textiles, paper and breweries. The main industrial centres were port cities of Mumbai, Kolkata and Chennai.

Factors Influencing the Location of Industries

Location of industry is influenced by many geographical factors. However there are several non-geographical factors of historical, political and economic nature which also influence the location of industries across the world. Consequently, for a detailed discussion, the factors influencing the location of industry can be divided into two broad categories; Geographical factors and Non-Geographical factors.

I. Geographical Factors

Raw Material

1. Raw Materials. It is the most important geographical factor and its significance in manufacturing industry is so fundamental that it needs no explanation.

Indeed, the location of industrial enterprises is sometimes determined simply by location of the raw materials. For example, pig iron, produced by smelting industry, serves as the raw material for steel making industry. Industries which use heavy and bulky raw materials in their primary stage in large quantities are usually located near the supply of the raw materials. Some of the industries, like watch and electronics industries use very wide range of light raw materials and the attractive influence of each separate material diminishes. The result is that such industries are often located with no reference to raw materials and are sometimes referred to as ''footloose industries'' because a wide range of locations is possible within an area of sufficient population density. In the regional context we can clearly notice that Jammu & Kashmir which is deficient in most of the industrial raw materials and ample power supply consequently is ranked among the industrially backward states of India due to geographical factors.

Energy

2. Power. Regular supply of power is a pre-requisite for the localization of

industries. Coal, mineral oil and hydro-electricity are the three important conventional sources of power.

Most of the industries tend to concentrate at the source of power. The iron and steel industry which mainly depends on large quantities of coking coal as source of power are frequently tied to coal fields

3. Labour. Labour supply is important in two respects (a) workers in large numbers are often required; (b) people with skill or technical expertise are needed. In our country, modern industry still requires a large number of workers in spite of' increasing mechanization.

Labour

Although, the location of any industrial unit is determined after a careful balancing of all relevant factors, yet the light consumer goods and agro-based industries generally requires a plentiful labour supply. This is the reason sugar industry is mainly concentrated in UP & Bihar.

4. Transport. Transport by land or water is necessary for the assembly of raw material and for the marketing of the finished products.

Transport

The development of railways in India, connecting the port towns with hinterland determined the location of many industries around Kolkata, Mumbai and Chennai.

5. Market. The entire process of manufacturing is useless until the finished goods reach the market. Nearness to market is essential for quick disposal of manufactured goods. It helps in reducing the transport cost and enables the consumer to get things at

Market

cheaper rates. It is becoming increasingly evident that industries are seeking locations as near as possible to their markets to save overall production cost.

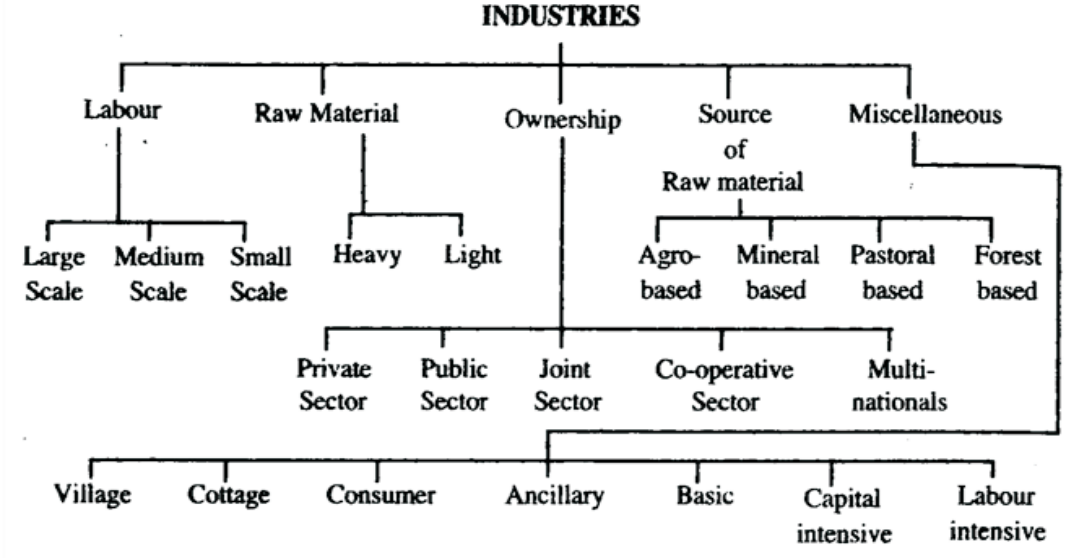
II Non-Geographical Factors

Following are some of the important non- geographical factors influencing the location of industries.

1. **Capital:** Modern industries are capital-intensive and require huge investments. Big cities like Mumbai, Kolkata, Delhi, and Chennai are big industrial centres because the big capitalists live in these cities and there is easy availability of capital.
2. **Banking Facilities':** Establishment of industries involves daily exchange of crores of rupees which is possible through banking facilities only. So the areas with better banking facilities are better suited to the establishment of industries.
3. **Insurance:** There is a constant fear of damage to machinery and men in industries for which insurance facilities are badly needed. The destruction caused by September 2014 floods in Jammu & Kashmir is a recent example in this regard.
4. **Highly professional management** and skilled manpower is an important component in the fast growing IT & E-Commerce industry due to which it gets concentrated in certain favoured pockets such as Bangalore, Hyderabad, and Pune.

CLASSIFICATION OF INDUSTRIES

Industries can be classified into several groups. The following table gives an understanding about them.



I. Classification on the Basis of Employment

1. **Large Scale Industry:** Industries which employ a large number of workers in each unit are called large-scale industries. Cotton or jute textile industries are large scale industries.
2. **Medium Scale Industries:** The industries which employ neither very large nor very small number of workers are put in the category of medium scale industries. Cycle industry, radio and television industries are some examples of medium scale industries
3. **Small Scale Industries:** Industries which are owned and run by individuals and which employ a small number of workers are called small scale industries.

II. Classification on the Basis of Ownership

Since the start of the planned development of Indian economy in 1951, industries are divided in the following four classes:

1. **Private Sector Industries:** Industries owned by individuals or firms such as Bajaj Auto, Reliance, Godrej industries and TISCO are called private sector industries.
2. **Public Sector Industries:** Industries owned by the state and its agencies like Bharat Heavy Electricals Ltd., NHPC, NTPC, ONGC or Bhilai Steel Plant or Durgapur Steel Plant are public sector industries.
3. **Joint Sector Industries:** Industries owned jointly by the private firms and the state or its agencies such as Gujarat Alkalies Ltd., or Oil India Ltd. fall in the group of joint sector industries.
4. **Co-operative Sector Industries:** Industries owned and run co-operatively by a group of people who are generally producers of raw materials of the given industry such as a sugar mill owned and run by fanners are called co-operative sector industries. Amul is the best example in this category.

Important Industries of India

Textile Industry

Textile is a broad term which includes cotton, jute, wool, silk and synthetic fiber textiles. The textile sector occupies an important place in terms of employment generation. The sectors like handloom, handicrafts, power loom, and readymade garments are specially known for their employment potential. Textile industries contributes about 14 percent of the value addition

in manufacturing sector, 4 percent to the GDP and provides direct & indirect employment to about 40 million people.

Map showing distribution of textile industries of india

Cotton Textile Industry

Cotton textile mill

Growth and Development: The first modern cotton textile mill was set up in 1818 at Fort Glaster near Kolkata. But this mill could not survive and had to be closed down. The first successful modern cotton textile mill was established in Mumbai in 1854.The real expansion of cotton textile industry took place in 1870's. By 1875-76 the number of mills rose to 47 out of which over 60 percent were located in Mumbai city alone. The industry continued to progress till the outbreak of the First World War in 1914. The total number of mills reached 271 providing employment to about 2.6 lakh persons.

Present Position

At present, cotton textile industry is largest organised modern industry of India. There has been a phenomenal growth of this industry during the last four decades. About 16 percent of the industrial capital and over 20 percent of the industrial labour of the country is engaged in this industry. The total employment in this industry is well over 15 million workers.

Production: Cotton cloth is produced in three different sectors, i,e, Mills, Power-looms and Handlooms.

1. **Mills.** The mill sector played a dominant role in cotton textile industry at the initial stage. But its importance reduced drastically with the growth of power-looms and handloom. The share of mill sector in cotton cloth production came down from 80.69 percent in 1950-51 to only 5 percent in 2003-04.
2. **Power-looms.** The decentralized power-loom sector plays a pivotal role in meeting the clothing needs of the country. This sector not only contributes significantly to the cloth production in the country but also provides employment to millions of people. The power-loom industry produces a wide variety of cloth with intricate designs. The production of cloth as well as employment has been increasing in the power-loom sector. During 2002-03, the production of cloth in the decentralized power-loom sector was 18281 million sq. metres while the employment generation was 4.23 million.

3. **Handlooms.** The handloom sector provides employment to over 65 lakh persons engaged in weaving and allied activities. The production of handloom fabrics registered more than fifteen fold increase from 500 million sqmetres in 1950-51 to 7585 million sqmetres in 2001-02.

Handloom

Distribution

Although cotton textile mills are located in over 80 towns and cities of India, yet its larger concentration is found in Maharashtra, Gujarat, West Bengal and Uttar Pradesh.

Maharashtra: Maharashtra excels all other states in the development of cotton textile industry. It produces 39.38 percent mill cloth and 10.79 percent yarn of India. Mumbai is the largest centre of India having 63 mills out of Maharashtra's total of 122 mills.

Gujarat: Gujarat is the second largest producer of cotton textiles. This state accounts for over 33 percent of the mill cloth and over 8 percent of the yam production of the country. Ahmadabad is the largest centre where 73 out of 118 mills of Gujarat are located. Ahmadabad is the second largest centre of cotton textile industry after Mumbai.

Jute Textiles

This is the second important textile industry of India after cotton textile industry. This industry existed in Bengal as handloom industry but the large-scale industry started in 1855 at Rishra, near Kolkata. In 1859, the first power-looms were started in the same mill and the spinning as well as weaving was undertaken. It was an export-oriented industry and it made rapid progress. The number of jute mills increased from 24 in 1884 to 76 in 1918-19 and to 112 in 1947. This industry suffered a great setback as a result of partition of the country in 1947, because 81

Cotton Mill

percent of the jute output went to Bangladesh (erstwhile East Pakistan) while 102 out of 112 jute mills remained in India. Consequently, acute shortage of raw jute was felt in India.

Many of the sick and inefficient mills had to be closed down due to shortage of raw material. At present, there are 73 mills in India. A relentless campaign to increase the production of raw jute by increasing area under jute cultivation in the Brahmaputra valley, West Bengal, Tarai and in Eastern coastal areas and by increasing yield per hectare eased the situation to a great extent. The production of raw jute increased from 33 lakh bales (of 180 kg each) in 1950-51 to 120 lakh bales in 2009-10.

2. Distribution: West Bengal has the largest concentration of jute industry. This state has 56 jute mills and 41261 looms which respectively account for 76 percent and 80 percent of all India installation. Over 84 percent of jute-goods production of India comes from West Bengal, Andhra Pradesh is a distant second producing only 10 percent of the Indian jute goods. Apart from Kolkata, the other important centres of jute textile industry are Titagarh (9 mills), Jagatdal (8 mills), Budge (8 mills), Haora (5 mills) & Bhadreswar.

Problems of Indian Jute Industry

Indian jute industry is facing some very serious problems. Some of these are briefly described as under:

1. Most of the jute-producing areas went to Bangladesh (erstwhile East Pakistan) resulting in acute shortage of raw jute. Although successful efforts have been made to increase the supply of raw jute since Independence, it still falls short of our current requirements.
2. Most of our customers could not get our jute products during World War II as a result of which several countries developed many substitutes of jute.
3. The newly established mills and improved machines in Bangladesh are able to produce better quality goods and have an edge over the Indian jute products in the international markets.
4. The overall demand for jute products is gradually decreasing in the international market. The input cost for jute products in India is quite high.

Metallurgical Industries

Metallurgical industries are those industries which use metal as the basic raw material. It is a very wide term and includes several industries like iron and steel, aluminum, copper smelting, lead and zinc smelting etc. These industries form the economic backbone of a

developing country. India has progressed a lot especially during the planning period and now occupies a place of pride with regard to the development and growth of metallurgical industries.

Metallurgical Industry

Iron and Steel Industry

Although Indians are known for their technique of smelting iron since early time, the first iron and steel unit on modern lines was established in 1830 at Porto Nova in Tamil Nadu. However, it could not succeed and was closed down in 1866. The real beginning of modern iron and steel industry was made in 1907 only when Tata Iron and Steel Company (TISCO) was set up at Jamshedpur. The Indian Iron and Steel Company (IISCO) was set up in 1919 at Burnpur followed by the setting up of Mysore Steel Works at Bhadravati. In Indian Iron and steel Industry witnessed rapid growth after Independence. India produced

Map Showing Some Important Iron and Steel Plants of India

16.9 lakh tonnes of pig iron in 1950-51. The development of iron and steel industry was envisaged during the first Five-Year Plan, but it was during the Second Five Year Plan, that the three integrated steel projects were started at Bhilai, Rourkela and Durgapur. India is now the eighth largest producer of steel in the world.

Factors influencing the location of Iron and Steel Industry.

Iron and steel industry uses large quantities of heavy and weight losing raw materials and its localization is primarily controlled by the availability of raw materials. Coal and iron ore are the two basic raw materials used by iron and steel industry. On the basis of minimum transportation cost most of the steel plants are located at three distinct places viz.

(i) Near coal fields,

(ii) Near iron ore mining centres and

(iii) At places between areas of coal and iron ore production.

Most of the iron and steel plants of India such as Jamshedpur, Burnpur, Durgapur, Rourkela , Bhilai and Bokaro are located in Jharkhand, West Bengal, Orissa and Chhattisgarh. These states are very rich in coal and iron ore deposits and are important producers of these minerals.

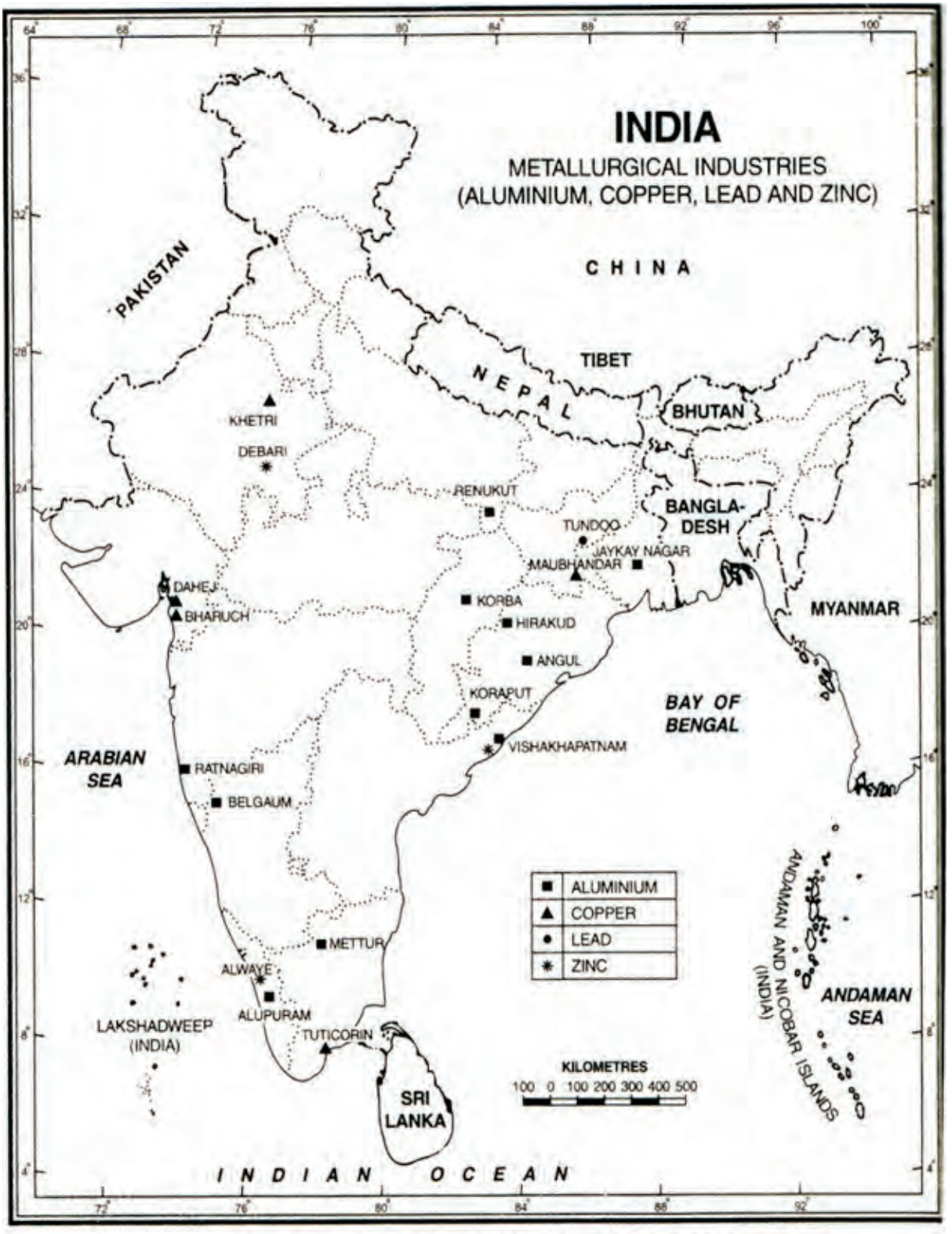
Centers of Production

At present there are 10 primary integrated plants and a large number of decentralised secondary units known as mini steel plants.

Besides, there are several rolling and re-rolling mills and foundries which manufacture different items of steel using pig iron and ingot steel. There are about 10,000 foundries, 95 percent of which are concentrated in the western states of Maharashtra and Gujarat and in the southern state of Tamil Nadu.

Large Integrated Iron and Steel Plants

1. **Tata Iron and Steel Company (TISCO)**: This is the oldest iron and steel centre of India. It is a private sector enterprise. It was established in 1907 by Jamshedji Tata at Sakchi in Singhbhum district of Jharkhand. Later on, it was renamed as Jamshedpur after Jamshedji. It started producing pig iron in 1911 and steel in 1912. The plant initially had capacity of producing 1.21 million tonnes of pig iron ' and 1.1 million tonnes of steel per annum. This capacity has been enhanced to 3.9 million tonnes of pig , iron, 2 million tonnes of steel and 3 million tonnes of saleable steel.



India : Metallurgical Industries (Aluminium, Copper, Lead and Zinc)

2. **Indian Iron and Steel Company (IISCO):** Three plants at Kulti, Hirapur and Burnpur in West Bengal were set up in 1864, 1908 and 1937 respectively. These plants have been merged together and are known as Indian iron and Steel Company (IISCO). It was brought under government control and management in July 1972.

Aluminum Smelting Industry

Aluminum smelting is the second important metallurgical industry of India, next only to iron and steel industry. It plays a crucial role in the overall industrial development of the country. Its elasticity, flexibility, good conductivity of electricity and heat, and its capacity to be modulated into any desired shape has made aluminum a universally accepted metal. It is widely used in a large number of industries including generation and distribution of electricity, manufacturing of aeroplanes, railway coaches and bus bodies, building and architectural activities, defense and nuclear accessories, household utensils, packaging and for making coins. It is gaining popularity as a substitute to several other metals like steel, copper, zinc, lead, etc. in a large number of industries.

Hindalco Hirakud Orrisa

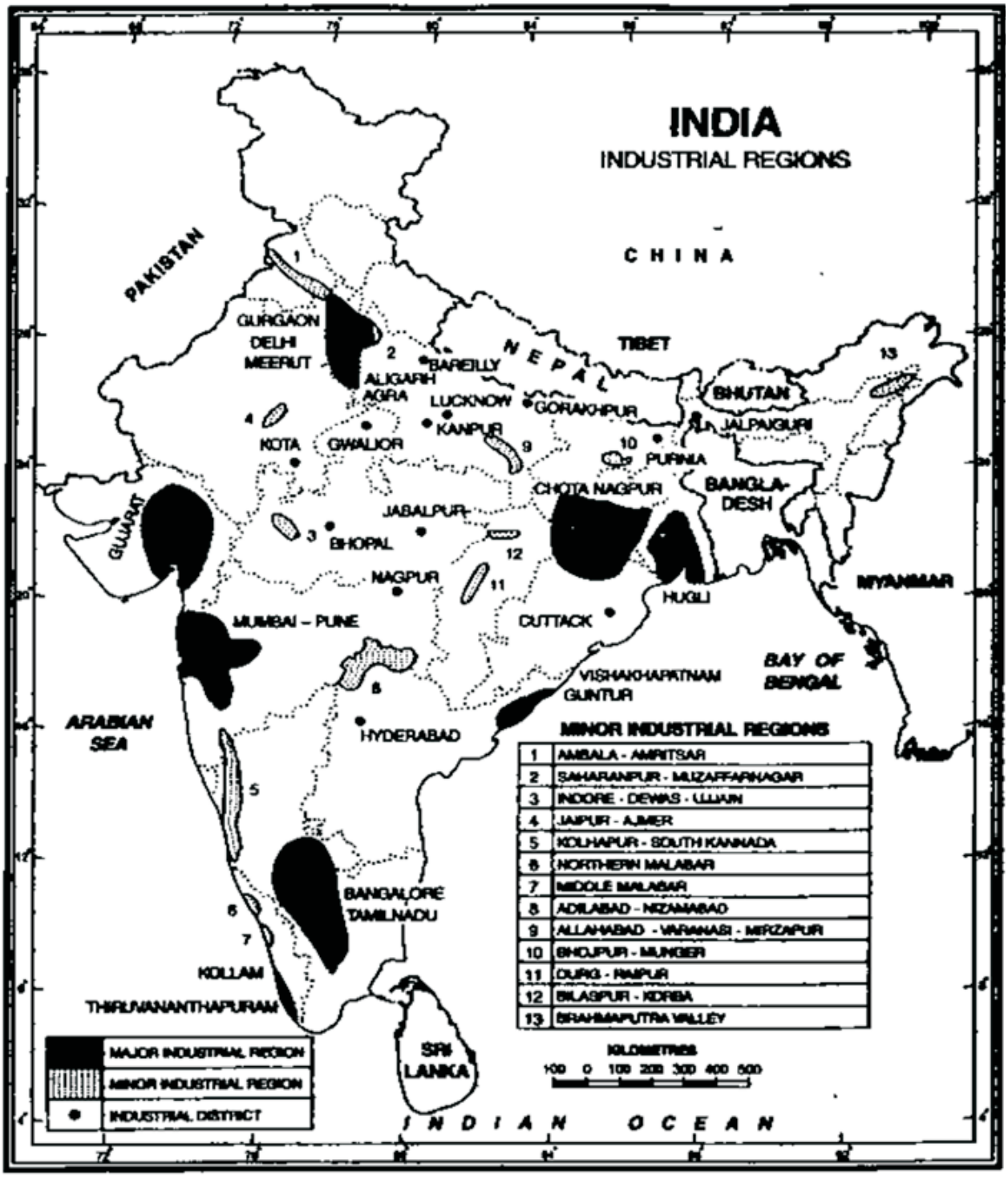
The per capita consumption of aluminium in India is barely 500 gram against 5.9 kilogram in the U.S. and 3.6 kilogram in Brazil.

Localization

The availability of bauxite and electricity are the two most significant factors which influence the localisation of this industry. Orissa and Gujarat are the major producers of bauxite in India.

Growth and Development

Manufacturing of aluminum metal commenced in 1886 and fabrication of utensils from imported metal started in 1929. Indian Aluminum Company started its production in 1938. Production of virgin aluminum from the indigenous bauxite ore made good progress during World War II. In fact, modern aluminum manufacturing is a war born industry.



India : Industrial Regions

The Indian aluminum Industry has taken giant strides following its decontrol in 1989 and launch of the economic liberalization programme in 1991. Production has grown, cost efficiency is proven and the industry has abundant resources of bauxite, a sizable pool of experienced manpower and its proven competence in aluminum smelting to accelerate its growth.

INDUSTRIAL REGIONS Industries are unevenly distributed in India because the factors affecting industrial location are not the same everywhere. Industries tend to concentrate in a few pockets because of certain favourable factors. The pockets having high concentration of industries are known as ***industrial regions***

The Centre for Monitoring Indian Economy (CMIE) recognized the Industrial centres on the basis of industrial employment exceeding 10,000 in 1971. Dr. B.N. Sinha (1972) has classified industrial regions into following three categories:

(i) Major Industrial Region is identified on the basis of a minimum daily factory working force of 1.5 lakh.

(ii) Minor Industrial Region must have a minimum of 25,000 working labour force.

(iii) Manufacturing District has a working labour force of less than 25,000

Major Industrial Regions

Following are the major industrial regions of India

(i) Mumbai - Pune Industrial Region.

(ii) Hoogli Industrial Region.

(iii) Bangalore - Tamil Nadu Industrial Region.

(iv) Gujarat Industrial Region.

(v) Chota - Nagpur Industrial Region.

(vi) Vishakhapatnam - Guntur Industrial Region.

(vii) Gurgaon - Delhi-Meerut Industrial Region.

(viii) Kollam - Thiruvananthapuram Industrial Region.

Minor Industrial Regions

1. Ambala-Amritsar in Haryana-Punjab.
2. Saharanpur-Muzaffarnagar-Bijnaur in Uttar Pradesh.

3. Indore-Dewas-Ujjain in Madhya Pradesh.
4. Jaipur-Ajmer in Rajasthan.
5. Kolhapur-South Kannada in Maharashtra-Karnataka.
6. Northern Malabar in Kerala.
7. Middle Malabar in Kerala.
8. Adilabad-Nizamabad in Andhra Pradesh.
9. Allahabad-Varanasi-Mirzapur in U.P.

Industries of Jammu and Kashmir

Although the state is comparatively backward in the industrial sector, there has been steady progress in the development of the small-scale industry, for which there is tremendous scope. Main industrial activity is concentrated in the Jammu and Kathua districts of Jammu division. This is mainly because Jammu is the only railhead, where loading and unloading of raw material becomes easy and less cumbersome as compared to Kashmir region where transportation cost is higher. However, the State is on the path of industrialization despite its topographical limitations. The Industry sector has been declared as the main vehicle for accelerating economic activity besides providing employment opportunities to the unemployed educated youth in the State. To attract investment, the State government has come up with a new eco-friendly industrial policy in 2004, which is valid until 2015. The industrial policy is designated to promote rapid industrialization and has evoked a great deal of interest in the private investment. The policy has slew of incentives in the form of subsidies for all sorts of industries, especially for small-scale industries to make them competitive.

Main industries of Jammu and Kashmir include Tourism, Pharmaceuticals, Agrochemicals, Beverages, Gems & Jewellery, Cement industry, textiles, Electronics and Handicrafts.

Jammu and Kashmir small-scale Industries Development Corporation Ltd was started in 1975. The main objective of the corporation is to aid council, assist, finance, promote, and protect the interest of small-scale industrial units in the state.

Main Industrial Clusters of J&K are:

Industrial Estate Gangyal Jammu

Industrial Growth Centre Samba Jammu

Industrial Infrastructure Development Project (IIDP)Udhampur

Export Promotion Industrial Park (EPIP) Kartholi Jammu

Industrial Complex Rangreth, Srinagar

Industrial Complex Lassipora, Pulwama,

Industrial Complex Khunmoh, Srinagar

Industrial Complex, Zainkot, Srinagar

Industrial Estate, Zakura, Srinagar

Industrial Growth Centre, Ompora, Budgam

Small scale Industries

There has been a remarkable increase in small-scale industrial units all over Jammu and Kashmir in recent years. These units manufacture food products, beverages, machinery parts, plastic goods, chemicals, drugs, paper products and automobile equipment.

Handicrafts

In Kashmir, with its severe winter when climate conditions are harsh, craftsmen utilize their leisure as well as creative intelligence in creating artifacts of exquisite beauty. Princely patronage encouraged these handicrafts from early times. Even today these products, light in weight and rich in art have great demand in India and abroad. The State Government has set up many training centers for coaching young boys and girls in traditional arts and crafts. As a result there has been a wide dispersal of handicrafts throughout the State.

Kashmir is known for the following handicrafts throughout the world:

1. The art of making **Carpets** is a gift of caravans coming into the valley from Central Asia. In the time of Zain-ul-Abdin Badshah, this art was greatly developed by imported skill and royal patronage. The Europeans also took a keen interest in it. It resulted in the establishment of more than 15 well known factories with about 350 looms weaving carpets.
2. **Namdas** are made of wool of inferior quality and old woollen blankets are used for making gabbas. The art of felting wool into namdas has come from Yarkand. Namdas and **Gabbas** are embroidered with thread, which gives then colour, beauty and strength. This cottage industry is concentrated in Anantnag, Rainawari and Baramula.
3. **Lois** (woollen blankets) of Shopian and Bandipore are well known. Hand-woven blankets of Rainawari are also durable and warm. Woollen pattus, tweeds, and worsted are manufactured in hand and power looms established in and around Srinagar.

4. The **Kangri** making is a cottage industry concentrated in the areas on the banks of Wullarlake near Watlab and at Chrar and Botingo villages.

Wicker-work and basket making are arts common to Kashmir and Jammu.

Kashmir is known for its **Wicker Willow**. Wicker is used for making baskets, boxes, lamp-shades, curtain rings, trays, chairs, tables, and cycle baskets etc. Srinagar, Harwan, Shalabug, Hazartbal, and Soura are the centers of its production. The cultivation of wicker willow is the monopoly of the State.

5. **Papier Mache** is a monoply of Kashmir. Pulp and paper are shaped into a variaty of decorative articles and colorful designs are painted on them. The goods prepared are mostly boxes, table lamps, toilet sets, jewellery boxes and other articles of decoration. Srinagar, Rainawari and Anantnag are famous for this cottage industry.

A rich display of Papier Mache in a Srinagar shop

6. **Pashmina shawl industry** is an old industry of Kashmir. Pashmina wool used to come from Tibet via Ladakh but since the invasion of China in 1962 and closing of the Leh Yarkand route, Pashmina shawl and carpet industries have been affected greatly. Now the raw material comes from Ladakh only.

Kashmiri pashmina shawls Embroidering a shawl with Kashmiri motifs

7. **Silver ware and imitation jewellery**. Silver-smiths, engravers and polishers work to make beautiful silverware articles like tea sets, tumblers, boxes, trays, soap cases, toilet cases, and other articles of decoration. This work requires skill and craft. Engraving is a specialty of the Kashmiri engravers. Kashmir purchases about one

lakh tolas of silver a year for this cottage industry. There are about 80 units of imitation jewellery at Srinagar. They prepare rings, cuff-links, bangles, broaches, bracelets, ear rings and tops etc. Jammu region is famous for its handicrafts, especially for Basoli Paintings, Calico Paintings, and Phoolkari work.

Furthermore, Ladakh region is also famous for wood carving, clay modeling, Pashmina weaving, Ladakhi carpets and Thanka paintings.

Basoli painting of Jammu

Thanka painting of Ladakh

Glossary

1. **Manufacturing:** A process of transformation of natural endowments into commodities of utility.
2. **Capital:** Investments incurred on the development of an industry.
3. **Insurance:** A security cover which can be used in times of need.
4. **Large scale industry:** An industry which employs a large number of labourers in each unit.
5. **Medium scale industry:** An industry which employs neither very large nor very small number of labourers.
6. **Small scale industry:** An industry which is owned and run by individuals and which employs a small number of labourers.
7. **Public sector industry:** An industry owned by the state and its agencies like Bharat Heavy Electricals.
8. **Joint sector industry:** An industry owned jointly by the private firms and the state or its agencies.
9. **Cooperative sector industry:** An industry owned and run by a group of people who are generally producers of raw materials of the given industry.
10. **Agro based industries:** Those industries which obtained raw material from agriculture like cotton textile industry.
11. **Mineral based industries:** the industries that receive raw material from minerals e.g. iron and steel industry.
12. **Cottage industry:** A small scale industry which is carried on wholly with the help of members of family.

Exercise

A. Very short type questions

Q.No.1.

i) The processing of primary products into more refined and usable products is called_____.

ii) Modern industries are _____intensive in nature.

iii) _____industry forms the backbone of industrial sector in India.

iv) An industry which is owned and managed by the government is called_____.

v) In the time of Zainulabidin Budshah _____industry was greatly developed in Kashmir.

B. Short type questions

Q.No.2

i) Define manufacturing?

ii) How is raw material an important geographical factor in the location of an Industry?

iii) Market is an important locational factor in the establishment of an industry. Explain?

iv) Write a short note on cotton textile Industry of India?

v) Differentiate between Private Sector Industry and Public sector Industry?

vi) What are the major industries regions of India and name five of them?

vii) Write short note on Handicrafts in Jammu and Kashmir

C. Match the following

Q.No.3

Mumbai	i. Private sector Industry
Pune and Banglore	ii. Public Sector Industry
TISCO and Reliance	iii. Capital intensive Industry
NPHC and ONGC	iv. Co-operative Sector Industry
Amul	v. Information Technology industry

D. Long answer type questions

4. What are the geographical, non-geographical factors which influence the location of an Industry?

5. Highlight the importance of iron steel industry in India. What are the factors influencing its location?

6. Discuss in detail the development, distribution and importance of textile industry of India?

7. Discuss in detail the growth and importance of Petroleum industry in India?

Activity

a) On an outline map show major Industries Regions of India.

b) Enlist Industries of India and divide them into:

a. Public sector b. Private Sector c. Joint Sector

d. Large Scale e. Small scale f. Cotton Industry

g. Agro based h. Mineral based i. Forest based

S.No	Name of industry	Public/Private/Joint	Large/Small/Cottage	Agro/Mineral /Forest

Chapter

8

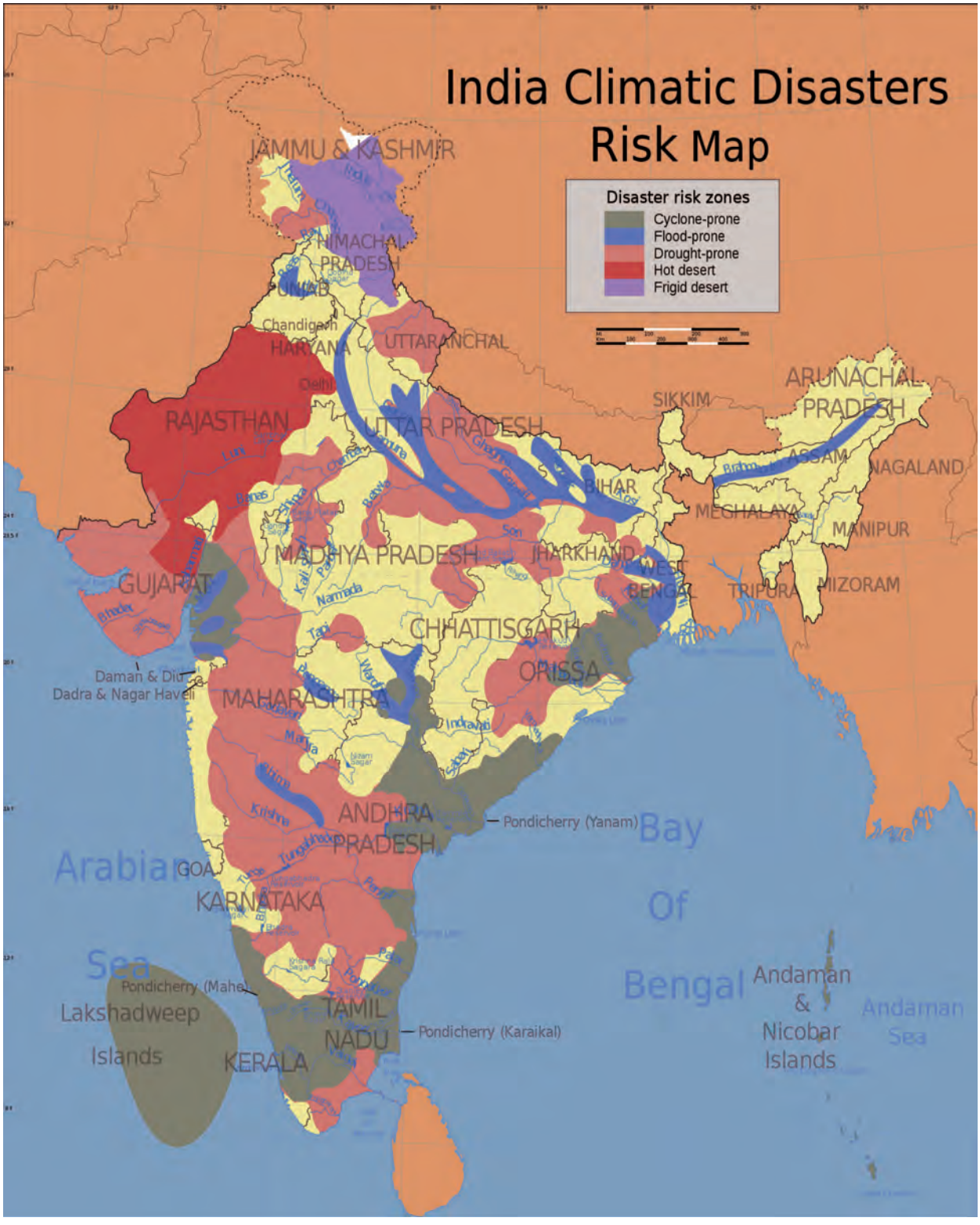
Disaster Profile of India

Although a standard definition of disaster is yet to be universally accepted and used. The International Decade for Natural Disaster Reduction **(IDNDR 1992)** has defined disaster as '***a serious disruption of the functioning of a community or a society involving widespread human, material, economic or environmental losses and impacts, which exceeds the ability of the affected community or society to cope, using its own resources***'. World Health Organisation(WHO) has added an emphasis on health in their definition: '***A disaster is any occurrence that causes damage, ecological disruption, loss of human life, or deterioration of health and health services on a scale sufficient to warrant an extraordinary response from outside the affected community or area***'. Disasters ae caused by natural and man-induced hazzards.

Hazard is a phenomenon, an event or occurrence that has the potential for causing injury to life or damage to property or the environment (e.g. flood, tornado, volcanic eruption, earthquake, landslide or man-made hazards). The magnitude of the phenomenon, the probability of its occurrence, and the extent and severity of its impact may vary. In many cases, these effects can be anticipated or estimated.

Vulnerability refers to the susceptibility of a community to a hazard and the prevailing condition, including physical, socio-economic and political factors that adversely affect its ability to respond to hazards. The community and its members may or may not be contributing intentionally or directly to the prevailing conditions. However, altogether, they create factors and situations that define the vulnerability of the community.

Due to widespread poverty, poor infrastructure, lack of education and awareness, lack of appropriate technology, and faulty developmental planning, levels of vulnerability to various disasters in India are very high. Impact of a disaster primarily depends on two things: firstly intensity of a hazardous event such as earthquake, flood, and cyclone; secondly the levels of vulnerability in the population. Although nobody can control the intensity of the hazard but if the vulnerability of the population is reduced through capacity building, the impact of the disaster can be minimised to a greater extent. Consequently due to high vulnerability in India a moderate intensity hazards cause tremendous damage while as in Japan due to low levels of vulnerability a high intensity earthquake causes little or no damage. Therefore nowadays



Disaster risk map of India

throughout the world it is admitted that Disasters are the consequence of inappropriately managed risk and a product of hazards and vulnerability.

The Indian subcontinent is among the world's most disaster prone areas. As per the statistics published by National Disaster Management Authority almost 85% of India's area is vulnerable to one or multiple hazards. Of the 28 states and 7 union territories, 22 are disaster-prone. It is vulnerable to storms spawned in the Bay of Bengal and the Arabian Sea, earthquakes caused by active crustal movement in the Himalayan mountains, floods brought by monsoons, and droughts in the country's arid and semi-arid areas. Almost 57% of the land is vulnerable to earthquake (high seismic zones III–V), 68% to drought, 8% to cyclones and 12% to floods. India has also become much more vulnerable to tsunamis since the 2004. Of the 7,516 km long coastline, close to 5,700 km is prone to cyclones and tsunamis.

Disaster risks in India are further compounded by increasing vulnerabilities related to changing demographics and socio-economic conditions, unplanned urbanization, within high-risk zones, environmental degradation, climate change, geological hazards, epidemics and pandemics. Clearly, all these factors contribute to a situation wheredisasters seriously threaten India's economy, its population and sustainable development. Moreover, India is also vulnerable to Chemical, Biological, Radiological and Nuclear (CBRN) emergencies and other man-made disasters. Following paragraphs provide a detailed description of various natural disasters faced by the country along with their impact, intensity and distribution. Table 8.1 gives a detailed account of the worst natural disasters faced by India during the last three decades.

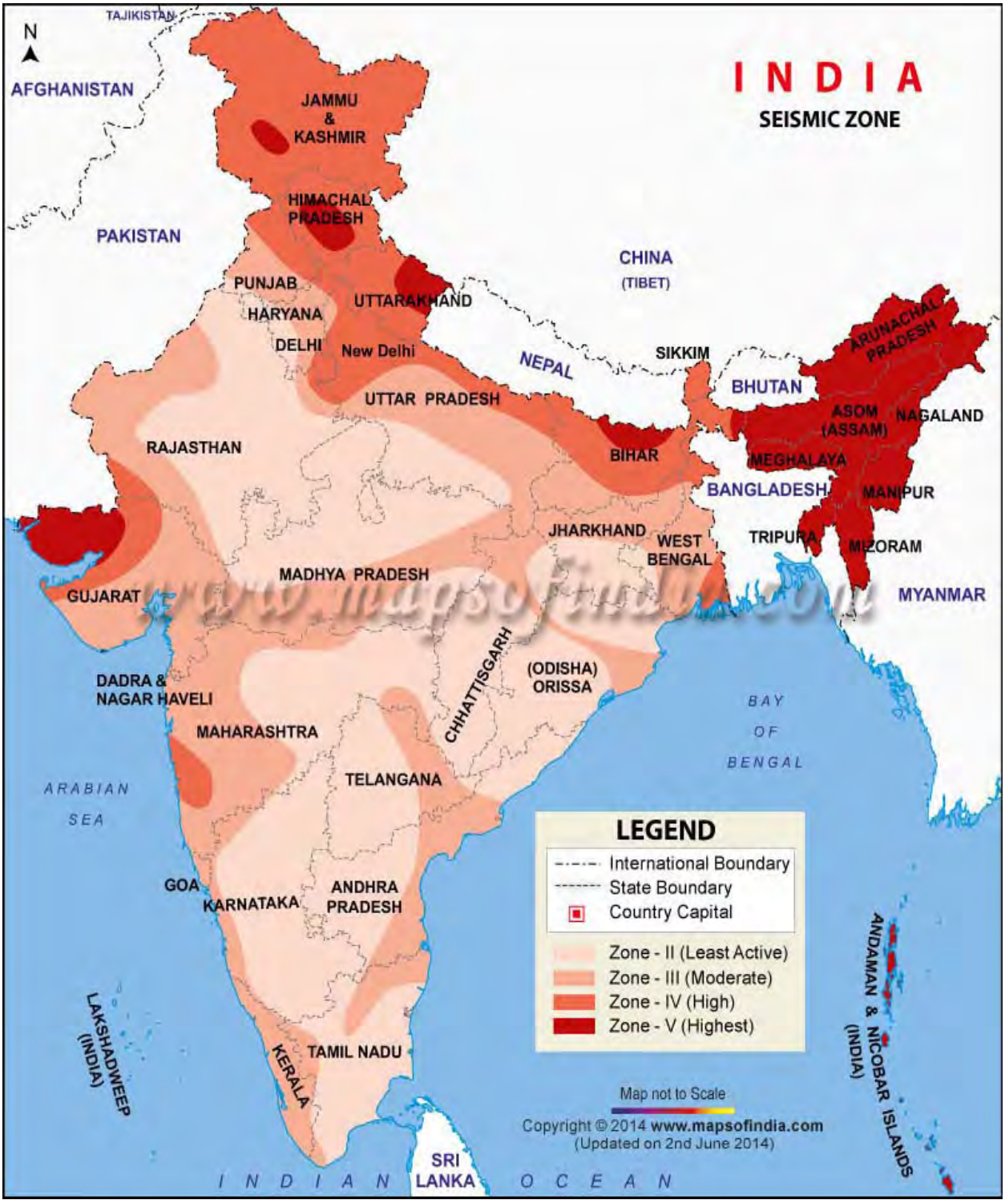
Earthquakes: Almost 57% of the Indian land is vulnerable to earthquake out of which, 12% is prone to very severe earthquakes, 18% to severe earthquakes and 25% to damageable earthquakes. The biggest quakes occur in the Andaman and Nicobar Islands, Kutch, Himachal and the North-East. The Himalayan regions are particularly prone to earthquakes. The last two major earthquakes shook Gujarat in January 2001 and Jammu and Kashmir in October 2005. Many smaller-scale quakes occurred in other parts of India in 2006.

Gujarat earthquake, 2001

Table 8.1: Some Major Disasters in India

1.	Floods	2014	J&K	300 Died
2.	Cloudburst	2010	Leh, Ladakh in J&K	300 Died
3.	Drought	2009	252 Districts in 10 States	-----
4.	Floods	2009	Andhra Pradesh, Karnataka, Orissa, Kerala, Delhi, Maharashtra	300 people died
5.	Kosi Floods	2008	North Bihar	527 deaths, 19,323 livestock perished, 2,23,000 houses damaged, 3.3 million persons affected
6.	Cyclone Nisha	2008	Tamil Nadu	204 deaths
7.	Maharashtra Floods	2005	Maharashtra State	1094 deaths 167 injured 54 missing
8.	Kashmir earthquake	2005	Mostly Pakistan, Partially Kashmir	1400 deaths in Kashmir (86,000 deaths in total)
9.	Tsunami	2004	Coastline of Tamil Nadu, Kerala, Andhra Pradesh, Pondicherry and Andaman and Nicobar Islands of India	10,749 deaths, 5,640 persons missing, 2.79 million people affected, 11,827 hectares of crops damaged, 300,000 fisher folk lost their livelihood
10.	Gujarat Earthquake	2001	Rapar, Bhuj, Bhachau, Anjar, Ahmedabad and	13,805 deaths 6.3 million people affected Surat in Gujarat State
11.	Orissa Super Cyclone	1999	Orissa	Over 10,000 deaths
12.	Cyclone	1996	Andhra Pradesh	1,000 people died, 5,80,000 housed destroyed, Rs. 20.26 billion estimated damage
13.	Latur Earthquake	1993	Latur, Marathwada region of Maharashtra	7,928 people died 30,000 injured
14.	Cyclone	1990	Andhra Pradesh	967 people died, 435,000 acres of land affected

All seven North East states of India - Assam, Arunachal Pradesh, Nagaland, Manipur, Mizoram, Tripura and Meghalaya, Andaman & Nicobar Islands and parts of six other states in the North and North-West (Jammu and Kashmir, Uttaranchal, and Bihar) and Gujarat, are in Seismic Zone V. India has witnessed many violent earthquakes during 20th century and suffered huge loss of life and property.1905 Kangra earthquake with an intensity of 7.5 killed 19,000 people and Bihar earthquake of 1934 caused death of 10,700 persons. Nepal-India



border earthquake of 1988 killed 1000 people and 2000 causalities were caused by Northern Indian earthquake of 1991.

Death toll in Latur Maharashtra earthquake of 1993 was around 9748. The 2001 Gujarat earthquake is a living example of the devastation caused by the earthquakes in India. It occurred on 26 January; India's 52nd Republic Day, at 08:46 AM local time which lasted for over two minutes. It had an intensity of 7.7 on Richter scale. The earthquake killed around 20,000 people.

Floods:

About 30 million people are affected annually. Floods in the Gangetic–Brahmaputra plains are an annual feature. On an average, a few hundred lives are lost, millions are rendered homeless and several million hectares of crops are damaged every year. Nearly 75% of the total rainfall occurs over a short monsoon season (June – September). Around 40 million hectares, or 12% of Indian land is considered prone to floods. Floods are a perennial phenomenon in at least 5 states - Assam, Bihar, Orissa, Uttar Pradesh and West Bengal. On account of climate change, floods have also occurred in recent years in areas that are normally not flood prone. In 2006, drought prone parts of Rajasthan experienced floods.

Floods in northern India are primarily caused by the concentrated monsoon rainfall from July to September which is a period when rapid melting glaciers also elevates the water level in various rivers of India. Consequently rivers are unable to accommodate the excessive monsoon runoff, forcing them to overflow and inundate the surrounding flood plains. Furthermore, inadequate drainage and encroachments of river courses also aggravates the flood scenario in various parts of India. Besides the above mentioned factors cyclones are largely responsible for widespread flooding in coastal areas of India.

In June 2013, a multi-day cloudburst centered on the North Indian state of Uttarakhand caused devastating floods and landslides becoming the country's worst natural disaster since the 2004 tsunami. From 14 to 17 June 2013, the Indian state of Uttarakhand and adjoining areas received heavy rainfall, which was about 375% more than the benchmark rainfall during a normal monsoon. This caused the melting of Chorabari glacier

Uttarakhand floods June 2013

at the height of 3800 metres, and eruption of the Mandakini River which led to heavy floods near Gobindghat, Kedar Dome, Rudraprayag district, of Uttarakhand, Himachal Pradesh and Western Nepal. According to figures provided by the Uttarakhand government, more than 5,700 people were "presumed dead." This total included 934 local residents. Kosi floods of 2008 with a death toll of 527 and south Indian floods of 2009 with over 300 causalities are other examples of disastrous floods in the recent history of India.

Droughts:

Drought may be defined as a long period of abnormally low rainfall, especially one that adversely affects growing or living conditions. Drought is a deficiency in precipitation over an extended period, usually a season or more, resulting in a water shortage causing adverse impacts on vegetation, animals, and people. It is a normal, recurrent feature of climate that occurs in virtually all climate zones. Drought is a temporary aberration from normal climatic conditions, thus it can vary significantly from one region to another. Drought is different than aridity, which is a permanent feature of climate in regions where low precipitation is the norm, as in a desert.

2009-drought situation in Telengana

About 50 million people are affected annually by drought. Out of approximately 90 million hectares of rain-fed areas, about 40 million hectares are prone to scanty or no rain. Rainfall is poor in nine meteorological subdivisions out of 36 subdivision (each meteorological sub division covers a geographic area of more than ten revenue districts in India). In India annually 33% area receive rainfall less than 750 mm (low rainfall area) and 35 % area receive between 750 to 1125 mm rainfall and only 32 percent falls in the high rainfall (>1126 mm) zone. Drought is recurrent phenomenon which results in widespread adverse impact on vulnerable people's livelihoods and young children's nutrition status. It typically strikes arid areas of Rajasthan (chronically) and Gujarat states. Drought is not uncommon in certain districts of Uttar Pradesh, Madhya Pradesh, Orissa, Andhra Pradesh, Maharashtra, Northern Karnataka etc.

In the past, droughts have periodically led to major Indian famines, including the Bengal famine of 1770, in which up to one third of the population in affected areas died; the 1876–1877 famine, in which over five million people died; and the 1899 famine, in which over 4.5 million died. In recent history the drought of 1972 affected 200 million people while as 300 million people were adversely affected by 1987 drought in 15 states across India. The drought of 2009 also affected large number of people and forced hundreds of farmers to commit suicide in Rajasthan, Gujarat, Maharashtra and Andhra Pradesh.

Cyclones:

A tropical cyclone is a rotating, organized system of clouds and thunderstorms that originates over tropical or subtropical waters and has a closed low-level circulation. Tropical cyclones rotate counterclockwise in the Northern Hemisphere. They are very destructive weather systems accompanied by torrential rain, high speed winds, storm surges and coastal flooding.

Super-cyclone Orissa-1999

About 8% of the land is vulnerable to cyclones of which coastal areas experience two or three tropical cyclones of varying intensity each year. Cyclonic activities on the east coast are more severe than on the west coast. The principal threat from a cyclone is in the form of gales and strong winds; torrential rain and high tidal waves/storm surges. Most casualties are caused due to coastal inundation by tidal waves and storm surges. Cyclones typically strike the East Coast of India, along the Bay of Bengal, West Bengal, Orissa, Andhra Pradesh and Tamil Nadu. Cyclones also to some extent affect parts of Maharashtra and Gujarat on the West Coast bordering Arabian Sea.

During summer, the Bay of Bengal is subject to intense heating, giving rise to humid and unstable air masses that produce cyclones. Many powerful cyclones, including the 1737 Calcutta cyclone, the 1970 Bhola cyclone, the 1991 Bangladesh cyclone and the 1999 Orissa cyclone have led to widespread devastation along parts of the eastern coast of India and neighbouring Bangladesh. Widespread death and property destruction are reported every year in exposed coastal states such as Andhra Pradesh, Orissa, Tamil Nadu, and West Bengal. India's

western coast, bordering the more placid Arabian Sea, experiences cyclones only rarely; these mainly strike Gujarat and less frequently, Kerala.

In terms of damage and loss of life, Cyclone 05-B, a super-cyclone that struck Orissa on 29 October 1999, was the worst in more than a quarter-century, with peak winds of 160 miles per hour (257 km/h). It was the equivalent to a Category 5 hurricane. Almost two million people were left homeless. Officially, 9,803 people died from the storm; unofficial estimates place the death toll well over 10,100.

Landslides:

Landslides occur in the hilly regions such as the Himalayas, North-East India, the Nilgiris, and Eastern and Western Ghats. Landslides in India are another recurrent phenomenon. Landslide-prone areas largely correspond to earthquake-prone areas, i.e. North-west and North-East, where the incidence of landslides is the highest. Landslides and avalanches are among the major hydro-geological hazards that affect large parts of India besides the Himalayas, the Northern-Eastern hill ranges, the Western Ghats, the Nilgiris, the Eastern Ghats and the Vindhyas, covering about 15 % of the landmass. The Himalayas alone count for landslides of every fame, name and description- big and small, quick and creeping.

Landslides in the Sub-Himalayas

The North-Eastern region is badly affected by landslide problems of a bewildering variety. Landslides in the Darjeeling district of West Bengal as also those in Sikkim, Mizoram, Tripura, Meghalaya, Assam, Nagaland and Arunachal Pradesh pose chronic problems, causing recurring economic losses worth billions of rupees. A different variety of landslides, characterized by a lateritic cap, pose constant threat to the Western Ghats in the South, along the steep slopes overlooking the Konkan coast besides Nilgiris, which is highly landslide prone.

Some spectacular events of tragedies are reported as Varnavat landslide, Uttarkashi District, Malpha landslide Pithoragarh district, Okhimath landslide in Chamoli district. The problem therefore needs to be tackled for mitigation and management for which hazard zones have to be identified and specific slides to be stabilized and managed in addition to monitoring and early warning systems to be placed at selected sites.

Tsunami is a large wave on the ocean, usually caused by an undersea earthquake, a volcanic eruption, or coastal landslide. Tsunami is a Japanese term which is translated as harbor wave. A tsunami can travel hundreds of miles over the open sea and cause extensive damage when it encounters land. Tsunamis can have heights of up to 30 m (98 ft) and reach speeds of 950 km (589 mi) per hour. They are characterized by long wavelengths of up to 200 km and long periods, usually between 10 and 60 minutes.

By virtue of being surrounded on three sides by Arabian Sea, Indian Ocean and Bay of Bengal India is very much vulnerable to the tsunami related disasters. Out of approximately 7500 km of coastline, 5700 km are vulnerable to the tsunami originating from surrounding oceans.

December 2004 Tsunami

Prior to 26 December 2004, there was no known record of tsunamis on the southwest coast of India. The west coast experienced a tsunami due to the Magnitude 8.1 earthquake of 27 November 1945 with an epicenter 100 km from Karachi, Pakistan, but the effects were felt only up to Karwar, 250 km north of the Kerala border. The southeast coast, however, has experienced tsunamis earlier. The earliest record dates back to 31 December 1881, when a tsunami about 1 meter high was recorded in Chennai. It was caused by an earthquake of 7.9 magnitude below Car Nicobar Island. The August 1883 eruption of the Krakatoa volcano in Indonesia caused 2- meter high tsunami waves in Chennai. On 26 June 1941, an 8.1magnitude earthquake occurred in the Andaman archipelago, which triggered a tsunami of about 1 meter in the city of Chennai. Some scientists have estimated deaths of over 3,000 people along the east coast of India in the 1941 tsunami.

The 2004 December Indian Ocean tsunami was caused by a 9.1 magnitude gigantic earthquake with its epicentre off the west coast of Sumatra, Indonesia. The under sea mega-thrust earthquake was caused when the Indian Plate was subducted by the Burma Plate and triggered a series of devastating tsunamis along the coasts of bordering Indian Ocean, killing 230,000 people in 14 countries, and inundating coastal communities with waves up to 30 meters (100 ft) high. It was one of the deadliest natural disasters in recorded history. Indonesia was the hardest-hit country, followed by Sri Lanka, India, and Thailand. According to official

estimates in India, 10,136 people were killed and six lakh fifty thousand made homeless. Andaman Nicobar, Tamil Nadu, Andhra Pradesh Orissa and other coastal states were worst hit. Economic cost of the disaster was several billion dollars.

Disaster Profile of Jammu and Kashmir

The State of Jammu and Kashmir has a long history of natural disasters. The State has witnessed many natural disasters especially in the 19th and early 20th centuries. Owing to its peculiar topography, rugged terrain, extreme weather conditions and underdeveloped economy, the State has suffered a lot on account of natural disasters. The J&K state by virtue of being a multi hazard prone region, Hazards like earthquakes, floods, fires, droughts, avalanches and landslides often convert into disasters leading to loss of human lives as well as public and private property. Enhanced vulnerabilities of the built environment make the State highly prone to natural disasters.

Human activities disturbing the ecological balance in most of the cases directly result in the disastrous event or exacerbate the natural disaster. Experts believe that due to lack of geo-hydrological assessments in advance while sanctioning projects such as construction of four-lane highway or railway track, we have unknowingly altered stream course, discharge areas and closed aquifers. Moreover the unauthorized and unplanned construction on the river banks has disturbed the river ecosystem. Sand and gravel dredging or top soil denudation for brick industry to support growing real estate industry have significantly enhanced the human induced disaster risk in the eco-sensitive zones of the State. With projected increase in the frequency and intensity of extreme events including storms, droughts, and floods, disaster management seeks greater attention.

Apart from the projected hydro-meteorological hazards viz. floods, droughts and cloud-bursts there are likely scenarios of natural hazards such caused due to earthquakes, landslides and snow avalanches. Following paragraphs provide a brief account about the vulnerability of the state to various natural disasters.

Earthquakes: Most parts of the Kashmir Valley (11% of the area of the state) covering the Districts of Srinagar, Ganderbal, Baramulla, Kupwara, Bandipora, Budgam, Anantnag, Pulwama, Doda, Ramban, Kishtwar come under Seismic Zone V, inhabiting around 50% of the population of the State. Remaining part of the State including, whole of Ladakh region and Jammu Division (89% of the total area of the state) fall under the Seismic Zone IV. This implies that the state can witness earthquakes of highest intensity which warrants the implementation

of proper preparedness and mitigation strategies to reduce the probable adverse impacts on the population, economy and ecology of state.

Floods: Low-lying areas of the Kashmir Valley, especially Sangam, Awantipora, Sonawari, Srinagar, along with parts of Jammu are prone to floods. Upper catchments of all the tributaries of the Jhelum, Indus, Chenab and Tawi rivers are prone to flash floods.

Avalanches & Snow Blizzards:

Technically, an avalanche is a mass of snow, ice, and rocks falling rapidly down a mountainside. Another common term for avalanche is "snowslide". As an avalanche approaches nearer to the bottom of the slope, it gains speed and power; consequently smallest of snowslides can cause a major disaster.

Snow avalaunche - Valtegu Nad

Higher reaches of Kashmir including Anantnag, Kulgam, Gurez, Kargil, Leh, Doda, Ramban, Kishtwar, Banihal etc. face avalanches. Areas along major highways particularly Ramban, Banihal, Doda, Kishtwar, Gulmarg, Dawar, Gurez, Tangdhar, Rajouri & zojila etc. are landslide prone.

Drought: Most parts of Jammu division including Doda, Udhampur, Kathua, Jammu etc. are drought prone. Some parts of Kashmir valley especially kandi belt is also considered drought prone.

Occasional wind storms destroy crops, horticulture and roof-tops of houses. Ladakhis prone to high speed winds but there are hardly any damages due to wind storm, perhaps due to the sparse population and traditional house construction practices. Furthermore all the hilly areas of the State are prone to cloudbursts.

Major Disaster Events in the States in Recent history

1. Snow Blizzard at Valtengu Nad

On 18th Feb 2005, a snow blizzard occurred in villages WaltenguNad, Pachgam and Nigeenpora affecting 128 families consisting of 618 persons. During the incident 175 lives (54 men, 48

women and 73 children) were lost. In many cases full families were wiped out. 183 sheep/ goats, 308 cows, 54 buffaloes and 5 horses perished.

2. Muzzafarabad Earthquake

On 8th October, 2005 a devastating earthquake of magnitude 7.6 resulted in 953 deaths and 418 injuries in J&K (also more than 87,000 deaths in PoK. This was one of the deadliest earthquakes in the sub-continent. 23,782 houses were fully damaged in the quake in J&K. 40.3% of the deaths comprised children below 10 years of age, thereby depicting their vulnerability and signifying the importance of school safety.

3. Leh Cloudburst and Flash floods, August 2010:

Cloudburst is actually a situation when the inter-molecular forces between the water molecules get very high due to the rapid decrease in the temperature or excess of electrostatic induction in the clouds causing the lighting to remain inside the cloud only, which causes hyperactive energy inside the cloud. The water molecules get denser and denser and get condensed but do not leave the cloud due to excess of electrostatic forces. As the water concentration gets higher and higher and so the weight gets heavier the water no longer is ableto maintain equilibrium with the clouds and consequently precipitates.

A cloudburst can suddenly dump 72,300 tons of water over one acre. However, cloudbursts are infrequent as they occur only in mountainous regions or occasionally when a warm air parcel mixes with cooler air, resulting in sudden condensation. The term "cloudburst" arose from the notion that clouds were akin to water-balloons and could burst, resulting in rapid precipitation; though this idea has since been disproven, the term remains in use.

Leh Cloudburst and Flash floods, August 2010

On the intervening night of August 5 - 6, 2010, Leh witnessed a devastative cloudburst followed by flash-floods. The unprecedented event resulted in the death of over 250 people and damage worth crores of rupees. The areas in and around Leh, especially Choglamsar, where people had constructed houses along the dry water course had no idea that the stream could get flooded and wash away everything whatever came in its way.

The Relief and Rehabilitation activities carried out in the affected villages by the Army, Civil Administration and the NGO's were appreciable, as there was total harmony and no duplication of activities. The courage, dedication and zeal of the local community including the Ladakh Buddhist Association and the Islamic Trust revealed that human relations were at its peak during the disaster. However, the need for greater cooperation between Army and Civil Administration was felt during search and rescue operations. The traditional village-level institutions through the village-head played a crucial role in the recovery of the affected areas.

4. Cloudburst at Beggar (District Doda) June-2011

A cloud burst occurred at Bagger in District Doda on 8th June 2011, where 17 structures got washed away and three people died. The dead bodies got washed away and have not been traced till date.

Jammu and Kashmir Floods-6th September 2014

Jammu and Kashmir faced unprecedented floods of the century. Incessant rains in the first week of September lead to massive floods in the valley as well as in Jammu region. A report prepared by Department of Environment, Ecology and Remote Sensing (DEERS) in collaboration with Hyderabad-based National Remote Sensing Centre, ISRO reveals that the floods in Jammu and Kashmir were a result of High rainfall in the catchments over short period of time, which were not less than cloud bursts and is a combine effect of the extreme event due to climate change and less capacity of our drainage system that failed to hold the quantum of water and it overflowed, which ultimately lead to floods.

There were incessant rains from 4 September for continuous 30 hours and in three days the rainfall touched 450 mm which was very unusual. On September 3, there was a rainfall deficit of 32 percent but on September 8 it showed excess of 18 percent i.e. a change of 50 percent in just five days. Lidder catchment received the maximum rain fall with adjoining catchments receiving high amount of rainfall, which was way above normal. Various catchments like Vishu, Sandran, Bringi, Kuthar, Arpal, Rambiara, Doodh-Ganga received very heavy rainfall leading to floods. The report indicates that in all 557 sq km area was inundated which includes 444 sq km was agriculture land 20 sq km horticulture land 67 sq km built up area, 3 sq km forest area, 23 sq km wasteland. An approximate population of 22 lakh was affected covering 287 villages.

As per the reports of National Disaster Management Authority 257 people lost their lives. At least three people were reported killed in Jhang and nine in other parts of Pakistan. The experts from state and NDMA realised the need to devise strategy to protect the cities from floods in future by conducting feasibility study for construction of parallel flood channel from Sangam /Kandizal to Wular. Dredging of the river on regular intervals, monitoring of sediments, land use, land cover, maintaining sanctity of Wetlands and Water bodies, climate change adaptation and mitigation etc have also been suggested. It also suggests need for a multidisciplinary team to study hydrological response of each catchment in the state.

Glossary

1. **Disaster:** A serious disruption of the functioning of a community involving wide spread human, economic and environmental losses.
2. **Hazard:** An event or occurrence that has the potential for causing injury to life or damage to property or the environment.
3. **Vulnerability:** Susceptibility of a community to a hazard depending upon community's socio-economic condition.
4. **Risk:** The probability of injury to life or damage to property and the environment will occur.
5. **Earthquake:** The shaking of earth or a part of it due to release of internal energy produced by endogenic forces of earth.
6. **Flood:** A condition in which the water of a river cross its banks and subsequently inundates surrounding land.
7. **Drought:** A long period of abnormally low rainfall, especially one that adversely affects growing or living conditions.
8. **Cyclone:** A rotating, organized system of clouds and thunderstorms that originate over are tropical are subtropical waters.
9. **Landslide:** A heavy fall of earth and rocks down the side of a mountains or steep slope.
10. **Avalanche:** A mass of snow, ice and rock falling down a mountain side.
11. **Tsunami:** A large wave on the ocean, usually caused by an undersea earthquake or volcanic eruptions.
12. **Cloudburst:** A situation in which a cloud suddenly precipitates tons of water over a small area.

Exercise

A. Short answer type questions

Q.No.1

i) Define a disaster?

ii) What is meant by hazard? Name some man- made and natural hazards?

iii) Write a brief note on the earthquake zones in India?

iv) Mention some worst cyclone affected areas in India?

v) Mention some worst affected landslide areas in north India?

vi) What is meant by tsunami, name some vulnerable area in India?

vii) Define a cloudburst and its implications?

B. Match the following

Q.No.2.

Cloudburst	ValtenguNad
Super cyclone	Leh
Bujj Earth	Orrisa
Snow avalanche	Gujarath

C. Long answer type questions

Q. No. 3 Give detailed account of flood prone regions of India. Highlight main causes of flooding in India?

Q. No. 4 Discuss in detail disaster profile of India.?

Q. No. 5 Jammu and Kashmir is a multi-hazard prone state? Discuss.?

Q. No. 6 Vulnerability to various disasters in India is very high. Give reasons?

Q. No. 7 Discuss causes and consequences of drought in India?

The list of subject experts who participated in the different workshops held both in Kashmir and Jammu division are as:

Dr. Mohammad Shafi	Sr. Assistant Prof. Kashmir University
Dr. Abdul Rehman Bhat	Professor, S.P. College, Srinagar.
Dr. Javeed Ahmad Rather	Sr. Assistant Prof. Kashmir University.
Mr. Aijaz Ahmad Najar	Sr. Lecturer, GGHSS. Kothibagh Srinagar
Dr. Gulshan Rasheed	Sr. Lecturer, BHSS Rajouri.
Ms. Anita Koul	Sr. Lecturer, GHSS. Satwari, Jammu.
Ms. Oscia Jabeen	Sr. Lecturer, DIET. Ganderbal.
Ms. Beenish Geelani	Sr. Lecturer, GBHSS. Jawahar Nagar Srinagar
Mrs. Seema Sharma	Master, GGHSS. Jhak, Jammu.
Ms. Mudasira Yaseen	Teacher, BHS. Gassi Mohalla, Srinagar.
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Mr. Mubashir Bhat	Teacher, GBHSS. Khonmoh Srinagar
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