GE(N)-202

Geography of Asia and Lab Work

DEPARTMENT OF GEOGRAPHY AND NATURAL RESOURCE MANAGEMENT
SCHOOL OF EARTH AND ENVIRONMENTAL SCIENCE
UTTARAKHAND OPEN UNIVERSITY

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Title	:	Geography of Asia
ISBN No.	:	
Copyright	:	Uttarakhand Open University
Edition	:	First (2021)

Published By: Uttarakhand Open University, Haldwani, Nainital-263139
Printed By:

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BLOCK- 1PHYSICAL ASPECTS

UNIT: 1 INTRODUCTION, STRUCTURE AND RELIEF

1.1 OBJECTIVES

- By the end of this unit you will be able to understand the following.
- Historical background and importance of Asia.
- Different types of geological structures like as ancient blocks of northern and southern, new folded mountain ranges etc.
- Reliefs like as central mountains and plateau, river basins, peninsular plateau, northern low land etc.

1.2 INTRODUCTION

Asia is the largest of the world's continents, covering around 30 percent of the earth's land area. It is also the world's most densely inhabited continent, with approximately 60 percent of the total population. Asia makes up the eastern part of the Eurasian supercontinent, Europe occupies the western part. The border between the two continents is debated. However, most geographical define Asia's western borders an indirect line that follows the Ural mountain, the causes mountains, and the caption and black seas. Asia is bordered by the Arctic, Pacific and Indian Ocean.

Asia is rich in diverse races, cultures, and languages, many of the world's major religions came out of Asia as well as Christianity, Judaism, Islam, Hinduism and Buddhism.

Asia has a major influence on world culture and the world's economy; countries such as Russia, China, Japan and India produce yield, and services that are used by every nation in the world. Asia is also rich in natural resource. Oil in the Middle East is a most important supplier of much of the world's energy.

The superficial relationship of the continent intensifies the contrast between south-Eastern and central Asia. The Himalayas, the loftiest mountain range in the world, capture the summer monsoons of India. North of these mountains, the tableland of Tibet, varying from about 10,000 to 18,000 feet in height, spreads out northwards to the Altyn Tagh and Nan-Shan mountain ranges, which also help to avoid the southern monsoon from reaching the heart of the continent. Still more efficiently deprived of the deprived of this important of life are the lower tablelands in the North-central part of the continent changeable from about 2,200 to upwards of 4,000 feet in height, and extending to the mountain on the borders of Siberia.

The Asian region of which the Suez Canal is the center has been the meeting place of national and races for lots of, years. It has provided battlegrounds for militaristic peoples for centuries. Proceeding of recent years again focused attention on the region. Little part of the world has played a larger part few in world history than has this region. It makes the centers where for

centuries the east and the west met. Humankind, always on the move, passed through have on its way between Europe and Asia, between Africa and Europe.

The crossing of trade routes and the interchange of produce led to the interchange of ideas. In these lands are proofs of the earliest civilization. Here took place the easy beginning of development which made possible the advances of the present day. Here were the great empire and territory of ancient times. Here lived and emperors of Babylon, Assyria, Chaldea, Phoenicia and Egypt when these emperors laws, practically all the rest of the world except China was in a state of barbarism. The valleys of the Nile and of the Tigris and Euphrates were well fitted to support large populations and become of their central location to play a large part in the affairs of the world as it was in those days. Early civilization developed in centers in which life was not too hard nor yet too easy. The rich river plains with abundant water for irrigation yielded to those who cultivated them returns so large that there was sufficient leisure to develop the arts of civilization. Furthermore early civilization required some measure of protection, such as that provided by mountains, seas and desert. Thus it was not necessary for the people to devote a large proportion of their time and resources to proportion for war. These areas possessed all of this advantage, and here developed the centers of most primitive culture.

It would be impossible to detail all the ways in which early culture influences modern life. Here the horse was most likely first used as a help in doing man's work. The use of the wheel had its beginning among the Babylonians and the Assyrians. Like the use of fire this was one of the greatest advances man ever made. The Babylonians did much to develop the science of arithmetic, and Egypt geometry was first used to establish boundary lines after irrigation. The Chaldeans were great scholar of the heavens and learned to foretell the times of eclipses of the moon and the sun. The Phoneticians, were country bordered the eastern Mediterranean, were the "missionaries of civilization." As dealers they carried the new thoughts, the culture of the Middle East, to all the shores of the Mediterranean Sea and thus on the Western Europe.

The countries of the Middle East especially since world war second, have become extra and extra sensitive to foreign control or what appears to them to be too much influence of other countries in their government or in their industries. ? This strong desire to be entirely free from exterior influence leads to the organization of collection or parties, known as nationalists. Often a nationalist party includes communists, who are usually spurred on by the Russians.

1.3 GEOLOGICAL STRUCTURE

Asia is not only earth's largest continent but also its youngest and structurally most-complicated one. Although Asia's growth began approximately four billion years ago, more than half of the continent remains seismically energetic, and new continental material is currently being created in the island curve systems that bound it to the east and southeast. It such places, new land is incessant emerging and is added to the bulk of the continent by episodic collisions of the island curve with the mainland. Asia also contains the greatest mountain group on earth's surface; the

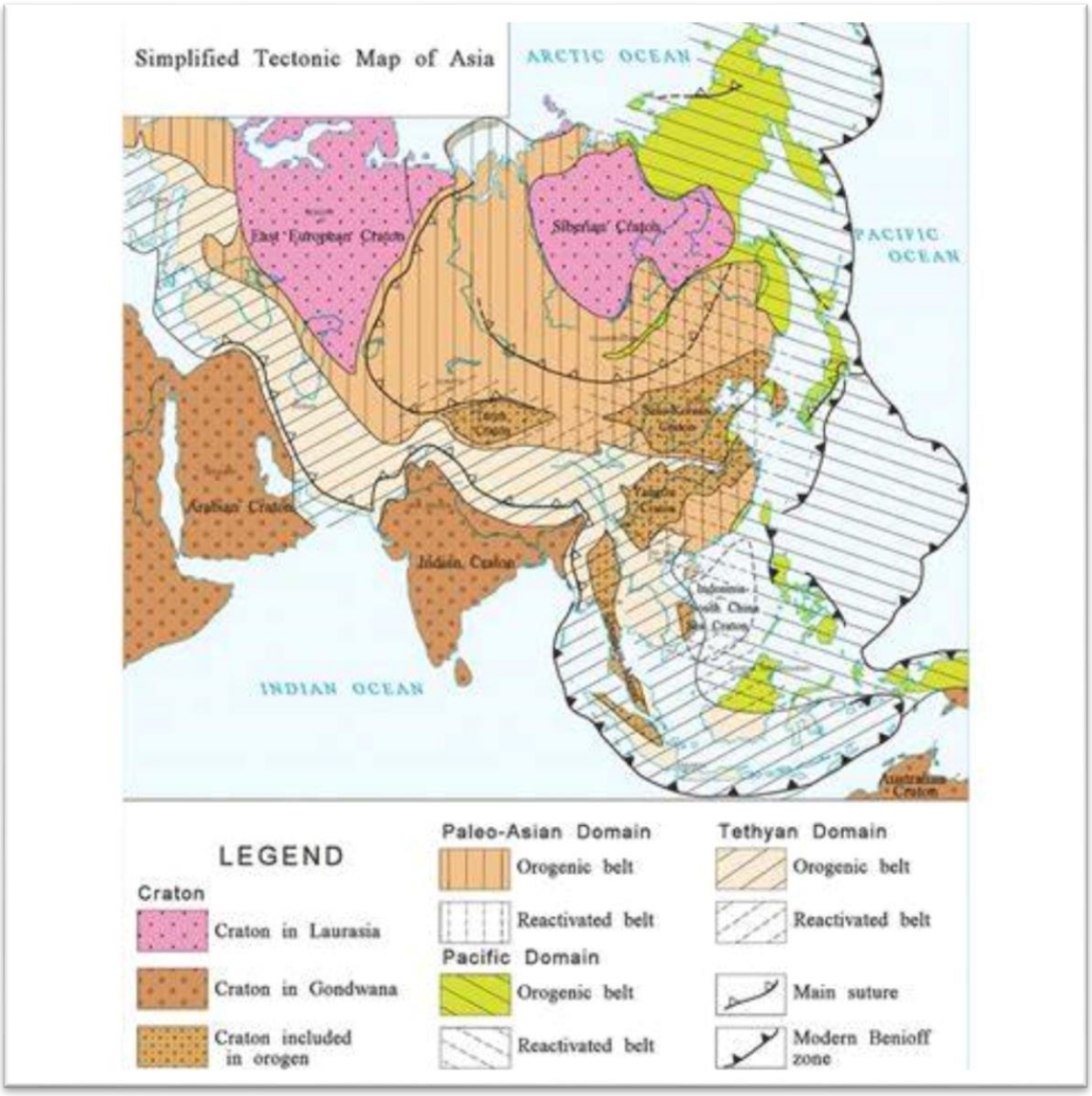
plateau of Tibet and the bordering mountains of the Himalayas, Karakoram Range, Hindu kush, Pamir, Kunlun mountain and Tine Shan. By virtue of its huge size and relative youth, Asia contains many of the geomorphologic extreme of the earth's land surface-such as its uppermost and lowest points, longest coastline, and biggest area of continental shelf. Asia's immense mountain series, various coastline, and huge continental plains and basis have had a profound effect on the way of human history. The reality that Asia produces vast quantities of fossil fuels-petroleum, natural gas, and coal-in addition to being a significant contributor to the worldwide production of lots of minerals heavily underlines the importance of its geology for the benefit of the world's population.

The geomorphology of Asia masks a particularly complex geologic history that predates the active bend great accountable for the existing landforms. Tectonics units (regions that once shaped or now form part of a single tectonic plate and whose formations derive from the construction and action of that plate) that are defined on the foundation of dynamic structures in Asia are not identical to those defined on the foundation of its fossil formations. It is therefore suitable to talk about the tectonic framework of Asia in phrases of two divided maps, one showing its paleo tectonic units and the other showing its neo tectonic (new and currently active) units.

Contrast of Asia with other continents in the world point out that each of the letters possesses a huge Precambrian craton taken as its major part for example, the North America, the east European craton in Europe, the Brazilian craton is South America and the west Australian craton in Oceania, all of which were shaped during the pre Cambrian. On the contrary Asia is a composite continent made up of three huge cratons and many micro continents included. The main body of the continent East Asia and central Asia is engaged by the difficult phanezoic tectonic belts, with the northern part of it engaged by the Siberian craton, and the Sothern part, by the Indian and Arabian cratons. They were finally assembled in meso-cenozoic times. The phanerozoic orogenic belts of Asia appropriately belong to three worldwide tectonic domains, the paleo-Asian Ocean active system the Tethyan region derived from the Tethyan region resulting from the Tethyan and Indian Ocean active systems and the pacific region originated from the Paleo-pacific and Pacific active systems. The suitable location of the Pacific and Teythan region upon the Pleo-Asian region and the interaction with each other have made the made the major part-central and East Asia into a region with the most complex evolutionary history and geological structure on the globe. The three Precambrian cratons of Asia are measured to be affiliated to the two extensive-scale continents Laurasia in the north and Gondwana in the south: The Siberian craton was a significant associate of the Southern continent. The little cratons and micro continent fell below the change tectonic zone between the Northern and Southern continents. The reported geomorphologic and Paleomagnetic data show that before the disappearance of the Paleo-Asian ocean such cratons as Tarim, sino-Asian ocean such craton as Tarim, Siow-Korea, Yangtze and Sibumasu had lain to the south of this ocean and were fraction of the Northern border of Godwana, and they were deceitful to the north of the

Tethys and become parts of the southern margin of Paleo-Asia or Laurasia after the closing of the Paleo-Asian ocean and the opening of the Tethys.

Figure 1.1Tectonic Map of Asia



Source- Google Image

There are many differences about the surface structure of the Asian continent but all geographers believe that the Continent of Asia is divided into the following four parts based on geological structure.

1. Ancient Blocks of North
2. Ancient Blocks of South
3. New Folded Mountain Ranges

4. Residual Parts

Ancient Blocks of North: Ancient block of the north have expanded to the northern part of the Asian continent. Asia Ancient block swells with solid Rocks before the Cambrian era. This ancient large block is a huge plot divided from the Pangaea place part. The rocks of these blocks are extremely hard.

Russian Platform: a platform of the Eastern European platform, situated between the Baltic and Ukrainian shield, the Ural and the time point. It is covered by a thick mantle of sedimentary deposits. The Precambrian basement of the Eastern European platform within the restrictions of the Russian platform is located at a huge, mainly in the Southwest and Southeast. Where the deepness many reach 16-18 km.

Starting with the Riphean, the Russian platform experience bends down warping that occurred at different times in various areas. The main structural elements of the Russian platform are tectonic depression curves and aulakogenes. The developments of the complex of deposits in the sedimentary mantle occurred from starting of the late proterozoic through the Quaternary. At the end of the Riphean, significant parts of the Eastern European platform south of the Baltic shield sank and was covered by sea until the end of the Silurian. Beginning with the Middle Devonian, the more southern portion of the Russian platform sank and was also enclosed by the sea.

The Baltic, Moscow, and Caspian tectonic depressions began shaping, surrounded by the Masurian Byelorussian and Voronezh curves and separated by the Volga-Ural curve. The tectonic depressions are filled with series of Devonian, Carboniferous, and Permian deposits and, in the Southern part, with Mesozoic and Cenozoic deposits. At the end of the proterozoic, the Dnieper-Donets aulakogne was shaped South of the Byelorussian and Voronezh arches, it is filled with Teiassic Jurassic, Cretaceous, and Paleogenic deposits.

Other ancient blocks of North are Angara Land, Chinese Massif, and Sardinian Massif.

Ancient Blocks of South: Similar to the ancient blocks of the north, the ancient plans of the south are built by solid and ancient rocks. These ancient blocks are broken land plots of Pangaea which are called Gondwanaland. There are two blocks of this Gondwanaland which are as follows.

1. Arabian Peninsula
2. Indian Peninsula

Arabian Peninsula: The Arabian Peninsula is located Persian Gulf on the northeast, the strait of Hormeoz and the Gulf of Oman on the east the Arabian Sea on the southeast and south, the Gulf of Aden on the south, the Beb-el-Mandeb strait on the southeast and the Red seas.

Geologically, this area is maybe more suitably called the Arabian subcontinent because it lies on a tectonic plate of its own, the Arabian plate, which has been moving incrementally away from the rest of Africa (forming the Red sea) and North, towered Asia, into the Eurasian plate (forming the Zagros Mountains). The rocks exposed vary methodically across Arabian-Nubian shield near the become younger towards the Persian Gulf. Perhaps the best preserved ophiolite on Earth, the semail ophiolite, lays showing in the mountains of the UAE and northern Oman.

Indian Peninsula: The Peninsular Plateau of India is also named as one of the main Physiographic elements of India. The northern boundary of the peninsular block may be taken as an unequal line running from kachachh along the western flank of the aravali Range hear Delhi and then approximately parallel to the Yamuna and Ganga as for as the Rajmahal hills ended the Ganga delta. Separately from these, the Karbi Anglong and the Meghalaya plateau in the northern parts are separated by the Malda fault in west Bengal from the Chotanagpur Plateau. In Rajasthan, the desert and other desert like features overly this block. The Indian peninsula is a triangular shaped landscape of earliest landmass with a record of a prolonged history of erosion, denudation and resurgent tectonic activates. The Plateau ascends 100 meters in the north, ascending further to over 1,000 meters to the south, creating a prominent triangle located in the well-known downhill- moving triangle of the coasts of the Indian subcontinent. Its cause lies in the collision of Indian and Eurasian Plateau around 15 million years ago.

New Folded Mountain Ranges: The new folded mountain range is found in the central part of Asia continent. As a result of the movements of earth, these mountain ranges expanded in the Triassic era. At the last moment of the Mesozoic era, these folded mountain ranges began to be built and in the third era. These categories were fully developed. These mountain chorines are built by many folds. The rocks of these mountain ranges contain marine debris and the remains of animals.

The new folded mountain ranges in Asia extend from the Mediterranean to the east to the Pacific Ocean in the west. These mountain ranges include Taras, Pontic, Jagrus, Elburg, Hindukush, Sulaiman, Kirthar, Himalaya, Karakoram, Tiansan, Arakanyoma etc. Many mountainous ranges are spread in different directions from the Pamir's knot in the middle and many high end paths are also found in the middle of the mountain ranges. These mountain ranges were formed in Europe's alpine mountain ranges as well as in the same time, these Asian folded mountains are also known as the alpine mountain ranges.

Residual Parts: Under the residual part of Asia all the land part like ancient blocks of north, ancient block of south, new folded mountain ranges. Which are located in the middle of the above three plots are included the rocks found in these area were formed in the Paleozoic era and Mesozoic era. During this period, many folded mountains were formed in these intermediate terrains as a result of the Caledonian movements. This was followed by several folded mountain due to the harsian land movements. In ancient times, those mountains were greatly eroded. As a

result of long term erosion, many mountains have been eroded to the form of peniplain. China's plateau is an example of a transformed plateau.

1.4 ASIA RELIEF

The elevation of the Continent of Asia is divided into five parts based on the following characteristics.

1. Central Mountain and Plateau Ranges
2. Basins of Vast Rivers
3. Southern Peninsular Plateau
4. Northern Low Land
5. Archipelagoes

Central Mountain and Plateau Ranges: The central mountains lie to the south of the central lowlands. Approximately all the mountains range of Asia extends out in different directions from the Pamir knot. The Hindu Kush and the Suleiman mountains lie to the west of the Pamir knot. The Hindu Kush Mountains extended to Knot. The Hindu Kush Mountains extend to northern Tajikistan, Pakistan and Afghanistan to the border of Iran. This range is known as the Elburz Mountain along the shoreline of the Caspian Sea. The Suleiman Mountain runs westwards as the Zagros Mountains along the coast of Iran and continues further westwards into Turkey as the Taurus Mountains. The plateaus in the region, four mountain ranges run to the east of the Pamir Knot- the Himalayas, the Karakoram Range, the Kunlun mountains and the Tien Shan mountain range. The Himalayas are young fold mountains which run into India and Nepal. It has Mt. Everest, the highest peak in the world. It runs further east and is known as the Arakon Yoma in Myanmar. The Karakoram Range lies to the north of the Himalayas. The second highest peak in the world, Mt. K2 lies in this range.

Basins of Vast Rivers: The land of Asia flourishes in rivers some of the world's longest rivers, for example the Yangteze. The Yellow River and Euphrates flow through the world's largest continent. These waterways account for most of the region's fertility and provide several significant resources to carry on its large population.

Low plains occupy the rest of Asian mainland, particularly the vast west Siberian and tundra plains of the interior. The remaining lowland is distributed also in the maritime regions. Those plain have monotonously level surfaces with broad valleys, through which the great Asian rivers and their tributaries flow. The topography of the plains in densely populated regions has been greatly modified through the construction lie extensive tableland and plateaus.

Tigris and Euphrates River Plain: The Tigris and Euphrates river system is the primary basis for the fertile crcacent in the region of Mesopotamia. The rivers originate in the Taurus Mountains and how all the way south to the Persian Gulf. These rivers supply essential life bearing water that was necessary to start civilization in the desert.

Indo-Gangetic Plain: It lies in the south of Himalayas stretching from the Suleiman Mountains to the Gango and Luchai hills. It is 100 to 300 miles broad. It is a flat and alluvial plain with deep and fertile soil. There is a work of roads and railways with the best system of irrigation, canals in the world. It is one of the most thickly populated elements of the world.

Irrawaddy River Plain: Irrawaddy River, Burma's most important river of Myanmar running through the centre of the country. Myanmar's leading commercial waterway, it is about 2,170 km long. Its total drainage area is about 411,000 square km. Its valley shape the historical, cultural and economical important.

Minam River Plain: The Minam river basin on the west side of the Wallowo Mountains is one of the most visited wilderness regions in Oregon, with 239 square miles of forested canyons, creeks, and Mountains mostly with the Eagle cap wilderness area. The Minam has its headwaters at blue Lake, at altitude 7,703 feet and from limited outflow on the south end of Minam Lake.

Figure 1.2 Irrawaddy River Plain

Source: Google image

Mekong River Plain: The Mekong river basin has diverse drainage patterns, Topography and geomorphology, with the river basin divided into upper and lower basin. The foundation of Mekong including its principal headwater, the river, originates from Tanggula Mountain's northern slope. Several tributaries feed the Mekong throughout its course.

Figure 1.3 Mekong River Plain (Cambodia)

Source Google Image

Yangtze River Plain: Yangtze River is 6'300 kilometers long and the largest river of China. It has a catchment area of 1,800,000 square kilometers, and is the major inland-river transport artery in China.

Southern Peninsular Plateau: The southern plateaus lie to the south of the Central Mountain belts. The Arabian Plateau rises steeply. It is a dry desert region. The Plateau of Indian Peninsula goes up steeply along the coast of the Arabian Sea and becomes gentle towards the Bay of Bengal. This is a dissected plateau and is transverse by rivers like Godavari, Krishna, Mahanadi and Knavery. Other plateaus are the Plateau of Shan and the Plateau of Yunnan in China. This plateau too has steep western slope and is drained by the Salween, Mekong and Si Kiang rivers.

Peninsular Plateau of Arab: The Arabian Peninsula or Arabia is the Peninsula in Southwestern Asia and northeast of Asia. The peninsula, which is mostly of deserted, is a geopolitically important region of the Middle due to its oil and gas resources. Most of the population in the region is of Arab and Muslim origin.

The Arabian Peninsula is a huge Peninsula located in western Asia. It is bordered to the north by Jordan and Iraq, to the west by the Red sea, to the east by the Persian Gulf and the gulf of Oman, and the south by the Gulf of Aden and the Arabian Sea.

Peninsular Plateau of India: The Peninsular upland of India is the most famous zones for several of Indian's development. The Peninsula Plateau is marked off from the plains of the

Ganga and the Indus by a mass of mountain and mount ranges varying from 460 to 1,220 meters in highest.

The Peninsula is sided on the one side by the Eastern Ghats where average elevation in about 610 meters and on the other by the western Ghats where it is normally from 915 to 1,220 meters, rising in places to over 2,440 meters.

Between the Western Ghats and Arabian Sea lies a narrow coastal strip, while between Eastern Ghats and the Bay of Bengal there is a broader coastal part.

The Sothern point of Plateau is shaped by the Nilgiri hill where the Eastern and the Western Ghats meet.

Northern Low Land: The northern lowlands of Asia enlarged from the Ural Mountain in the west up to the Bering Strait in the north-east. These lowland are triangular in form and widest in the west lying between the Arctic Ocean in the north and central mountains in the south, they from the world's greatest continuous plains. Three rivers which flow north wards into the Arctic Ocean Ob, Yenisey and Leha, have together built this plain. These marshy and muddy lowlands are also called as the great Siberian plain. The lower courses and mouths of the rivers freeze in winter. So, water coming from the course in warmer latitudes spreads out over a large part of the plains. Another low lying land exists south of the Siberian plain in central Asia called the Turan plain. This plain is an area of inland drainage and is drainage by rivers Amudarya and Syr-Darya.

Archipelagoes: The lower land north of Siberia is extended as a triangle field. The plain is bordered by the Arctic Ocean to the north, The Eural Mountain to the west and the intermediate mountain, plateau arrange to the southeast. This lower plain is made up of basins of the Rivers Obe, Yeneseya and Lina. This lower plain is made up of basins of the Rivers Obe, Yeneseya and Lina. This huge ground has faced many modes falling in the surface of Asia. The slope of this plain is towards the Arctic Sea in the north

1.5 CONCLUSION

After reading this chapter, you will have knowledge of the various types of structures on the surface of Asia. While on the one have you will know the global importance of Asia, on the other hand, you will know the geological event of Asia very well. Asia has been made into various streamline part of which have mountain ranges, Plateaus, wide plains of rivers etc. these diverse structural features have made the continent of Asia.

1.6 SUMMARY

The unit comprises three objectives first historical background and importance of Asia, second different types of geological structures like as ancient blocks of northern and southern new

folded mountains ranges, third reliefs like as central mountains and plateaus, rivers basins, peninsular plateau northern low land etc.

Asia, the world's largest continent has the distribution of being the origin of race and the oldest civilization. Eminent anthropologist believe that continent of Asia has been the birthplace of humans. It has also been the cradle of the human race and the place of migration of human beings. Apart from Asia being the birthplace of human beings this continent has also taught the world the lesson of civilization. About 5,000 years before the first AD, human civilization developed in the valleys of the Tigris- Euphrates Rivers. The ancient lands and the newest landmass of the world are the pillars of the Asia. The oldest land in the north and the oldest in the south are located in the north and south parts of the continental plateau of India and Arabia are among the oldest structures of the world in which the rocks found are the oldest rock to be found. thus, there are many types of inequalities and divergence found in the continent of Asia. Even after these inequalities there is unity in the different faces of the continent of Asia.

1.7 GLOSSARY

Geologic history: Geologic history is a showing the sequence of geological periods in the history of the Earth.

Fossil: Fossil is the preserve remains or traces of remains, of ancient organism. Fossils are not remains of the organism itself! They are rocks.

Drainage system: River system is the patterns formed by the streams, river and lakes in a particular drainage basin.

Folded mountains: Folded Mountains are created where two or more of earth's tectonic plates are pushed together. At these colliding, compressing boundaries, rocks are warped and folded into rocky outcrops, hills, mountains and entire mountain ranges.

Civilization: The condition that exist when people have developed effective way of organizing a society and care about art, science, etc.

1.8 ANSWER TO CHECK YOUR PROGRESS

1. The name of the desert located in the north of Balochistan is.

(A) Thar
(B) Hamoon Mush khali
(C) Dast-e-Lut
(D) Rub-al Khali

2. There are rivers that fall into the pacific ocean:

(A) Hwang ho, Mekong, Minam
(B) Narmada, Krishna, Kaveri
(C) Ob, Yenisei, Lee
(D) Manisa, madori, Orontes

3. Where is the Tigris- Euphrates Plane located?
(A) Iran
(B) Iraq
(C) Arab
(D) Israel

4. Which plateau of the world is known as the "Roof of the World"?
(A) Deccan plateau
(B) Pamir plateau
(C) Khorat plateau
(D) Katanga plateau

5. Which of the following countries of Asia are not landlocked?
(A) Magnolia
(B) Tajikistan
(C) Uzbekistan
(D) Malaysia

6. Which is the longest river in Asia continent?
(A) Yellow
(B) Brahmaputra
(C) Mekong
(D) Yangtze river

7. The Arabian plateau is located in Asia:
(A) Eastern
(B) Western
(C) Southern
(D) Norther

8. The Yangtze river flows in:
(A) China
(B) India
(C) Tibet
(D) Nepal

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1.11 TERMINAL QUETIONS

1- Explain the role of Geological structure on the southern and northern part of Asia.
2- Discuss the new folded mountain ranges of Asia.
3- Write a note about the role of basins of vast rivers of Asia continent.
4- Explain briefly the southern peninsular plateau.
5- Give the division of constitutional parts of Asia.
6- Describe the main objects of geological constitution of Asia continent.

UNIT 2 - DRAINAGE AND CLIMATE

2.1 OBJECTIVE

By the end of this unit you will be able to understand the following

- Different types of drainage systems of Asia.
- To know about Climate and whether conditions of Asia continent.

2.2 INTRODUCTION

With more than 30% (about 44,444,100 km²) of the landmass and about 60% of the world's population, Asia is the largest continents of the world, located in the southern hemisphere, stretches over 85 latitudes and 164 longitudes and have large scale diversity due to its vast size. It is the home of world's largest country both in terms of population (Russia) and population (China). Ural Mountains, Caspian Sea, Caucasus Mountains and Black sea mark the boundary between Asia and Europe while Suez Canal and Red Sea divides Asia from Africa. From east, it is surrounded by Okhotsk Sea, Sea of Japan, Yellow Sea, East China Sea and South China Sea, while from south it is surrounded by Indian Ocean, Arabian Sea and Bay of Bengal, and from north it is surrounded by Arctic Ocean. Bearing straight separates Asia from the North America in East.

Asia is a diverse continent both in terms of physical features as well as people and culture. Variations can be noted in its economy also, as it has both worlds most underdeveloped countries like Nepal, Bhutan, Afghanistan, etc., fastest developing countries like China, India, Indonesia, etc., and most developed countries like Japan, Singapore and Russia. It has both worlds' deepest and highest points, viz., Mariana Trench and Mount Everest respectively. Both the highest and lowest rainfall is measured in Asia in Mawsynram in India and Aden in Yemen. Maximum and minimum temperatures of Asia are recorded in Jacobabad and Verkhoyansk respectively. The continent has the world's largest coastline among all the continents and has most varied type of climate system and physical structure, thus produces most diverse varieties off lora and fauna The territory of Asia stretches from the north to south for more than 10 thousand kilometers, passing all the physiographic belts from Arctic Circle to Equatorial belts. All kinds of climate, soil, flora & fauna, culture and people can be observed in the continent of Asia. There are more than 50 countries in Asia, each have distinct physiographic structures, socio- economic and cultural situations, size and population. Hussain (2012) divided the countries of Asia into 5 categories:

a) South-west Asia,

b) South Asia also called Monsoon Asia,

c) South-east Asia,

d) East Asia, and

e) Central Asia.

2.3 DRAINAGE SYSTEM

Drainage system includes rivers, streams, lakes, etc. in geomorphology, drainage system refers to the river system, that are patterns formed by the streams and rivers in a drainage basin. Rivers are an important resource for any country or continent that provides sources of irrigation, hydroelectricity, navigation, etc. World's earliest civilizations occurred in the river valleys because rivers provided the source of drinking water, irrigation, and navigation, like Nile Valley Civilization, Sumerian Civilization, Indus Civilization, etc.

Figure 2. 1 Major Rivers of Asia

Source:World Atlas

Asia has a number of rivers, including some of the world's largest rivers like Yangtze, Huang Ho, Euphrates, Tigris, etc. These rivers have important role in sustaining the large population of the continent, as most densely population of the continent lives in the plains of Ganges, Indus, Euphrates, Tigris, Huang Ho, etc. Throughout the history, they allowed several civilizations to

sustain and flourish around their banks. The drainage system of Asia can be divided and studied in terms of 5 major parts based on their orientation:

1. **Rivers flowing into India Ocean**; includes Ganges, Indus, Irrawaddy, Brahmaputra, Shatt al-Arab etc.
2. **Rivers flowing into Pacific Ocean**; includes Yellow River, Yangtze, Mekong, Amur,etc
3. **Rivers flowing into Arctic Ocean**; includes Ob, Yenisei, Lena, etc.
4. **Rivers flowing into Mediterranean Sea, Caspian Sea, Black Sea & Azov Sea**; includes Kura, Aras, Ceyhan, etc.
5. **Inland drainage system**; includes Lake Baikal, Aral Sea, Syr Darya, Amu Darya, etc.

2.4 MAJOR RIVERS OF ASIA

1. Yangtze: - With a length of 6380 kilometers and a basin area of 1,808,500 km^2, Yangtze is the longest river of Asia and third longest in the world. The river originates from Tanggula range of Qinghai Province in China and travel across the eleven provinces of China and finally drains into East China Sea near Shanghai. As the largest water system of the China, Yangtze has important role in the History, cultural and economic growth of China. The main tributaries of Yangtze are Min River, Jialing River, Gan River, Huangpur River etc. The river is also called Chang Jiang, meaning Long River.

2. Yellow River (Huang Ho): - It is the second longest river of Asia, flowing in China. It originated from Tibet and flows through Qinghai, Gansu, Inner Mongolia, Henan etc., and finally drains in Gulf of Bo Hai in Yellow Sea. Its total length is about 5464 kilometers and its basin area is 752,546 km^2. Also known as Sorrow of China, it is slow and sluggish in nature and is the world's muddiest river which discharge trice mud than Mississippi River. It is called Yellow river due to its colour which is due to the yellow silt which it picks in Shaanxi loess plateau. It travels across major Industrial and mineral regions of China.

3. Mekong: - With an estimated length of 4350 kilometers Mekong is the longest river of South-east Asia and seventh longest in Asia, which drains an area about 795,000 km^2. It originates as Za Qu River, from Tanggula Mountains in south-eastern part of Qinghai

province of China and flows through Tibet and Yunnan province. It forms natural boundary between Myanmar and Laos and between Laos and Thailand, and finally drains into South China Sea. Two important cities, Vientiane (Capital of Laos) and Phnom (Capital of Cambodia) are situated on its bank. Its important tributaries are Nam Ta, Nam Ou, Nam Mae

Kok, Nam Mae Ing, etc.

4. Yenisei: - Also called as Enisei is the largest river system flowing into the Arctic Ocean and sixth largest river system of world in terms of water discharge. It stretches from south to north across central Siberia. It originates near the city of Kyzyl in Russia, where two head streams namely Great Yenisei and Little Yenisei joins to formtheYenisei

5. River. The total length of the river is about 3487 kilometers and its basin area is 2,580,000 km², and it drains into Kara Sea. Its major tributaries are Angara, Nizhnyaya, Tuba, Podkamennaya, etc. Angara, a major tributary of Yenisei passes through the Lake Baikal.

6. Indus: - With a basin area of more than 11, 65,000 km² Indus system (also called Sindhu) forms one of the largest river basins of the world. Its total length is 2880 kilometers, of which most parts lies in Pakistan and some parts in India (1114 km). It originates from Bokhar Chu glacier of Kailash range in Tibet. It flows between Zaskar and Ladakh ranges and passes through Gilgit-Baltistan region and enters Pakistan near Chillar in Daristan region. Its major tributaries are Satluj, Beas, Ravi, Chenab and Jhelum join it near Mithankot, while a number of minor Himalayan streams like Shyok, Nubra, Gilgit, etc. joins it in India. Kabul River joins it near Attock in Pakistan. It finally drains into Arabian Sea near Karachi, where it forms a large delta.

7. Tigris-Euphrates System: - Tigris and Euphrates are the major rivers of West Asia. Along with their tributaries the forms one of the most fertile plains of the world. They originate from Armenian highlands of Eastern Turkey at a distance of around 80 kilometers to each other and both of them flows through Syria and Iraq and drains into Persian Gulf after joining each other. After joining to each other they are called Shatt-al- Arab. The total length of Euphrates is about 2800 km while Tigris has a length of 1900 km. Two earliest civilizations (Sumeria and Assyria) developed and flourished in the Tigris-Euphrates plains in Mesopotamia during 3000 BC and 2000 BC.

8. Brahmaputra: - Also known as Tsangpo in China, Dihang in Arunachal Pradesh and Jamuna in Bangladesh, it is one of the major rivers of South Asia having a basin area of 712,035 km^2. It originates from east of Manasarovar lake in Tibet and runs for nearly 2900 kilometers through Tibet, Arunachal Pradesh, Assam, and Bangladesh and finally drains into bay of Bengal with Ganga and forms world's largest delta Sundarban delta. In most of its course, river serves as important inland waterways. It forms largest Riverine Island of the world known as Majuli in Assam state of India. Its right bank tributaries are Teesta, Sankosh, Manas, Kameng, etc. and left bank tributaries are Lohit, Dhansiri, Barakar, etc.

9. Ganges: - Originating in Uttarakhand Himalayas of India, this holy river makes one of the most important fertile plains of the world. Two streams named as Alaknanda and Bhagirathi joins at Devprayag district of Uttarakhand to form the Ganga. The total length of the river is 2510 kilometres, and its basin cover an area of about 1,080,000 squarekilometres. It's important tributaries are Yamuna, Sharda, Son, Kosi, Gandak, Ghaghra, etc. After flowing through the northern plains of India, river enters Bangladesh, where it is called Padma at Goalundo, and joins Jamuna (Brahmaputra), after which it is called Meghna, and drains into Bay of Bengal.

10. Ob: - With a length of about 3650 km and 2,972,497 km² basin area, Ob is the seventh

longest river of world and one of the major rivers of Asia, flowing through the Siberia. Originating from the Altai Mountain, it passes through the central Russia and finally drains into the Gulf of Ob in Kara Sea. Two major streams Biya and Katun joins to form Ob in the Siberian part of Altai. But Irtysh is regarded as main source of Ob by some scholars, as it is the largest stream of Ob system. It is an important inland water transportation route, which crosses through the heart of Russia.

11. Amu Darya: - Also called Amo River, it is a major river of the central Asia. It was called Oxus during ancient times. It is formed by the confluence of two major streams known as Vakhsh and Panj. It forms natural boundary between Afghanistan and its neighborhood countries Tajikistan, Uzbekistan and Turkmenistan. Its total length is about 2400 km and its drainage basin cover an area of 534,739 km² and finally it drains into Aral Sea. Along with Syr Darya, Amu Darya is the main source of water to Aral Sea, but during past century, the diversion of water for irrigation and other purposes have resulted in shrinking area of Aral Sea.

2.5 FACTORS INFLUENCING THE CLIMATE OF ASIA

There are a number of factors that influence the weather and climate around the globe. Due to these factors, the differences in climate around the world are found. The most important factors are:

a. Altitude: The temperature decreases with increasing height due to normal lapse rate. Due to this the climate becomes cooler as altitude increases. On high mountains flora and fauna are different from that of plain areas. In high mountainous regions, the temperature becomes so cool that snowfall is the common phenomena.

b. Latitude: The distance from equator also affects the climate. Climate in higher latitudes are generally cool and mild while in lower latitudes, near equator hot and humid climate is found. This is because sun is vertical over equator all year around resulting in highTemperature and high rate of evaporation but as we move away from equator, the sun rays become oblique and thus temperature decreases.

c. Distance from the Sea: Proximity to the water surfaces affect the climate of a place, because coastal areas are cooler and wetter due to sea effects. The Sea breeze brings rain in coastal regions, while the amount of rainfall decreases as we move away from the sea coast. The range of temperature is also low in the regions near to sea coast while interior land masses experiences the high range of temperature.

d. Ocean Currents: Ocean temperatures can increase or reduce the temperature. The warm ocean currents slightly increase the temperature of a region while cold currents reduce the temperature. For example Gulf Stream keeps the West coast of Europe free of ice during winter and during summer keeps it warm.

e. Prevailing Winds: Prevailing winds determines the climatic conditions of a location. The

winds blowing from sea to land brings rain to the inland areas. A wind blowing from cooler to warmer areas brings relief for the people living in warmer areas. The cold wind coming from Arctic Circle keeps the climate of central Asia mild.

f. Topography: The topography of an area can significantly affect the climate of that area. Mountains acts as barrier in the way of winds, while plain areas keep winds flow on their way. Western Ghats acts as a barrier to the moisture laden winds coming from Arabian Sea, thus windward sides of the Western Ghats receive heavy rainfall while leeward sides receive low or no rainfall.

Other factors like amount of moisture and dust in atmosphere, El Nino, slope of the surface etc., also significantly affect the climate of a region.

2.6 CLIMATE: SUMMER & WINTER CONDITIONS

Climate refers to the sum total of all the conditions of atmosphere over a longer period of time. You have already studied that the climate of any place is influenced by latitudinal extent, altitude above sea level, prevailing winds, cyclones and ocean currents. Due to its vast size and large scale diversity in physiographic structure, the climate of Asia has great differences between regions. All types of climate classified by Koppen are found in Asia (Gautam, 2007). Different parts of Asia experiences different type's conditions in all the seasons. During summer, the warm air above the interior Asia rises and creates low pressure centre, thus high pressure above Pacific and Indian Oceans causes' moisture laden winds to move towards interior parts of Asia which causes heavy rain (Hussain, 2012). The countradjacent to Mediterranean Sea experiences dry & warm summer and cold & wet summer, while Monsoon Asia experiences hot & humid summer and dry and cold winter.

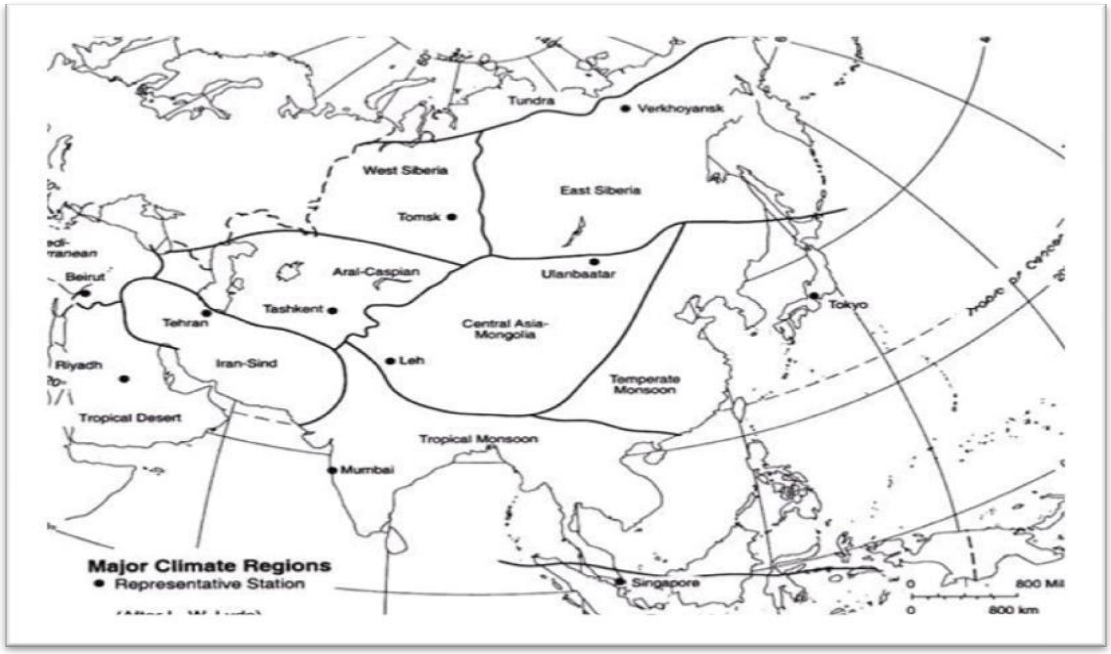
North and Central Asia have relatively mild climate due to cold wind coming from Arctic Circle while Himalayas makes boundary between Indian subcontinent and rest of Asia which results in humid type climate in Indian subcontinent. The countries of West Asia have dry climate due to vast deserts and their geographical location, while East Asia have climate almost similar to the Monsoon Asia. The highest temperature observed in Asia is in Tirat Zvi, in Israel in 1942, while coldest temperature is normally observed in Siberia, Russia. The west Asia experiences some of the largest diurnal temperature ranges on the earth. In higher latitudes and high altitudes of Himalayas, Karakoram and Altai Mountains, during winter season, the temperature falls below freezing point causing snowfall.

2.7 CLIMATIC REGIONS OF ASIA

Asia has all the climate types defined by Koppen. The variety of climatic types can be either studies on the basis of 5 major cultural realms of Asia or can be divided into climatic regions.

1) **Tundra Region:** It stretches along Arctic Ocean from east to west of the continent. The winters of this region are long and dry with precipitation in the form of snowfall and the summers are short and warm enough to melt the snow. The temperature goes beyond freeing point during most parts of the winters, while summer temperature roughly reaches 25° C.
2) **Siberian Region:** This region is further subdivided into 2 parts East and West Siberia. The region drained by Ob and Lena Rivers and topography is plain to mountainous. Lake Baikal is situated in the region. Region experiences world's largest temperature ranges more than 50° C. During summers, this region experiences little rain due to Pacific effect while winters remain mostly frozen.
3) **Temperate Monsoon Land:** This region lies north of Himalayas and includes china, Japan, Korean Peninsula, etc. The summer gets heavy rainfall while winters remain cold and dry. The temperature range in interior parts increases because temperature falls rapidly during winters due to chilled air coming from Arctic and summer temperature rises due to Continentality. During winters Taiwan and some island of Japan including Honshu receives rainfall due to winds coming from Japan Sea.

Figure 2.2 Climatic Regions of Asia



Source: http://www.geographynotes.com

4) **Tropical Monsoon Land:** It includes South and South-east Asia between 10° N and

Tropic of Cancer. In this region mostly tropical climate prevails with monsoonal conditions, seasonal reversal of winds, etc. during winters, Western disturbances causes' rain in western part of the region. Most of the region receives rain during summer months by south-east winds. During winters the condition changes and wind starts blowing from Eastern Siberia to outer belts. The temperature range of this region is comparatively smaller.

5) **Equatorial Regions:** This region lies between 10° N and 10° S, including Indonesia, Malaysia and some island nations. This region experiences high temperature and high rainfall throughout the year. Thus the climate of this region is hot and humid type, with a small range of temperature. The seasonal shifting of trade winds causes some parts of year dry.
6) **Central Asia:** The region lies above the Monsoon Asia and in east of West Asia. The region experiences extreme temperature ranges and in some parts the extreme dryness. In summer months, extreme dryness due to heating of surface creates a low pressure centre in the region and dusty winds starts blowing. During winters cold continental dry winds starts blowing over the region. In some parts, Mediterranean influence causes winter rain, but most parts receive rain during summers.
7) **Mediterranean Region:** This region includes the Asian countries along the Mediterranean Sea coast, including Turkey, Syria, Israel and Iraq. The temperature range is relatively small in this region than interior Asia and Monsoon Asia. The winter temperature hardly reaches 15° C while temperature during summer reaches 25° C. The winters are characterized as cold and wet, as the region experiences most of rainfall during winter season.
8) **Tropical Desert Region: -** This region includes the western part of Indian subcontinent, Iran, Arabian Desert, etc. The region experiences very high temperature with excessive dryness. The region also include coastal areas but the rainfall is almost absent from this region.

2.8 CONCLUSION

Asia is the largest continent of the world, which you have already studies in this chapter. Its vast size and large scale disparities in physical structure leads to diversity in climate, physical features, culture, drainage patterns, etc. The continent has more than 100 major rivers with more than 30 having length more than 1500 km, including world's third longest river Yangtze and Huang Ho, Mekong, Yenisei, Ob, Brahmaputra, Indus, Ganga, etc. Most of the rivers causes flood during the rainy seasons. Beside major rivers, a number of lakes are also present in the Asia, including world's largest Lake, Caspian Sea which makes boarder between Asia and Europe and world's deepest fresh water Lake Baikal. You have also studies that Asia has both worlds' wettest and coldest place on the earth, Mawsynram and Verkhoyansk,

respectively. It has unique diversity in terms of climate as the Monsoon Asia; the rainfall is abundant while West Asia experiences very less rainfall. The northern parts experiences precipitation in the form of snowfall and Mediterranean region experiences rainfall during winters. It has some of the world's driest deserts (both hot & cold) like Thar Desert, Kalahari Desert, Arabian Desert, etc (hot) and Gobi Desert, Ladakh, etc (cold).

2.9 SUMMARY

Asia is the continent of large scale differences in physical, cultural and economic conditions. It has some of the greatest rivers of the world, including Yangtze, Mekong, Ob, Lena, Ganges, Brahmaputra, Indus, Yenisei, etc. Rivers makes some of the world's most fertile plains of the world in Asia, such as Indo-Gangetic plain, Euphrates-Tigris plains, Amur River plain, Irrawaddy plain, etc. Most of the major rivers originate from the Great mountain ranges like Himalayas, Karakoram, etc. rivers of Asia are of great socio-economic as well as political significance.

Due to its vast size, the climate of Asia has large scale diversity. The diversity of climate is due to its large physical extent as well as large scale physical diversity. Mountain ranges makes barrier in the wind directions, while latitudinal locations also have significant impact on the climatic system. Asia has both some of the driest deserts as well as wettest places of the world. In one part the summers are wet and humid and winters are cold and dry, while in western parts, the summers are mind and dry and winters are cold and wet. A large area of Asia experiences snowfall for a large part of the year.

2.10 GLOSSORY

- **Physiographic:** The systematic description of the surface of the earth. It studies the physical patterns and processes of the earth.
- **Tributary**: A stream that flows into the larger or main stream or river or lake. A tributary directly does not flow directly into an ocean or sea, but joins a parent stream that flows into the ocean or sea.
- **Flora & Fauna:** Both words are from Latin origin. A group of plants of an ecosystem or a geographical location is called flora and fauna refers to a group of animals in an ecosystem or a geographical location.
- **Continentality:** Continentality refers to the climatic effect of continental interior and which is devoid of oceanic influences.

- **Freezing Point:** The temperature at which the liquid starts to change its form into solid is called freezing point. The freezing point of water is 0° C.
- **Monsoon:** A seasonal wind of Indian Ocean and South Asia caused due to temperature differences. It causes rain in South Asia and East Asia.
- **Kara Sea:** A small sea located in Arctic Ocean on the coast of Western Siberia between Novaya Zemlya Island, Franz Josef Land and Severnaya Zemlya islands**.**
- **Gulf of Bo Hai:** It is a shallow body of water (north-western arm of Yellow Sea, located on the coast of China. **Harmatton:** A hot and dry wind that blows from eastern part of the Western Sahara through Western Africa to Atlantic Ocean. Usually it carries large amount of dust which it transport for more than 100 kilometers.

2.11 ANSWER TO CHECK YOUR PROGRESS

1. Which of the following river is the longest Asian river flowing into Arctic Ocean?
   a. Lena
   b. Yenisei
   c. Ob
   d. Syr Darya
2. Min River and Jialing River are tributaries of which of the following rivers?
   a. Mekong
   b. Huang Ho
   c. Yangtze
   d. Irrawaddy
3. Sutlej and Beas joins Indus at:
   a. Pathankot
   b. Jammu
   c. Kupwara
   d. Mithankot
4. Which of the following regions of Asia have climate similar to the Monsoon Asia
   a. East Asia
   b. West Asia
   c. Central Asia
   d. Mediterranean Region
5. In Mediterranean region, climate is characterized as:

a. Hot-Wet Summers and Cold-dry Winters
b. Humid Summers and Cold winters
c. Hot summers and Humid winters
d. Hot-dry summers and Cold-wet winters

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2.14 TERMINAL QUESTIONS

Write Short Notes on the following (250-300 Words)

1. Discuss the drainage system of Asia on the basis of their Orientation.
2. The area of Aral Sea is shrinking. Why?
3. Give a brief account about either Yellow River or Yenisei River.
4. What are the factors influencing the climate of Asia?
5. What are the basic differences between Equatorial and Monsoon climatic regions?
6. Discuss the cause of high temperature range in Temperate Monsoon region of Asia.
7. What are the reason for hot and humid type climate in Malaysia and Indonesia?

UNIT 3 NATURAL VEGETATION AND SOILS

3.1 OBJECTIVES

The objectives of the study are the following give below:

- To know the relationship between vegetation and soil type
- What is the difference between vegetation and plant community
- To assess the climatic conditions impact on vegetation types
- Importance of soil for vegetation growth
- Study of different type of vegetation found in Asia
- Sub divided the vegetation on the basis of indigenous plant species
- To study the different type of characteristics of the natural vegetation of Asia
- To see the distribution pattern of natural vegetation of Asia
- To study about the soil of Asia
- To see factor responsible for soil formation
- To see the relationship between climatic factors and soil types
- Study of type of soils found in Asia
- To study the different characteristics of the soils
- To see the distribution pattern of soil of Asia

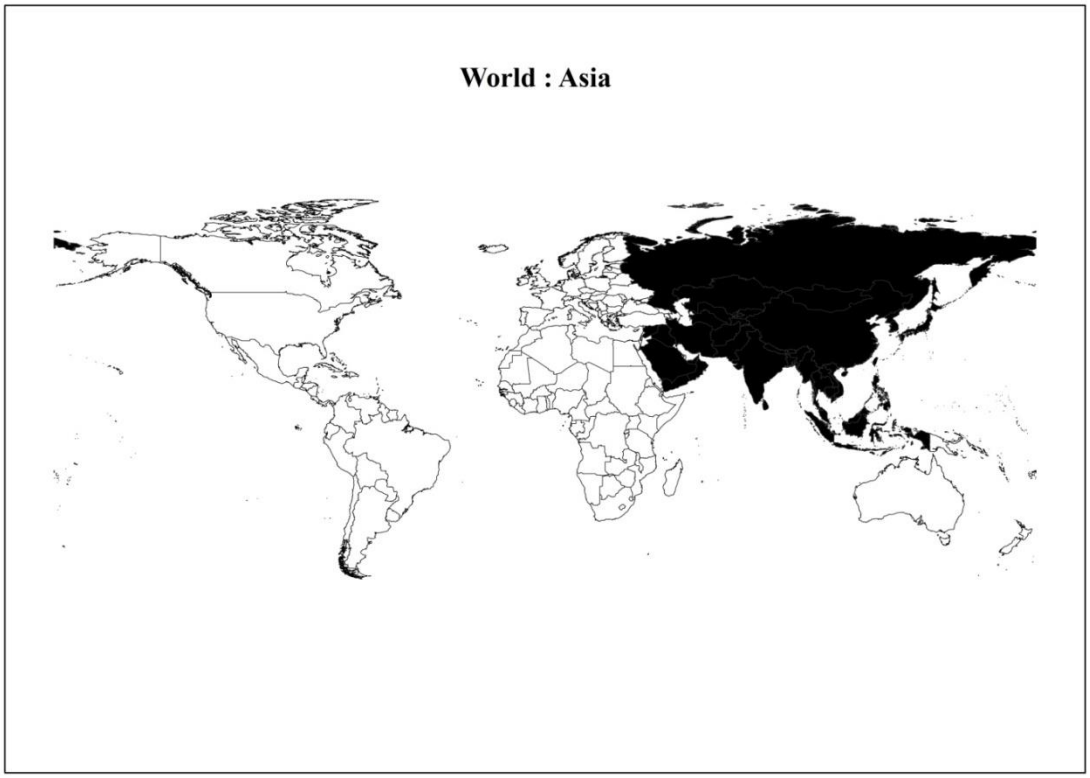
3.2 INTRODUCTION

Vegetation is the most important natural resource for all living organisms. The decreasing trend of vegetation cover is dangers for all living organisms and our environment. Human being takes many things from vegetation such as food, grass, wood, etc. Natural vegetation changes take place slowly whereas the human activities aggravate these changes much faster. Thus it is important to study about vegetation, its types and its distribution. On the other side forest degradation and its conservation is also a matter of great concern.

The term vegetation is a wide concept it includes all the association of plant communities of any region that has been left undisturbed over a long period of time. On the other hand plant community is the group of association of plants which grow together in a particular habitat.

Impacts of natural vegetation and forest degradation are critical such as it causes soil erosion, expansion of desertification, water pollution, leads to food chain disturbances, environmental pollution and greenhouse effect and global warming. So there is a need of forest conservation. Forest conservation means wise use of forest resources and saving of forest resources. The aims of conservation are to know casual relationship between man and natural resources, to know causes of human impact on forest, protection of forest resources, planning for forest resource conservation, keeping ecosystem safe and to bane on human over activities such as deforestation.

Figure 3.1 World Map of Asia



Source: Google

3.3 TYPES OF NATURAL VEGETATION

There are many different types of vegetation found within the geographically diverse Asia-Pacific region.

In Asia there are many different types of natural vegetation found. Types of this natural vegetation are closely related with the soil type, and climatic condition. Both tropical and temperate types of vegetation are found in the Asia region. The types of vegetation found in this region includes Tropical rain forests, tropical deciduous forests, temperate broad leaf evergreen forests, temperate broad leaf deciduous forests, temperate coniferous forests, grasslands, desert vegetation and tundra vegetation.

The natural vegetation of Asia can be divided into following types:

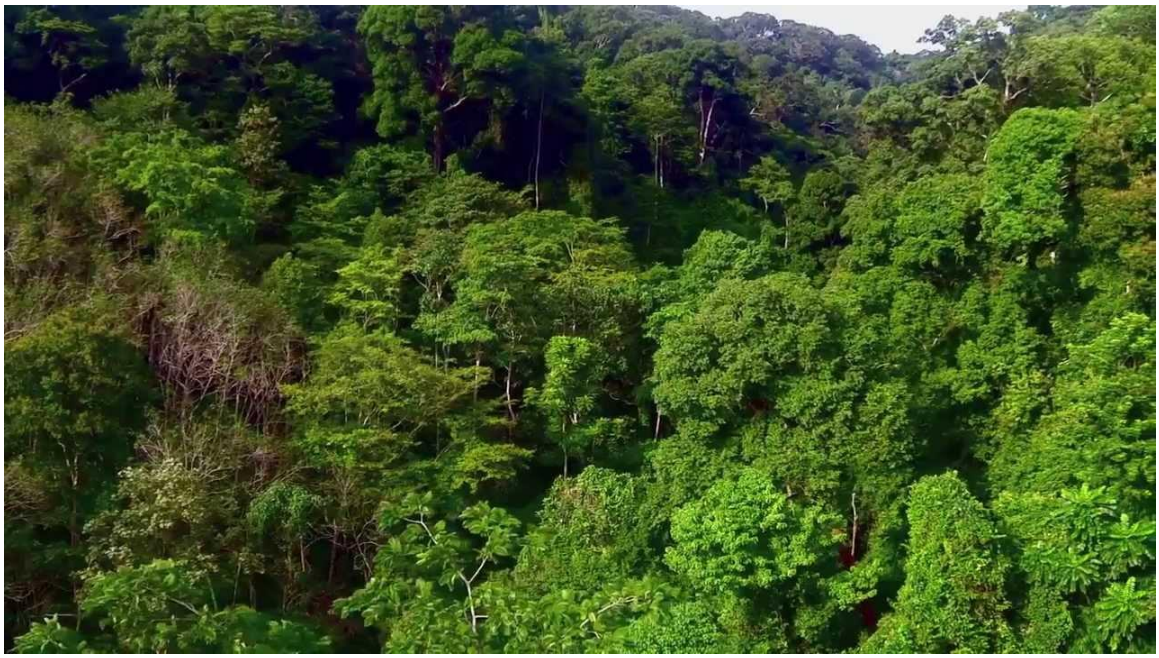
(A) Forest

It is an area of planted or natural trees. High temperature, fertile soils, high humidity and rainfall, and sufficient sunshine, etc. are the characteristics of these forest areas. These forests can be sub-divided as give below:

(1) Tropical rain forests

These forests are found near the equator. It is always hot. This region lies between 10 degree n and 10 degree S latitudes along both sides of equator and comprising the areas of the Malay Peninsula, Indonesia, south-western Sri Lanka and Philippines. Tropical rain forests cover only about 6 per cent of total forest area of the world. However these forests play a most important role in the ecosystem because these forests are the home to half of the world's plant and animal species.

Figure 3.2 Tropical rain forests



Source: Google

These forests are also known as equatorial evergreen forests and also known as the Selva. There are number of plant species found in these forests because of high temperature and high rainfall and characterized by rood leaf evergreen dense forest. The wood of trees is very hard and the trees are usually 30 to 45 meters high. The rainfall in this is between 1500-4000 millimeters annual. Some of them are mahogany, bamboo, rosewood, coconut, palm, avory, cinchona, plantain, wild rubber, sandal wood etc.

(2) Tropical Deciduous Forests

These type of forests are lies between 5 degreeNand30 degree N latitudes. These forests are found in India, western Philippines, Cambodia, Vietnam, south-eastern China, Pakistan, Bangladesh, Myanmar, Thailand, and Laos.Tropical deciduous forests are usually 12 to 30 meters high.Theshrubs are evergreen while most of them are deciduous. These forests are the home of many tribal populations. In many areas shifting cultivation is done. In India these are the

most wide spread and also called monsoon forest. This forest may be sub divided into two parts: (i) moist dry and (ii) dry deciduous. Such as teak, sal, bamboo, Mahua, mango, neem, shisham etc.

Figure 3.3 Tropical Deciduous Forests

Source: Google

(3)Temperate broad leaf evergreen forests

Temperate broad leaf evergreen forests are found in the western Turkey, Syria, Lebanon, and western Israel and composed mainly of road leaf evergreen trees. These forests are the Mediterranean climatic type and dominated by trees and shrubs.

(4) Temperate broad leaf deciduous forests

Temperate broad leaf deciduous forests lie between 30 N and 45 degree N. This region includes Korea, Honshu, Kyushu and Shikoku islands of Japan, and northern China. Maintrees include maple, oak, chestnut, hickory etc. the varieties of deciduous road leaf forest are occur on hill slop. Main trees are maple, oak, chestnut, hickory etc.

(5)Temperate coniferous forests

Temperate coniferous forests extend between 50 degree N and 70 degree N latitudes. The region spread in Russia over Siberia region. Coniferous forests become thinner towards the pole. These forests are also known as Taiga forests. The Siberia belt of Coniferous forests is the biggest belt of the world.

Figure: 3.4 Temperate coniferous forests

Source: Google

(A) Grasslands

These grasslands receive very low rain fall between 50 and 90 centimeters of rain fall annually. These grasslands are the home of many animal species and many animals are rely on these grasslands for food water and shelter. These areas are covered with grass, shrubs and a few trees. In this region temperate grassland are most prevalent which are found between deserts and rainforests. Most of the grasslands are found to the south of Siberia. These grasslands spreading between the Ural River and Caspian Sea in the west to Mongolia and western China. These grasslands are also known as the steppes. These grasslands experience a cold winter and a warm, rainy summer. There are many different size of grasses are found which ranges upto two meters. These grasslands are the good example of dependent food chain.

Figure: 3.4 Grasslands

Source: Google

(B) Desert vegetation

Deserts have very little vegetation. So wind is a active factor for soil erosion in these areas. There are three major hot desert in Asia namely, Thar desert of India and Pakistan, Arabian deserts, and Iranian desert. In this region xerophytic type vegetation is found. The characteristics of xerophytic type vegetation are extreme aridity, high temperature and very high rate of evaporation. In the deserted areas vegetation is very little, sparse and bushy in nature.

Figure 3.5 Desert vegetation

Source: Google

Tundra vegetation

The tundra vegetation is sub-divided in three:

i Desert tundra includes the vegetation which is found on are rock surfaces.

ii Grass tundra which has lichens, mosses, sedges, flowering plants and low bushes.

iii Bush tundra which includes willow, birch and alder.

Figure 3.5 Tundra Vegetation

Source: Google

Deforestation:

It is the permanent destruction of forests. Destruction of forests contributes 6 to 12 % of annual global CO2 emission warming (nature geoscience). As per the figures of world wildlife fund around 36 football field worth of trees lost every minute. Common causes of deforestation are urbanization, demand for housing and furniture, agriculture etc. the effects of deforestation are loss of species, soil erosion, global warming etc.

Figure 3.6 Deforestation

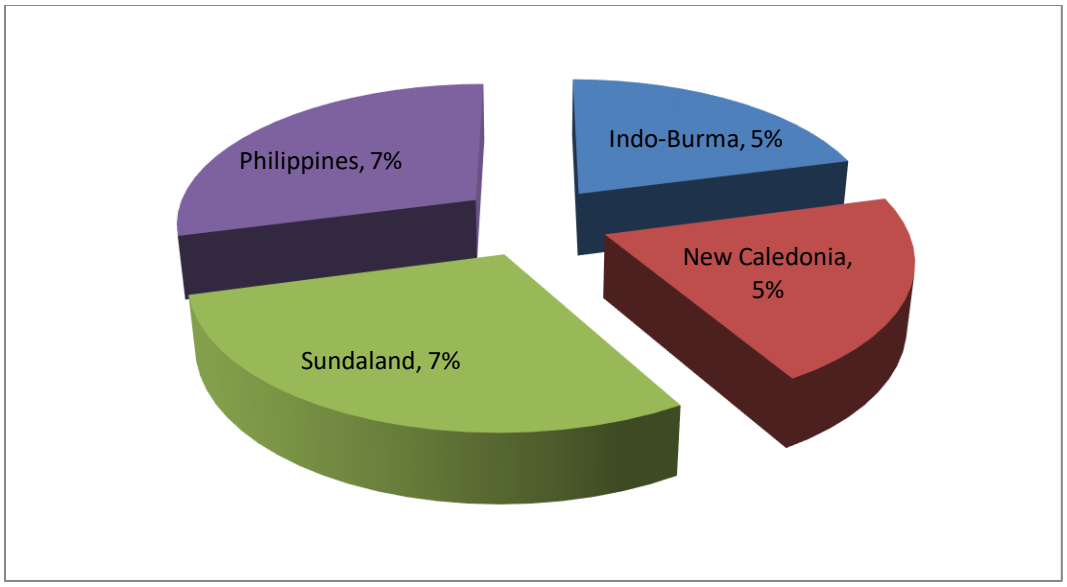
Source: Google

Table: 3.1

Tope four Endangered Forests 2011			
Endangered forest	**Region**	**Remaining habitat**	**Predominate vegetation type**
Indo-Burma	Asia-Pacific	5%	Tropical and subtropical moist broadleaf forests
New Caledonia	Asia-Pacific	5%	Tropical and subtropical moist broadleaf forests
Sundaland	Asia-Pacific	7%	Tropical and subtropical moist broadleaf forests
Philippines	Asia-Pacific	7%	Tropical and subtropical moist broadleaf forests

Source: https://en.wikipedia.org/wiki/Deforestation

Wheel Diagram: 3.1 Tope four Endangered Forests 2011



Forest fire: forest fire is a serious problem. Mostly it occurs in dry seasons. There are two factor responsible for forest fire one is naturally caused ad second is human caused. Natural forest fires are occurs due to lighting, spontaneous combustion of dry fuel.

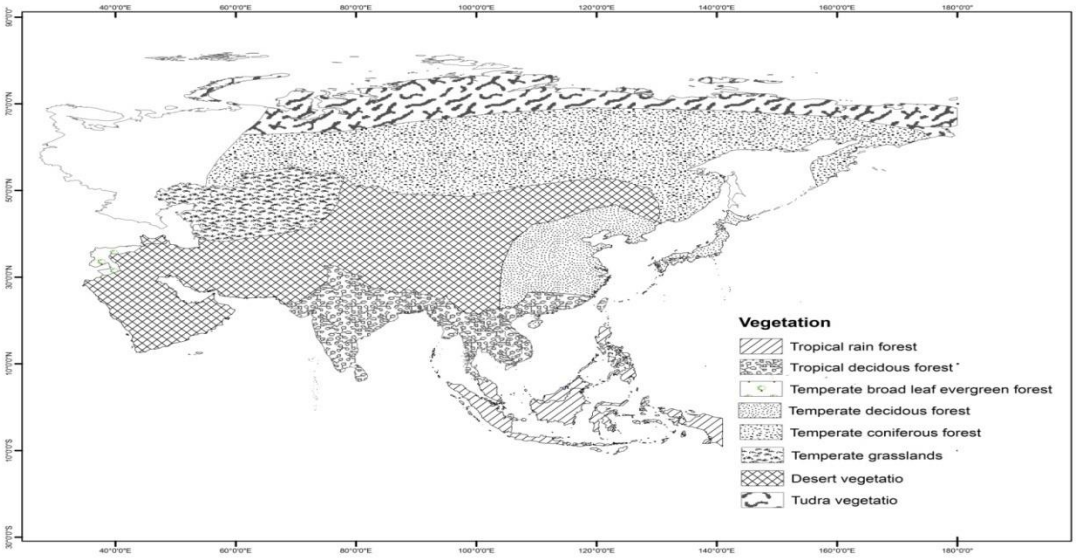
Figure 3.7 Forest fire

Source: Google

Figure 3.8 Forest fire conservation

Source: Google

Figure 3.9 Vegetation of Asia



Source: Google

3.4 TYPES OF SOIL

It is the thin surface-layer on the earth. Soil is one of the most important natural resources. It is the mixture of various types of debris and organic materials. It is the top most layer of the earth's surface. Soil formation is caused due to: (1) rock weathering and (2) pedogensis. In the rock weathering, parent rocks are disintegrate and decomposed through several physical and chemical processes. On the other hand the process of Pedogensis is deals with biological factors. These processes convert the weathered material into soil. In all there are five basic factors that develop soils: (i) parental material, (ii) topography, (iii) climate, biological activity and (v) time. Soils of Asia are classified into three classes: (a) zonal soils, (b) intra-zonal soils and (c) azonal soils.

(A) zonal soils

The most important characteristic of zonal soil is that these soils follow the climatic and vegetation zone of the Asia. So these soils are known as zonal soil. The soil profile of zonal soils is influence by the climate and vegetation. These soils may be sub divided into two parts:(1) pedalfar soils, and (2) pedocal soils.

(1) Pedalfar soils

Pedalfer is made up of three words (ped + al + fer). These soils are rich inaluminumand ferrous (iron) but there is a lack of organic matter in this soil. Most importantpedalfer soils are (a) podzols, (b) podzolic, (c) laterite (d) podzolic-latozolic, and (f) tundra soil.

a. Podzols

These soils are found in the Siberian region. This region is covered y the taiga forests.Podzol soils are infertile in nature. There is a lack of organic matter, calcium and other minerals in this soil.

b. podzolic

In nature these soils contain more humus compare to podzols. The process of padzolization is responsible for the formation of podzolic soils. These soils are spreading south of the podzols and have a moderate to high depth.

c. laterite

These soils are found in equatorial rain forest regions including Malaysia, Indonesia and Philippines where hot and humid climate is found and are framed through the process of laterization. These soils are fertile.

Figure 3.10 Laterite Soil

Source: Google

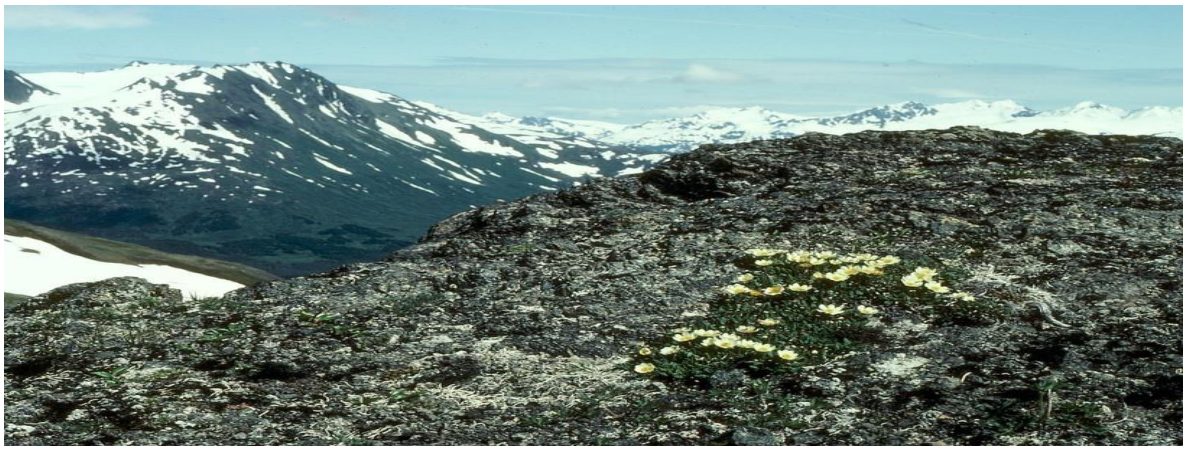
d. Podzolic-latozolic

Podzolic-latozolic soils framed under long grasses in the wetter regions through the process of laterization and podzolization. These soils are extending in peninsular India, Japanese islands and south-eastern China and moderate fertile in nature.

e. Tundra soils

Tundra soils cover the areas of tundra region. These are unfertile in nature. These soils are lacking in minerals, inorganic matter and lack of stratification.

Figure 3.11 Tundra Soil



Source: Google

(2) Pedocal soils

These soils are rich in calcium such as chernozem grass soil, brown steppe soil, desert soils and chestnut soil. Chernozem grass soils are found in the areas having short grasses. These soils are widely found in southern Russia. Soil is rich in organic matter and contains fine particles. This is a black colour soil. On the other hand brown steppe soil found between chernozems in the north and desert soils in the south. These are very low fertile soils. While deserted soils are less fertile. Dry and deserted climate are the characteristics of these soils. On the other side Chestnut soil contains calcium carbonate and framed in the areas having greater aridity and sparse coarse steppe grasses. There is a very little leaching process in the areas having Chestnut soil because rain fall is very low. This soil contains high humus.

(B) Intrazonal soils

The impact of climate and vegetation is very less on Intrazonal soils. By nature these soils are not mature. These soils have developed their own features. These soils are less fertile because of the presence of salinity and alkalinity. There is an inadequate drainage system in these soils. Terra Rosa soil, Regur or black soil and Rendzina soil are the examples of Intrazonal soils.

(C**) Azonal soils**

Transported or azonal soils are developed through the deposition of sediments. These soils are young in nature. Erosion is the most important factor for their formation. Alluvial, loess and glacial soils fall under this category.

Alluvial soils

Alluvial soils are the high fertile soils. These soils are rich in potash but there is a lack of phosphorous in alluvial soils. These soils are varies in colour. The colour of these soils is light gray to ash gray. Alluvial soils are high fertile.

Widespread alluvial soils are found in the areas of river valleys such as Indus-Ganga-Brahmaputra river valley in the northern Indian, Irrawaddy valley in Myanmar, Chao Phraya valley in Thailand, Mekong valley in Vietnam; Hwang Ho, Yangtze and Sikiang valleys in China, Mahanadi, Godavari, Krishna and Kaveri valleys in south India, and the valleys of Tigris and Euphrates (Iraq).

Figure 3.12 Alluvial soils

Source: Google

(i) Loess soils

Loess soils are widely spread in north-west china, and Hwang Ho basin. These soils are high fertile with fine-textured. Deposited soils through the windblown are known as loess. This soil is homogeneous, porous, friable, pale yellow or buff, slightly coherent, typically non-stratified and

often calcareous. grais of loess are agular with small polishing or rounding and composed of crystals of quartz, feldspar, mica and other minerals.

Figure 3.13 Loess soils

Source: Google

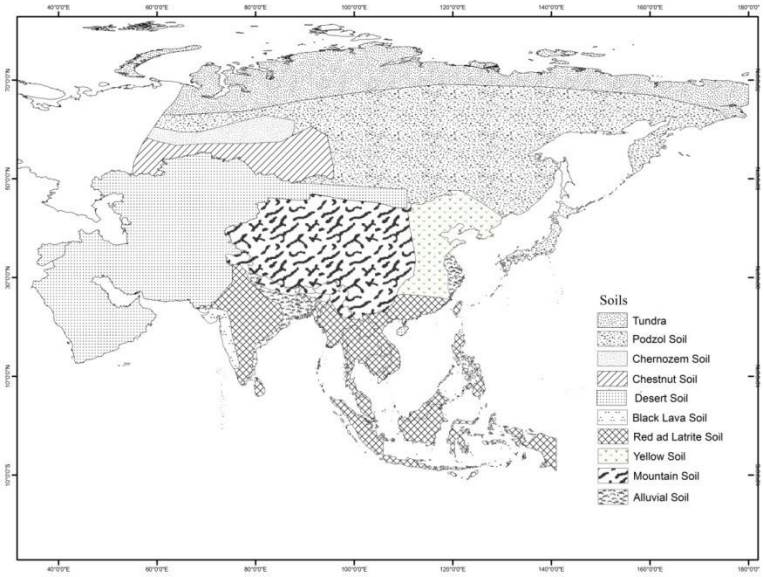
(ii) Glacial soils

Glacial soils are found in the higher latitudes such as Siberia region. There are two type of material for the formation of glacial soils (1) glacial and (2) fluvio glacial such as tills, outwash, sand and gravels etc. these soils are less fertile.

Figure 3.14 Glacial Soils

Source: Google

Figure 3.15: Types of Soils



Source: Google

Soil erosion

It is a serious menace and it has adverse impact on agriculture. Soil erosion is about the removal of thin upper layer of surface by the natural and human forces. There are many factors responsible for soil erosion.

Figure 3.15: Soil erosion

Source: Google

Causes of soil erosion: Some important causes of soil erosion are mention below:

1. River

2. Over grazing
3. Heavy rain
4. Deforestation
5. Slope
6. Air
7. Agriculture

Figure 3.16: Conservation of soil

Source: Google

It includes all measures that help in protecting the soil from erosion and exhaustion. Following method are generally adopted for conservation of soil:
Construction dam
Plantation
Protect from grazing
Change in agriculture patter
I. crop rotation
II. Shifting cultivation
III. Contouring ploughing

3.5 CONCLUSION

Natural vegetation and soils are most important natural resource. Types of forest are closely correlated to soil types. Climate is one of the most important factors which effect the natural vegetation and soil formation. Many different types of vegetation found in Asia region which includes tropical rain forests, tropical deciduous forests, temperate broad leaf evergreen forests, temperate broad leaf deciduous forests, temperate coniferous forests, grasslands, desert vegetation and tundra vegetation. Soils of Asia are classified into three classes' zonal soils- these soils may be sub divided into two parts pedalfar soils, and pedocal soils, intra-zonal soils and azonal soils such as alluvial, loess and glacial soils.

3.6 SUMMARY

The main objectives of the study are to know the relationship between vegetation and soil type, to assess the climatic conditions impact on vegetation types, study importance of soil for vegetation growth, to find out different type of vegetation found in Asia, sub divided the vegetation on the basis of indigenous plant species, to study the different type of characteristics of the natural vegetation of Asia, to see the distribution pattern of natural vegetation of Asia and to see factor responsible for soil formation etc. Vegetation is the most important natural resource for all living organisms. The decreasing trend of vegetation cover is dangers for all living organisms and our environment. Human being takes many things from vegetation such as food, grass, wood, etc. The term vegetation is a wide concept it includes all the association of plant communities of any region that has been left undisturbed over a long period of time. On the other hand plant community is the group of association of plants which grow together in a particular habitat. Types of this natural vegetation are closely related with the soil type, and climatic condition. Both tropical and temperate types of vegetation are found in the Asia region. The types of vegetation found in this region includes Tropical rain forests, tropical deciduous forests, temperate broad leaf evergreen forests, temperate broad leaf deciduous forests, temperate coniferous forests, grasslands, desert vegetation and tundra vegetation. Soil is one of the most important natural resources. It is the mixture of various types of debris and organic materials. It is the top most layer of the earth's surface. Soil formation is caused due to: rock weathering and pedogensis. In the rock weathering, parent rocks are disintegrate and decomposed through several physical and chemical processes. On the other hand the process of Pedogensis is deals with biological factors.

3.7 GLOSSARY

Vegetation: Plants in general, or the plants that are found in a particular area.

Green House Effect: An increase in the amount of carbon dioxide and other gasses in the atmosphere.

Global Warming: A gradual increase in world temperatures coursed by gasses such as carbon dioxide that are collecting in the air around the earth and stopping heat escaping into space.

3.8 *ANSWER TO CHECK YOUR PROGRESS*

Q. 1 what do you understand by natural vegetation how it is different from forests?

Q.2 what is the relationship between vegetation and soil type?

Q.3 what is the difference between vegetation and plant community?

Q.4 How climatic conditions impact the vegetation types?

Q.5 what is the importance of soil for vegetation growth?

Q.6 Describe the importance of natural vegetation?

Q.7 what are the different type of vegetation found in Asia?

Q 8. Classify the vegetation on the basis of indigenous plant species?

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3.11 TERMINAL QUESTIONS

Q. 1 What are the characteristics of the natural vegetation of Asia?

Q.2 Define what is soil?

Q.3 What are the factor responsible for soil formation?

Q.4 Describe the different type of soils found in Asia.

Q.5 Discus the different characteristics of the soils.

Q.6 Write short notes

(i) Importance of natural vegetation

(ii) Temperate coniferous forests

(iii) Importance of soils

BLOCK-2 RESOURCE

UNIT: 4 WATER RESOURCES

4.1 OBJECTIVES

By the end of this unit you will be able to understand the following:

- Different types of drainage systems and other water resources in Asia
- Water availability in Asia
- Water Policy adopted by Asian countries

4.2 INTRODUCTION

Water is central to human existence and is an essential requirement for the survival of humans and ecosystems, and a vital element for human development. Thus, water availability is an issue of major concern globally. Although water is the most widely occurring substance on Earth, it is a well-known fact that only about 2.5 per cent is freshwater while the remainder is salt water. Of the world's 2.5 per cent or 35 million square kilometres volume of freshwater, its biggest portion is locked up in glaciers and permanent snow cover, is frozen in the icecaps or lies in deep underground aquifers. Thus, in reality, only about 1 per cent of the world's freshwater are readily available and accessible for direct human use. This is the water found in lakes, rivers, reservoirs and those underground sources that are shallow enough to be extracted. However, while water resources are renewable, there are huge differences in availability in different parts of the world. There are also wide variations in seasonal and annual precipitation in many places, with arid regions having evaporation that is greater than the amount of precipitation. For these reasons, the availability of water worldwide may fluctuate, causing some areas to flood while other parts suffer drought.

The quantity of freshwater on earth is limited, with no alternative to water availability on Earth. While the quantity of freshwater does not change on an absolute basis, the amount available to each individual does change, in accordance with the growth of the human population and other factors. With increasing per capita use and growing population, the percentage of appropriated water is also increasing. Together with spatial and temporal variations in available water, the consequence is that water for all uses is becoming scarce and may lead to a water crisis.

Asia is the largest continent in the world. It covers an area of 4,45,79,000 square kilometres and it is the most populated continent. Asia is situated in the northern hemisphere and there are 48 countries in this continent. Asia is surrounded by the Arctic Ocean on North, the Indian Ocean on South, Bering Strait and the Pacific Ocean on the East, Red and Mediterranean Sea on the South West. It is widely accepted that water availability is an issue of major concern in Asia and the rest of the world. Within Asia, people, agriculture and industry are confronted with problems ranging from water shortage to conflict of uses. Freshwater resources are unequally distributed on Earth, with a sharp contrast in terms of water availability and consumption. On average,

world water availability is about 7600 cubic meters per capita. However, Asia not only has the smallest continental average at 4000 cubic meters per capita, but the amount of available water keeps declining.

Asia is the home to some of the largest drainage networks in the world. A big chunk of it has its source from the high mountainous system of the continent from where it drains the wide fertile plains. Besides, Asia is also the home to some of the largest freshwater and salt-water lakes. In the present lesson, we will learn about various water resources as well as the water policy adopted in the biggest continent of the world.

4.3 WATER RESOURCES OF ASIA

The water resources of Asia can be categorized in the form of rivers, lakes and groundwater.

RIVERS

The river as a source of drainage is very important for a big continent like Asia. The rivers as a tool of development are very significant water resource for any country or continent as a whole.

The drainage system of Asia shows ancient as well as new type of drainage systems. The rivers originating from the rigid and old rock systems of North viz Ob, Yenisei, Lena, Indigirka and its tributaries are one of the most ancient rivers of Asia. While the rivers originating from the Himalayas viz. Hwang Ho, Yangtze Kiang, Ganges, Indus, Brahmaputra, Irrawaddy etc are the relatively younger rivers. It is interesting to note that the old river systems like one flowing in South India with rivers like Godavari, Krishna, Kaveri, Narmada and Tapti are continuously deepening there valleys, while the Himalayan river system are still depositing the silt to its valleys.

The huge continent of Asia on the basis of its drainage can be divided into the following:

1. Pacific Ocean Drainage
2. Indian Ocean Drainage
3. Arctic Ocean Drainage
4. Inland Drainage
5. Mediterranean Sea Drainage

1. Pacific Ocean Drainage

It is smaller than other drainage systems in Asia. This drainage system includes all the rivers flowing from East Asia and Indo-China peninsula. The rivers in this drainage system form deltas and estuaries in Pacific Ocean. The rivers in this drainage generally originate from the great mountain ranges of Central Asia flowing east to drain into the Pacific Ocean. The area drained by this drainage system is relatively less. The main rivers of Pacific Ocean Drainage

System are Amur, Hwang Ho, Yangtze Kiang, Si Kiang, Mekong, Menam, Red etc. Among these rivers the first four of them originate from the lakes of mountains and plateaus of Central Asia. The other major rivers are Ussuri and Sungari as the tributaries of Amur, and Wei Ho and Fen Ho as the tributaries of Hwang Ho etc. There are many types of drainage patterns that can be seen, like the rectangular drainage of Hwang Ho River near Qinghai Mountains and Ordos Plateau. Similarly, Yangtze Kiang with its tributaries forms dendritic type of drainage pattern. It also performs 'river capture' of Si Kiang River.

The rivers in this region are highly valuable for irrigation, agriculture and transport. These rivers have formed fertile plains and deltas. The great northern plains of China are made by Hwang Ho River. The Hwang Ho is also called 'the sorrow of China' because of the fierce floods it brings to the country every year. Similarly the longest river of China and Asia, the Yangtze Kiang is also very important. The most populous part of China is found in the delta of river Yangtze Kiang.

2. Indian Ocean Drainage

The Indian Ocean Drainage extends from the origins of Tigris, Euphrates River in the west in Iraq to the Rajang River in east in Malaysia. The main rivers of this drainage are Tigris, Euphrates, Indus, Ganga and Brahmaputra. The other important rivers are Irrawaddy, Salween, Chindwin, Godavari, Narmada, Krishna, Cauvery etc. An important feature of the drainage system is that many examples of river capture are found here. The biggest examples are Irrawaddy and Indus river system. Many examples of river capture still appear in the Himalayas. The rivers flowing over the southern peninsular plateau of India are engaged in deepening their valleys, rather than expanding the valleys. Thus, the drainage pattern of these rivers is in the form of Antecedent Drainage Pattern. The rivers flowing in this area have more importance from the point of view of agriculture and irrigation. The Ganges and Indus plains are the most famous and most fertile plains of Asia. The Irrawaddy River of Myanmar has provided a better economic life to this country. The rivers found in this region have been helpful in alleviating the problems of water scarcity of the region to a large extent. The rivers flowing in this region are generally filled with water throughout the year.

3. Arctic Ocean Drainage

This is the largest drainage located in the northern part of the continent of Asia. Rivers in this region originate from the central highlands of Asia, flowing into the vast northern plains of Asia and fall into the Arctic Ocean in the north. Due to the frozen ice for part of the year in Arctic Ocean, the rivers of this region spread to the coast from both its side. This results in the formation many wide marshes near the coast. The rivers in this region have no economic significance due to the marshy part and snow in winter. These rivers don't have much

commercial significance because the Arctic Ocean remains frozen with snow for the greater part of the year, so there are no major ports here. The three major rivers of this region- Obe, Yenisei and Lena are among the longest rivers in world. The other important rivers of the region are Indigirka, Kolyma, and Yana etc. The drainage pattern of these rivers is dendritic.

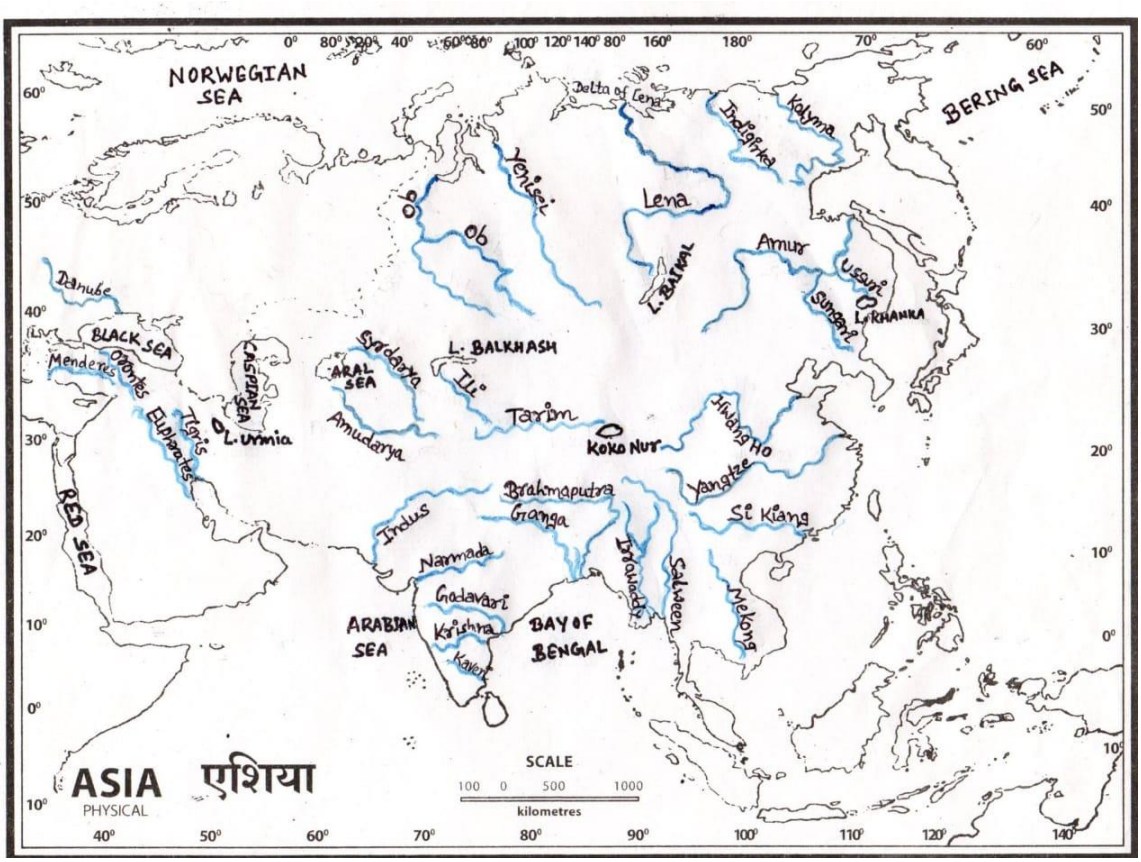
4. Inland Drainage

The inland drainage of Asia extends from Anatolia in the west to the Manchuria in the east. The existence of rivers found in the region depends upon the amount of rain and melting of snow. When these rivers get enough water due to rains or melting of snow, the rivers flow into the lakes or the deep sea, otherwise due to less water, these rivers gets lost into the dry sandy parts of Central Asia. The economic importance of these rivers are very less. The major rivers of this region are Amu Darya and Sir Darya that flows to the Aral Sea. The other rivers of the drainage are Ili, Chu, Tarim, Khotan, etc. that drains into Balkash and Lop Nur lakes. This drainage system is more important for its lakes rather than the rivers.

5. Mediterranean Sea Drainage

In the western part of Asia there lies Mediterranean Sea. The sea drains the rivers from south-western part of Asia. This drainage is not so widespread and only includes the rivers flowing in Turkey, Lebanon, Syria, Israel, Jordan and Cyprus. This drainage region does not have any significant major river. Only small rivers drain from here to the Mediterranean Sea that does not have any economic importance. Manisa and Menderes rivers originating from Turkey, and Orontes River originating from Syria are the major rivers of this drainage.

Figure 4.1: Drainage System of Asia



Source: Author

Lakes

Numerous lakes in Asia vary greatly in size and origin. The largest of them, the Caspian and Aral seas, are the remains of the largest seas. The size of the Caspian Sea fluctuated, and the Aral Sea decreased, mainly because its tributaries, Amu Darya and Syr Darya, were mainly used for irrigation purposes. Lakes Baikal, Issyk-Köl and Hovsgöl (Hubsugul), the Dead Sea and others are found in tectonic depressions. In addition, the basins of the lakes Van, Sevan and Urmia are surrounded by lava, and Lake Taurus was supplanted by the ancient ice age. Several lakes formed as a result of landslides (Lake Sarez in the Pamirs), karst processes (western Taurus lakes in Turkey) or the formation of lava dams (Lake Jingpo in northeastern China and several lakes in the Kuril Islands). In the volcanic regions of the islands of East Asia, the Philippines and the Malay Archipelago, crater lakes and calderas formed. The subarctic has a particularly large number of lakes; In addition to the lakes formed as a result of permafrost melting and subsidence, there are also ancient moraine glacial lakes. Many laconic lakes are located along the lower coast.

Lakes in inland watersheds such as Coco Nor, Lake Ace and others are usually saline. Lake Balkhash has fresh water in the west and brackish water in the east. The lakes through which rivers flow are freshwater and regulate the flow of rivers that flow or flow into them. Vivid examples are Lake Baikal, connected with the Angara River; Lake Khanka (Sungacha and Ussuri rivers); Dongting Lake and Poyang Lake (Yangtze River); and Tonle Sap (Mekong). Large reservoirs were also created through the construction of hydropower plants.

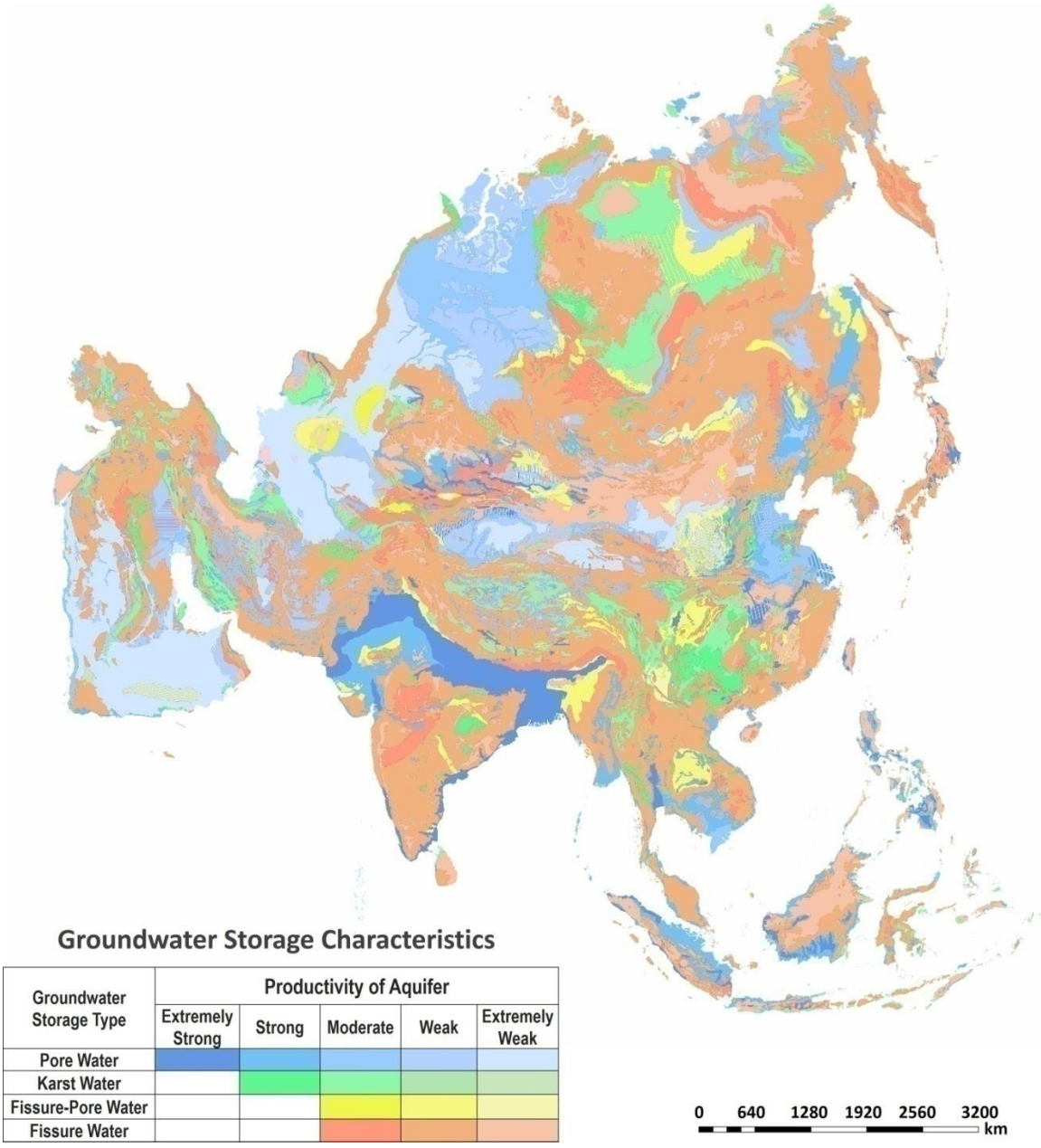
Groundwater

Groundwater resources play an essential role in supporting Asia's water needs. Groundwater is widely used for irrigation of crops, food production, industry and domestic use in urban and rural communities, which account for about 25% of total water consumption in Asia. Groundwater abstraction in Asia accounts for the majority (72%) of the global cost of use, caused by intensive agricultural activities and explosive population growth in the region, including Bangladesh, China, India, Iran and Pakistan. Groundwater also provides valuable base flow, providing rivers, lakes, and wetlands with water, thereby serving as an important resource for maintaining the diverse ecosystems that depend on it. In addition to its environmental function, groundwater has important socio-economic consequences. For example, it is estimated that groundwater irrigation in Asia brings $ 10-30 billion annually to its economy.

The groundwater storage may be in the form of porous water, karst water in the limestone region, fractured porous water or fractured water. A detailed map showing the type and productivity of the aquifer in Asia is shown in Figure 4.2. Asia accounts for 72% of global groundwater use. Thus, eight out of ten countries with the highest level of groundwater use are in Asia; India, China, Nepal, Bangladesh and Pakistan make up only half of the total groundwater use in the world, which is mainly due to the large population and intensive agricultural activity. Many countries in West and Central Asia rely heavily on groundwater for water supply. In Bangladesh and Mongolia, about 80% of the total water intake comes from groundwater. Several West Asian countries without permanent rivers (Saudi Arabia, the United Arab Emirates, Oman, Kuwait, Bahrain and Qatar) depend on groundwater for almost 100% of their renewable water source.

In arid regions, groundwater (groundwater) is often the only source of water. Large clusters are known to exist in artesian basins and below the immersion plains at the foot of the mountains; these basins are connected with the vast oases of Central Asia, Kashgar and many other regions.

Figure 4.2 Groundwater Storage Characteristics in Asia



Source: Google

4.4 WATER AVAILABILITY OF ASIA

Water availability is becoming an increasingly important issue for Asia. With increasing water use in the region, water demand is also increasing significantly. Many Asian countries are

beginning to experience moderate or severe water shortages due to the simultaneous effects of various factors, including agricultural growth, population growth and environmental pollution. Global phenomena, such as climate change, are also contributing to water access issues. That is why it is important that several Asian countries present sound water policies in such scenarios.

In recent years, evidence has shown that unstable weather conditions are increasingly affecting water, as has already happened in countries such as Indonesia and China, which suffer from drought and inevitable food shortages. Climate change and population growth have also affected water availability in South Asia, such as India and Bangladesh. Other Asian countries, such as Singapore, experience water problems in different ways, as Singapore has limited water availability and are highly dependent on Malaysia for water supply.

The main problem is that the constant reduction and deterioration of available fresh water not only leads to national problems in Asian countries, but can cause possible interstate disputes and international instability.

Before discussing Asian water policy, it is important to understand the current availability of water in the region. In determining the problem of water availability, it is necessary to determine what is meant by “accessibility”. In general, the presence of water can be called the physical presence of adequate water supplies. More broadly, the availability of water also includes problems, ranging from people's ability to access clean water to factors that influence that access. In this chapter, the problems of water availability in Asia are examined from a broader perspective, highlighting the factors affecting the availability of water, as well as factors related to its availability.

In terms of volume, the availability of fresh water of less than 1000 cubic meters per capita per year indicates that the country is facing water shortages. For Asia, this problem is already occurring in countries such as Singapore, India and Pakistan. In India in particular, the annual amount of available fresh water is approximately 2,000 cubic meters per person per year, and it is expected that this amount will decrease in the next decade due to an increase in population and other factors. Previous studies have shown that by 2025, India will reach a water shortage when accessibility drops below 1,000 cubic meters, which requires an urgent review of water policies before the problem becomes unmanageable. Similarly, Pakistan is also rapidly becoming a country that is afraid of water, as the gap between water demand and supply is widening, along with prolonged drought. Thus, future climate change may affect the availability of water resources in Pakistan, causing additional water scarcity.

In Southeast Asia, Thailand has an average annual rainfall of 1700 millimeters. Depending on geographical features, Thailand can be hydrologically divided into 25 river basins. However, of the total rainwater in all river basins in Thailand, 75 percent of this water is lost through evaporation and infiltration. With a population of over 60 million, water availability in Thailand, which is about 3,000 cubic meters, is statistically adequate. However, as in many

Asian countries, factors such as population growth and economic, agricultural, and industrial expansion pose a threat to water quality and affect Thailand's water availability.

For Japan, in terms of water availability, this country off the east coast of Asia in the North Pacific has heavy rainfall due to regular monsoons. In general, Japan's available water resources per capita are approximately 3,000 cubic meters per year. However, spatial and temporal differences in rainfall, marked topographic differences and small river basins have led Japan to experience frequent water shortages. Similarly, Korea can also be considered a water-scarce country with an annual rainfall per capita of more than 2500 cubic meters per year. There are many factors that contribute to water access problems in Korea. For example, in Korea, about 70 percent of the annual precipitation falls in the summer, which leads to flooding in the summer and drought in the spring. In addition, population growth, improved living standards, urbanization and industrialization mean that water demand is increasing, leading to a possible shortage of water.

Compared to many other Asian countries, Singapore is faced with water availability problems of a different nature. Singapore is a small city-state at the tip of the Malaysian Peninsula with an area of about 700 square kilometers and a population of about 4.4 million people. This makes it one of the most populous nations in the world with a population density of 6,050 people per square kilometer. One of Singapore’s main tasks is to provide the population with clean water, which currently consumes about 1.36 billion liters of water per day. Singapore is considered a country with a lack of water, not because of the lack of rain, but because of the limited number of land where you can store rain.

The challenge Singapore faces in terms of fresh water contrasts with that of other countries in South Asia. For these countries, the availability of water is due to monsoons. Therefore, although there may be an excess of water in all parts of South Asia, there are serious imbalances, since most of this water is generated by the monsoon and is not used at sea.

Even in Asia, water availability varies. For example, Indonesia has a lot of fresh water, which averages 15,500 cubic meters per year per capita. However, such an abundance of fresh water is unevenly distributed in different parts of this archipelago. In Indonesia, the availability of fresh water may be associated with issues such as population growth, as well as industrialization, urbanization, overuse of groundwater and inadequate water supply in some regions. These problems have led to a decrease in water quality and a decrease in reliable flow, which over time reduces the availability of water, which ultimately leads to a shortage of water.

Vietnam also faces similar challenges in terms of water availability. Given that most of Vietnam’s territory of 332,000 square kilometers consists of hills and mountains, these formations have led to the formation of a very complex network of rivers. More than 60 percent of the river water in Vietnam is concentrated in the Ku Long Delta in the Mekong Basin, while the rest of the rivers serve the majority of the population of Vietnam.

Although constant rains in Vietnam allow abundant water supplies, the uneven distribution of water has affected the availability of water in different parts of this country. For example, places such as mountains may be water scarce, especially during the dry season. While areas that have numerous rivers, such as plains, can flood during the rainy season. As in many other Asian countries, an increase in Vietnam's population means an increase in water demand and could inevitably lead to a water crisis.

As for China, water problems are perhaps the biggest threat to human health and the environment. In terms of water supply, per capita water availability in China is only a quarter of the global average, and the rate is lower in northern China, where per capita water availability is about 500 cubic meters. As in India, the water resources in China are vast, with the existence of more than 50,000 rivers with a total length of 226,800 kilometers. However, as a developing country with continued population growth, annual water demand in China continues to grow, and in some areas of China there is a significant shortage of water resources due to the use of fresh water resources that have reached the limits of existing sustainable potential.

Factors Affecting Water Availability:

As already mentioned, the demand and availability of water is created and depends on various driving forces. These include agricultural growth, persistent water pollution, climate change and population growth. These factors are discussed below:

(1) Agriculture

In many Asian countries, agricultural water use accounts for nearly 90 percent of total water use. While about 40 percent of agricultural land in Asia is irrigated, helping to produce about 70 percent of food, the main problem is the inefficient use of water in agriculture. Since agriculture is heavily dependent on an adequate supply of fresh water, it is disturbing that food production is severely limited due to a lack of fresh water. For example, China needs to ensure adequate water supply in the future, given that about 70 percent of the additional food supply to this country over the next 20-30 years is expected to come from irrigated land. In the countries of South Asia, their agriculture is very intensively irrigated; therefore, water needs for the agricultural sector are also highest.

In Thailand, it is predicted that the current water demand for irrigated areas and other purposes will increase, with the result that this country will face serious supply constraints. Given that more than 50 percent of the Thai population is farmers, adequate water supply for agriculture is critical. In the Philippines, agriculture is considered the largest consumer of water. Irrigation accounts for most of the total water consumption by agriculture, and most of the irrigated land is used for rice cultivation.

The increased demand for food, especially rice, means that the Philippines must make great efforts to increase the total irrigation area. In the Philippines, water shortages caused by various factors, including technical and institutional weaknesses have become an obstacle for this country, especially in terms of meeting the growing demand for rice. Similarly, irrigation water is one of the most important requirements in Korea because of the importance of rice cultivation in this country. It is reported that as of 2000, nearly 50 percent of Korea's total water resources were used for agriculture, and most of this goes to rice farming. However, one of the biggest threats to ensure that there is enough water for agricultural activities is water pollution. The main sources of pollution for irrigation are domestic wastewater, wastewater from livestock and other non-point sources such as land use, chemicals and agricultural drainage.

(2) Environmental pollution

Environmental pollution is an important factor that can affect the availability of water for a particular country. Ineffective control over the discharge of pollutants into water, including industrial wastewater, can lead to pollution of water resources and, therefore, limit the amount of fresh water available. In many parts of Asia, the presence of a large number of rivers alone does not guarantee sufficient fresh water, especially when factors such as water pollution put pressure on water availability.

In Thailand, the main contributing factors to water pollution are the overuse of fertilizers and pesticides, urban wastewater and industrial waste. Large rivers in Thailand, such as the Chao Phraya, suffer from pollution due to the discharge of pollutants from industrial, agricultural and human settlements. In Indonesia, one of the most important river basins, Citarum, continues to face a serious pollution threat. This catchment area provides water to millions of people in Jakarta, irrigates rice farms in Indonesia, and is the source of water for its factories. However, over the past 20 years, rapid urbanization and industrial growth have led to the discharge of untreated domestic wastewater, solid waste and industrial effluents into the river, making it one of the most polluted rivers in Indonesia.

For the Philippines, although this country is endowed with abundant water resources, water pollution and pollution have reduced the amount of water available. It is reported that about 40 major rivers of this country are polluted, and rivers in the metropolitan area of Manila, such as Marikin and Pasig, are considered biologically dead. While in South Asia, overall, increasing water scarcity and declining water quality due to pollution over the past decades are factors that contribute to water scarcity.

In China, declining water supplies are not only affected by significant pollutants, but also insufficient for the country's fast-growing economy and its vast population. Over the past 20 years, water demand in China has increased in the urban, domestic, and industrial sectors. This problem can make the entire water resource useless, increasing the water shortage in China.

Water pollution also puts pressure on water availability even in water-rich Asian countries such as Malaysia today. For this country, despite the availability of abundant water resources for supply purposes, pollution continues to affect the availability of water and inevitably affects the amount of fresh water available.

India also faces the same quality problem of its water resources. In India, water comes from rivers, reservoirs, lakes, wetlands, mangroves and ponds. However, despite the fact that various types of freshwater bodies of water are widespread throughout the subcontinent, the presence of drinking water suggests a bias in the distribution of actual stock. This problem is further compounded by India's high population density in catchment areas, which has caused pollution in river basins, especially in larger ones such as the Ganges and Brahmaputra. Therefore, in India, despite the presence of large perennial rivers, poor water quality in the rivers limits the use of these water sources.

(3) Climate Change

When a region experiences a change in average climate, it represents climate change. A common example - climate change due to the enhanced greenhouse effect today is becoming one of the most acute environmental problems. The threat of global warming is real, and the effects of climate change are alarming, even in terms of water availability.

In Asia, in particular, the effects of climate change in the form of higher temperatures, more variable precipitation and more extreme weather events threaten the water supply to millions of people living near river basins. Freshwater availability is projected to decline in many parts of the Asian river basins, including in central, southern, eastern and Southeast Asia due to climate change. This problem, along with the emerging problems of population growth and growing demand for water, could adversely affect more than a billion people by the 2050s.

At present, everyone agrees that climate change can increase the incidence of extreme events such as droughts and floods. It can be noted that even relatively small climatic changes can cause serious problems with water resources, especially in the arid and semi-arid areas of India and Pakistan, as well as in vulnerable flood areas in India and Bangladesh. In other places in Asia, floods are due to the rapid decline of glaciers due to elevated temperatures and increased seasonal variability of precipitation.

For example, previously glacial melt water from the Himalayan glaciers held large rivers within the multi-year Indian subcontinent year-round. However, climate change has intensified the melting of glaciers much faster than their accumulation. This will lead to an increase in summer flows in some river systems over the next several decades, and then to a decrease in runoff as glaciers disappear, which ultimately affects water availability.

For Asia, climate change can also have a serious adverse effect on agriculture. Agriculture, which depends on the need for irrigation water, is also sensitive to climate change, as it can change the need and time of irrigation. Climate change, which changes precipitation and evaporation and changes the nature of precipitation, can adversely affect the availability of water and, consequently, agricultural production. Inevitably, given that water is the most vulnerable to climate change, the droughts and floods that will accompany climate change will have devastating consequences for the agricultural sector, especially for food production.

In Asian regions with a dry tropical or subtropical climate, their erratic precipitation, which is too limited to allow full harvesting during the short wet season, makes these regions vulnerable to poor yields. As a result of climate change, rice crops in many parts of Asia suffer from drought, saltwater intrusion, floods and other water shortage problems. For example, in 2008, the Nargis cyclone devastated the Irrawaddy Delta in Myanmar, transferring salinization to land, resulting in Myanmar losing 6 percent of its rice crop. Similarly, in Vietnam, the typhoon season lasts longer, and storms intensify, flooding large areas of agriculture, flooding low fields with salt water and destroying crops. The global climate is changing and creating a new level of uncertainty in the planning and management of water resources. Therefore, it is possible that competition for water between agriculture and urban and industrial users will become more expensive, especially when drier conditions become more extensive due to stronger heat waves.

(4) Population Growth

Extremely fast population growth, which depends on a limited amount of fresh water, is another factor affecting water availability. Over the past ten years in Asia, gross water demand has increased by almost two and a half time. Recalling this past trend of global water withdrawal over the next 30 years, total water withdrawal may exceed the limit of what can be made available through water and development.

Asia currently represents just over 60% of the world's population, and South Asia is one of the most densely populated areas in the world. For example, the population of Pakistan has already reached 20 million rupees and continues to grow at a rate of 2% per year. Due to this continuous growth, water demand for all uses can increase and by 2025 will reach 10% of the total available water resources.

Similarly, in India, as the population grows, there will also be a corresponding increase in water demand. Demand for domestic water in India is likely to increase from 6.6% to 7% today in 2050, while the availability of water per capita in New Delhi is close to a critical level. Southeast Asia is less populated than South Asia, but it also has crowded areas, especially Java, part of the Philippines, and river deltas such as Red, Mekong, Chao Phraya and Irrawaddy.

Urbanization and an increasingly concentrated population in urban areas can further affect water availability. While the rural population of Asia is estimated to remain nearly constant until 2025, the urban population is likely to increase by 60 percent.

4.5 WATER POLICY OF ASIA

In recent years, water policy reform can already be seen in many Asian countries as a way to solve the problem of reducing the availability of water per capita and expanding the access and use of available fresh water.

Water policy is increasingly oriented towards an integrated approach to water resources management. Emphasis is also placed on factors such as demand management measures, for example, efficient use of water, conservation and protection, institutional mechanisms, legal and regulatory conditions.

For Asia and other countries, policies that focus on massive changes in the legal and institutional configuration are considered one of the most appropriate measures for water reform. In Japan, for example, decades of introducing advanced water laws have helped that country achieve its political goal of protecting water resources and water supply. As early as 1896, surface waters in Japan were regulated by the Rivers Act. By the 1950s, several laws had been adopted aimed at protecting water resources. These include the Sanitary Works Act and the Wastewater Act, which were adopted to establish quality standards for tap water and discharge standards. More water-related laws were passed in the 1960s, such as the Water Promotion Act, which was enacted to ensure the full development of water resources and the efficient use of water resources, especially in response to the rapid development of industry and an increase in urban population. Subsequently, the Basic Law on the Control of Environmental Pollution was adopted, which became the central legislation in the field of environmental regulation in Japan. This law addresses issues of public harm, including water pollution, and establishes the responsibilities and obligations of individuals, government and individuals in environmental matters. The law also introduced environmental standards that must be followed to maintain a healthy life and environment.

For some Asian countries, national water management policies will include a strict water pollution law. Singapore is a good example when the abatement law is effectively applied in matters related to water resources and water supply.

Another country that relies on legal norms to solve problems with water availability is Korea. As noted above, the main source of water pollution in Korea is the discharge of non-point pollutants, which is the result of increased economic activity and land use. Korea faces difficulties in developing measures for the quantitative management of non-point pollution, given that this type of pollution does not come from a single source and therefore is not easy to control or detect. For this reason, a major reform has been carried out in Korea by amending the 1990 Water Conservation Act. This law was completely amended in 2005 to present a basic ideology and

policy direction. to preserve water quality and improve the law as a framework law on the preservation of water quality. It also establishes a legal framework for the protection of water resources through the control of inaccurate sources of pollution.

In Asia, guidelines for access to water can take many forms. One of them concerns water rights. Perhaps, as water availability becomes more and more limited, and access becomes more controversial, it is necessary that better rules are needed to coordinate water use and resolve conflicts. The lack of clearly defined and reliable water rights is already creating problems in addition to increasing the vulnerability of poor, politically and economically weak water users. Thus, for part of Asia, the right to water is seen as an important policy not only to ensure access to water, but also to ensure better management of water supply. From a holistic point of view, there are several aspects that can be derived from water rights. These include the right to own water, the human right to water, and the environmental right to water. The experience of Asia has shown that water rights are supported in various ways and are realized in various ways. In the context of human rights, it is important to observe how the principles of water rights are emerging in some Asian countries. In general, the right to drinking water can be considered a human right, which some societies consider vital for human life and, therefore, must be guaranteed by the highest law of the country. However, not all countries guarantee such rights under their constitutions, as is evident in Malaysia, where environmental rights, including the right to clean water, are not clearly described in their constitution. A clear comparison can be made with the Indian Constitution, which is directly trying to protect the right to clean water. The Indian Constitution is one of the few in the world that contains specific provisions in this regard.

In China, water availability is dictated by factors such as geography, topography, and monsoon climate. In order to develop a sustainable water resources management system, it is necessary to reform water resources management and significantly introduce a system of water rights. China has begun updating its water management system based on the theory of water rights, with a special quota system that will be created to clarify water rights in different regions and sectors.

Measures related to water rights were later incorporated into the Water Act of 2002, which is the main law regarding water management in China, and the main law regarding water rights. This law provides a comprehensive framework for water planning and the distribution of water rights. It covers the issues of water ownership, the collective right to use water, the right to extract water, water resources planning, development and use of water resources, water conservation, and distribution of water resources, use and saving of water, dispute resolution and administrative duties. Indeed, for China, the decision to develop an integrated system of water rights should not be underestimated. However, given that water rights as a property right are a complex problem, developing one of China's forms of ownership over water will be a long-term process.

In addition to China, Indonesia is another country that has recently integrated water rights provisions in its water legislation. Like China, in the past Indonesia's water development strategies tended to emphasize the supply side. Therefore, the current strategy for the development and management of water resources completely changes this emphasis, focusing on the demand side when creating a system of water use rights. Indonesia's attempts to change the paradigm in water management can be found as a result of the adoption of the Water Act 2004. This new law, which replaces the 1974 law, was formulated to develop and implement integrated management principles. as part of water policy reform. Perhaps the creation of water use rights allows copyright holders to satisfy all basic water needs and helps to avoid conflicts related to water use. This is based on the fact that each right holder gains an understanding of the limits of his rights and, in turn, must also understand the distinction between these rights so that he can effectively use water, making more water available so that others use it. These rights serve as the basis for the accounting of resources, which is necessary both for long-term planning and for making decisions on the real-time distribution of water in the basin. Water rights currently play an important role in Indonesia's water policy reforms. It can be argued that, in the context of water availability, more developed Asian countries can be used as a guideline for better legal and institutional structures for water resources management. Although it may be unfair or impossible to compare the achievements of one country with the achievements of another, it is still important to emphasize the experience of countries such as Singapore in this matter.

Singapore is a good example of water supply, wastewater management and general watershed management. Singapore, unlike neighboring countries such as Malaysia and Indonesia, is small in size with a high density of cities, avoiding the environmental problems usually associated with larger countries engaged in the extraction of natural resources. However, due to water shortages, Singapore's dependence on water imports from Malaysia makes water a national security problem for this republic. Due to this unresolved water problem and reduced dependence on external sources, Singapore has developed and implemented a new policy plan. This plan aims to ensure greater water security and self-sufficiency, as well as effective supply and demand management practices. The plan includes the development and implementation of new water-related policies, major investments in desalination and intensive reuse of wastewater, watershed management and other similar activities. In 2001, to ensure centralized management and integrated water management policies, the responsibility for sewage and sewage was transferred to the Singapore Public Services Council.

Although individual Asian countries may have taken several national initiatives to address water issues, it is also important to mention the efforts made by some of these countries at the regional level, especially in ASEAN. The Association of Southeast Asian Nations or ASEAN consists of several Southeast Asian member states. In the region, as a rule, similar environmental and water problems exist (possibly, with the exception of Singapore).

This has led to the growth of ASEAN environmental instruments to meet the growing demand for good quality water and to protect water resources, which are in the form of mutual agreement and cooperation. The ASEAN Environmental Strategic Action Plan has several strategies. These include a regional framework for the conservation of biological diversity and the sustainable use of its components; promoting the protection and management of coastal areas and marine resources; and promoting the environmentally sound management of toxic chemicals and hazardous wastes and the control of transboundary movements of hazardous wastes. Despite discussions and criticisms regarding the effectiveness of ASEAN environmental tools in resolving environmental issues, it is worth emphasizing some of his efforts to manage water resources. The ASEAN water vision was originally defined in the ASEAN Long-Term Water Strategic Plan, initiated by the ASEAN Water Management Task Force. This working group was created in 2002 and envisages areas of cooperation, which include the creation of networks and joint actions in the field of integrated water resources management; exchange of relevant information, experience, technologies and knowledge on water resources management; and training, education and awareness. It is generally recognized that ASEAN needs to integrate the management of sectors and issues related to water, including water supply, and that increasing variability is due to human intervention and climate change. ASEAN has a long way to go before these efforts bring real results, but it is important that the ASEAN countries that share many of the common challenges and principles related to water management continue to set goals and regional strategies that produce the expected results.

4.6 CONCLUSION

The chapter started with the discussion of different type of water resources of Asia in the form of river systems, lakes and underground water. In this part we learned about the different type of drainage systems that exist in the Asia. Further we discussed the issue of water availability and various factors affecting the water availability in Asia. Then we focused our study about the water policy of different Asian countries and organizations.

4.7 SUMMARY

In this chapter, the water resources distribution in the form of drainage all across the Asia is examined. The Asia is very resourceful when it comes to the sheer amount of drainage networks in it, so we have categorized them into various drainage systems. Besides the water resources are available in the form of fresh water lakes and underground water that is also placed into consideration. Then it is important to see the availability of water in the countries of Asia to get an idea of water scarce and water rich regions within the continent. The availability of water depends on various factors; there are also cases where the regions with rich source of fresh water are also affected by water scarcity due to poor management and problems like water pollution. Then there are factors like population pressure and climate change that are effective in limiting the water availability. The problem of scarcity or mismanagement of water resources can be

controlled by an effective water policy that is also examined in the chapter. The role of various countries and the associations within the continent is examined and analysed to look at the solution of the current problem.

4.8 GLOSSARY

Annual Rainfall: The average amount of total rain that a place generally receives.
Antecedent Drainage: Stream that maintains its original course and pattern despite the changes in underlying rock topography.
ASEAN: Association of South East Asian Nation
Drainage System: The patterns formed by the streams, rivers, and lakes in a particular drainage basin.
Dendritic System: Having a branched form of river drainage resembling a tree.
Lake An area filled with water, localized in a basin, surrounded by land, apart from any river or other outlet that serves to feed or drain the lake.
Nargis Cyclone: An extremely destructive and deadly tropical cyclone that caused the worst natural disaster in the recorded history of Myanmar during early May 2008.
Right holder: A person or institution who owns the intellectual property rights or a person acting on his behalf within the scope of authorities assigned.
River Capture: The natural diversion of the headwaters of one stream into the channel of another, typically resulting from rapid headward erosion by the latter stream.
Salinization: The increase of salt concentration in water, caused by dissolved salt in water supply
Transboundary: Having effect across boundaries.

ANSWER TO CHECK YOUR PROGRESS

1. Explain briefly the different drainage systems of Asia.
2. Explain water availability in Asia.
3. How the water availability in Asia is affected by different factors? Explain in brief.

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4.10 SUGGESTED READING

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Water Resources: An Integrated Approach by Joseph Holden
Water: Asia's New Battleground by Brahma Chellaney
Water Mangement in South Asia: Socio –economic, Infrastructural, Environmental and Institutional Aspects by Suman Bandhopadhyay et al

4.11TURMINAL QUESTIONS

1. Explain the role of environmental pollution in the water availability problem of Asia.
2. Discuss the water policies of major countries of Asia.
3. Write a note about the role of ASEAN in determining the water policy of the region.

UNIT 5 : LAND RESOURCES

5.1. OBJECTIVES

After reading this unit you will be able:

1. To know about different types of mineral resources and its types.
2. To find different metallic minerals and its sources.
3. To find different non metallic minerals and its sources and uses.
4. To know about different types of energy resources.

5.2. INTRODUCTION:

Natural resources play a very important role in the life of human being. They are necessary for us to live in this world. Land resource is very important natural resource. In this world 29% of the surface area covered by land & remaining 71% covered by water. Terrestrial life form & many usable resources are found on land. Life on earth traces the process by which living & fossil organisms evolved since life appeared on the earth. Resources are evenly distributed over the earth so it balanced the diversified features like soil texture, minerals, grasslands etc. Areas where land meets large bodies of water called Coastal Zone.

Area of land surrounded by ocean is called a "landmass" the measure of land area. Landmasses include supercontinents, continents, and islands. There are four major continuous landmasses on Earth: Afro-Eurasia, the Americas, Antarctica and Australia . lands can also be differentiated by giving them different names ,like the land which is capable of being ploughed and can be used in agricultural area is called arable land or agricultural land, and there are also some land which cannot be use for agricultural purpose and those are named as non arable or non agricultural land. Land which are barren and no plant or grass can be grown on that land, that land can be used for industrial purpose. But we must not overuse our land resources. We need to be aware about the demerits of overusing our land resources.

Land use:

Land is a very essential resource for human being. We use land for many purposes ie. agricultural, housing, and industrial and many more. Land use signifies the better and more productive use of land; it involves the modification and management of environment into as agricultural land, grasslands, for wood, growing more and more new industries.

The physical factors that influence uneven distribution of resources also influence land use. Five important influencing factors are:

a) Water: People live near water course like river, lakes and sea coasts.
b) Climate: It includes temperature and precipitation, which determine agricultural use of land as well as influence the lifestyle of the people.
c) Soil: This is made by weathering of rock material. It includes humans in which plants grow
d) Sunshine: The duration of the day and night varies from equator to poles. A large amount of sunshine is received around the equator. This, together with aspects and sun facing slopes, help in cultivation 2 to 3 agricultural crops a year.
e) Topography: Topography means the land feature like Grassroots, Mountains, valley etc. For example, steep stones are not suitable for agriculture.

5.3 MINERAL RESOURCES

A continent or country cannot be economically sound until unless there is Industrial development & the key of industrial development is its minerals deposition in that particular continent or country. The overall development of a continent depends on the minerals and mineral ore deposition.

Extraction of minerals is a continuous process since ancient time as people uses stone for building house, for hunting and fire at that time. The minerals & its ore become very important as we are going towards the modernization, because its economic , social and political geography depends on the quantity of minerals it has in its deposition. Minerals are those substances that occur naturally in rocks of the earth's crust. Everything we use or consume is made up of minerals. About 2,800 minerals have been identified so far. They are concentrated in particular areas of rock formations either easily accessible like soluble minerals in sea water but economically expensive to obtain or inaccessible like under snow clad in Antarctica, the Himalayas and the arctic ocean.

TYPES OF MINERAL RESOURCES:

Metallic minerals:

Minerals are the substances that are natural occurring. They have different physical properties such as crystal structure, luster, Color, hardness, etc. They are extracted from mineral deposites.Some metallic minerals have valuable metals like copper, lead, zinc, gold, platinum etc. In general metallic minerals are good conductor of heat and electricity. For extracting these metals, the metallic minerals must be chemically processed. Extracted minerals are very valuable and useful and are used for many different purposes. They are used in many different fields such as engineering, technology, manufacturing and construction.

Iron ore:

One of the most abundant elements on earth is iron. Iron ore is the term applied to a natural iron bearing mineral or rock in which the content of iron is sufficient to be commercially usable. Steel is derived from metallic iron which is extracted from iron ore. Steel consist the combination of iron and some carbon in very less amount. Mostly iron ores are always consisting of iron oxides. Their primary forms are magnetite and hematite. It is the source of primary iron for the world's iron and steel industries.

Iron ore and its sources

There are 800 billion tons of iron ore resources, containing more than 230 billion tons of iron. It is said that The United States has 110 billion tons of iron ore representing 27 billion tons of iron. The largest iron producing nations are Russia, Brazil, China, Australia, India and the USA.

Asia produces only 14% of the total iron of the world. Main iron production countries in Asia are China, India, North Korea, Philippines and Malaysia. Japan, Myanmar, Thailand, Turkey, Pakistan and South Korea also produce Iron. There are four types of iron ore in the world.

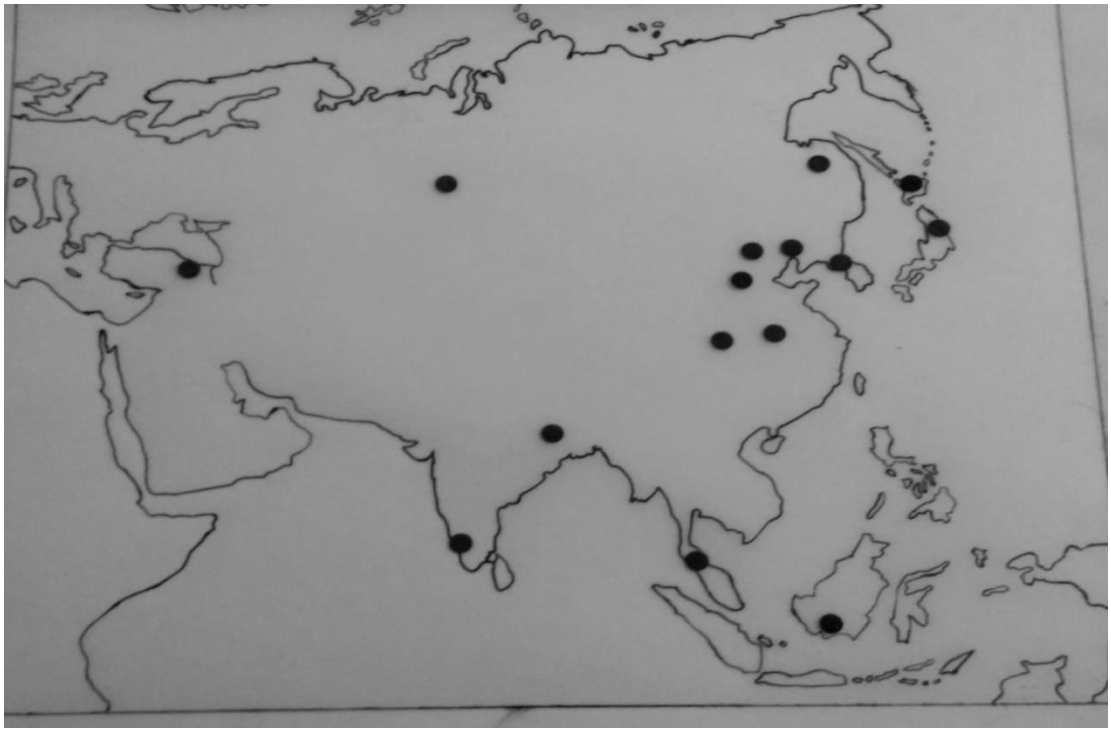
a) Hematite b) magnetite c) Limonite d) Siderite

Iron Production in Asia (2013-15)

Country	Production(000 Ton)
India	**15600**
China	**375000**
North Korea	**3054**
Turkey	**8589**
Philippines	**1057**
Indonesia	**4000**
Malaysia	**11588**

Iron is a metallic element and it composes about 5% of earth's crust. It is very reactive and oxidizes very easily in its pure state i.e., it gets rusted easily.

Figure 5.1 Iron ore resources in Asia



Source: Author

pure metals are not always useful because they are not that strong so metals are alloyed with different other metals for making it suitable for use for example iron ore is mined to make steel but Raw iron is not as strong and hard as needed for construction purposes, So the raw iron is alloyed with various elements like tungsten, manganese, nickel, chromium, vanadium to harden them and make them useful for automobiles, construction, etc.

Gold:

Gold is a mineral which is very costly and is highly loved by people because of its shine, color, lustier, ductility, malleability etc Gold is high priced because of its rarity, desirability and usefulness and its historical values.

Gold is found in many places but large deposits are only found in few locations. Since gold minerals are of twenty different types and all of them are rare, so the most found gold in nature is in the form of native mineral.

Asia produces very small amount of gold in total world production. Main gold producing Countries in Asia are Uzbekistan, Japan, Philippines, India, South Korea, Malaysia, Indonesia, and Turkey.

Gold Production in Asia

Country	Production(Kilogram)
Uzbekistan	**93,000**
Japan	**7,233**
Philippines	**15,762**
India	**1,800**
South Korea	**2000**
Indonesia	**58,800**

Source: United states geological survey (USGS) (2012).

Gold and its properties:

It is chemically classified as native element. Gold is generally yellow in color and metallic with specific gravity of 19.3.

It is used in numerous of jewelry; coinage; bullion; currency backing. It is also used in computers, circuits, appliances, cell phones, dental work, gilding etc.

Manganese:

Silver metallic element manganese is not found as an element in nature. It is found in many minerals such as magnetite, purpurite, rhodonite, rhodochrosite, and pyrolusite. It is also used as an impurity or as alloy with metals such as aluminum and copper. Manganese combines with oxygen, carbon and silicon to form a long list of manganese minerals. Manganese ores consist of 25% to 45% manganese, mostly in oxide and carbonate minerals. Manganese ores can be found widely in large amount but most amounts of these ores are extracted from small districts. Manganese ores are formed in layers in sedimentary rocks after millions of years under the oceans.

In Asia India is the largest producers of Manganese, in India Orissa, Maharashtra, MP & Karnataka are the main producers. Besides India China, Eurasia, Japan, Malaysia, Thailand & Philippines also are the producer of manganese. India, China & Thailand also Export the Manganese.

Manganese Production in Asia	
Country	**Production (000, Ton)**
India	**950,000**
China	**290,000**
Malaysia	**400,000**
Mexico	**240,000**
Mayanmar	**100,000**

The world has no shortage of manganese because they are found in large amount in many other parts of world. Which are around 70 percent in the total world.

Chromite

Chromite is an oxide mineral consists of chromium, iron and oxygen. It usually occurs in basic igneous, metamorphic and sedimentary rocks that are produced when chromite-bearing rocks are disturbed by heat or weathering.

Chromite is identical to many other metallic ores so it is very difficult to identify it. But numerous properties helps to differentiate it.

Some of the properties are also identical such as the magnetic behavior due to that property it can be confused with magnetite. Also Chromite and ilmentite have very similar properties.

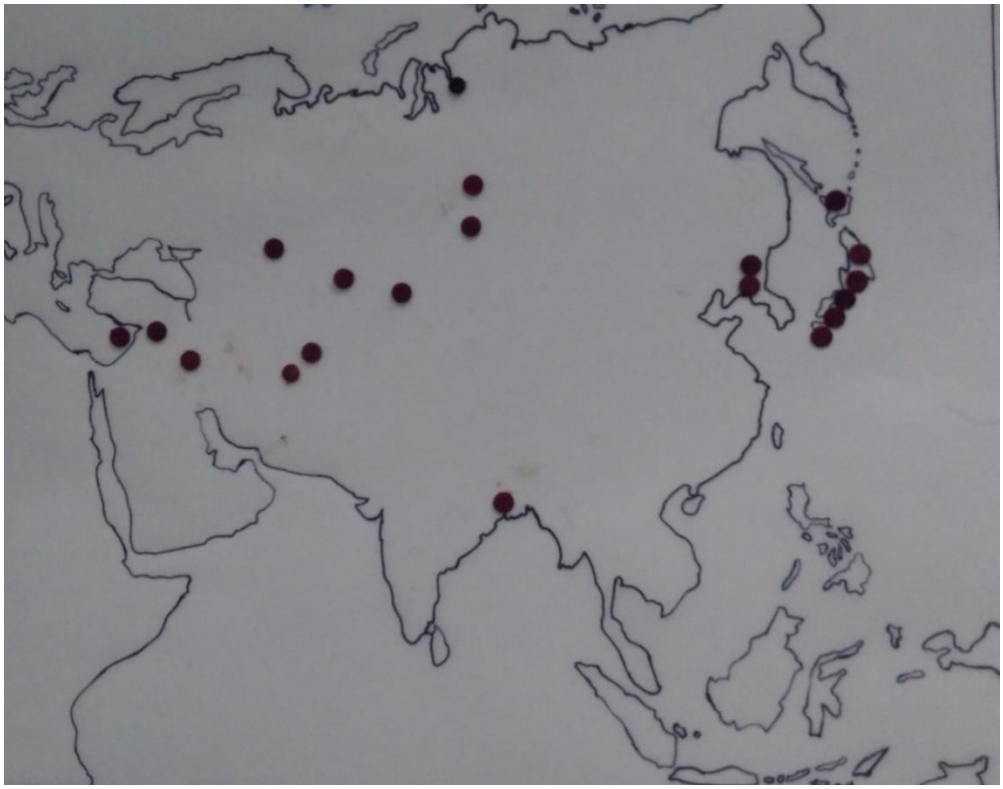
small amounts of chromium is alloyed to produce the color in many minerals and gemstones. The red color of ruby, the pink of some sapphires and the green color of emerald are caused by tiny amounts of chromium added to that metal or we can say chromium as a impurity is added to those metals for their stability.

Copper:

Copper is a mineral that is found in the oxidized state of copper deposits. It is also found in cavities of basalt that have been in contact with hydrothermal solutions, and as pore fillings and replacements in conglomerates that have been in contact with hydrothermal solution. Normally it is found in average amount and rarely in large quantities. Most copper that is produced is extracted from sulfide deposits. Copper is also a native element like gold with red on a fresh surface and dull brown on a tarnished surface. Its specific gravity is 8.9.

Copper production in Asia is very less but more than gold, 0nly 8% of the total production of the world. Japan, China, Philippines, India, Turkey, Russia are the main producers of the copper in Asia. Akota, Rangasia, Hiteshi etc are the main copper mines in Japan. Yunan Province and shachwan are known for copper in China. Lujo Island is mainly known for Copper mines. In India Singhbhumi is the main copper mine.

Figure 5.2 Copper resources in Asia



Source: Author

(2006-12)

Copper Production In Asia (2001)	
Country	**Production (000, Ton)**
Chile	**5760**
China	**1710**
Peru	**1700**
Indonesia	**2,981**
Japan	**1282**
South korea	**1004**
India	**1068**

Copper and its uses

copper is a very ancient known metal used by our ancestors from years. Copper is a good conductor of electricity that is why it is used in wiring. It is also an excellent conductor of heat hence copper utensils are used in kitchens. It is used as a cooking utensils, heat sinks, and heat

exchangers. Copper is also used as alloys with different metals like in brass which is a mixture of copper and zinc and bronze which is a mixture of copper, tin and zinc .

Types of copper deposits

Copper occurs in different form it can also be found as an impurity with some other element so it is very difficult to find it.

The classifications of copper deposits are on the basis of how the deposits formed. Igneous intrusions with which porphyry copper deposits are associated, yields about two third of the world's copper and are therefore the world's most important type of copper deposit. Mountainous regions of South America and Western North are some places where such types of large copper deposits are found. Another type of copper deposit is contained in sedimentary rocks. These accounts for approximately one fourth of the world's identified copper resources. These deposits occur in the areas such as the central African copper belt and the Zechstein basin of Eastern Europe.

Nickel

Nickel is known as a chemical element which is of silvery white color. It is a lustrous metal with a slight golden tinge. Nickel is hard and ductile due to which it belongs to transition metals. Pure nickel is found in tiny amounts in earth's crust usually in ultramafic rocks and in interiors of larger nickel iron meteorites that were not exposed to oxygen when outside Earth's atmosphere.

An economically important source of nickel from which nickel can be extracted is the iron ore limonite, which often contains 1-2% nickel. Garnierite and Pentlandite are other important ore minerals of nickel.

Uses of nickel

- Earlier it had been used for plating iron and brass, coating chemistry equipments and manufacturing certain alloys.
- About 6% of the total nickel population is used as corrosion resistant.
- This metal is very much famous in our modern world about 60% of world population uses nickel-steels.

Lead

Lead is a heavy metal with a exceeding density that of most common materials. It is soft, malleable and melts at relatively low temperature.

Lead can be easily extracted from ores.

Some properties of lead which make it very useful to us are High density, low melting point, ductility and relative inertness to oxidation. lead is of very low cost due to this and other properties results in extensive use of lead in construction, plumbing, batteries, bullets and shot, weights, solders, pewters, fusible alloy and radiation shielding.

With all these good qualities Lead is also recognized as highly toxic. It is a neurotoxin that accumulates in soft tissues and bones, damaging the nervous system and causing brain disorders and blood disorders in mammals.

Only 10% of lead is found in Asia. 40% of it is produced in china , North Korea is in second place in Lead production followed by Japan. India and Myanmar is also produces Lead. China and North Korea are the main exporter of Lead in Asia.

Lead Production in Asia (2000)	
Country	**Production (metric ton)**
China	**1410,000**
North Korea	**13,000**
Turkey	**20000**
Mayanmar	**2000**
Iran	**25000**
India	**77500**

Source: United state Geological survey (2007)

Tungsten

Tungsten is known for its hardness and rareness. It is found naturally on earth. Its an important ore which include wolframite and scheelite. It has the highest melting point among all the elements discovered.

Polycrystalline tungsten is an intrinsically brittle and hard material making it difficult to work. However, pure single crystalline tungsten is more ductile, and can be cut with a hard steel hacksaw.

Several alloys of tungsten are there for numerous applications performed nowadays. It is used in incandescent light bulb filaments, X-ray tubes (as both filament and target), electrodes in TIG welding, super alloys, and radiation shielding.

China is the main producer of Tungsten in the world. Asia produces 46% of the Tungsten in the world out of this 66% produces only in China. Besides China Myanmar, North Korea, South Korea, Japan and Thailand also produce Tungsten in Asia.

Due to the properties Tungsten require it is highly demanded in the world. China and North Korea are the main exporter of Tungsten in the world along with it Myanmar and Thailand also export Tungsten.

Bauxite

Bauxite is obtained due to weathering. The name bauxite is derived from its first study area Les Beaux in south eastern France. It had been classified into two types laterite and terrarossa . The laterite type bauxite is formed from crystalline rocks and is rich in gibbsite. The terrarossa type bauxite is formed from limestone or dolomite and is rich in boehmite.

Asia is a poor producer of Bauxite in the world, india produces only 6% of the total world production. Malaysia, China and Indonesia are the main producer of Bauxite in Asia. Myanmar and Taiwan also produces Bauxite. Malaysia is the only exporter in asia.

bauxite production in Asia (2014)	
COUNTRY	**PRODUCTION (000,TON)**
India	**19,000**
China	**47,000**
Indonesia	**500**
Russia	**5300**
Vietnam	**1000**

Source: geological survey (2014)

Bauxite is primarily a metallic mineral along with it, it is also used as an industrial mineral. It is the only ore used for large scale aluminium production. Although aluminium is the most abundant metallic element in the earth's crust constituting about 8%, it usually occurs in clays, soil and rocks that cannot be utilized for its extraction.

For deciding the usefulness of this metal The main deciding criteria are the chemical and mineralogical compositions, softness and solubility in caustic soda.

ALUMINIUM

The products from which aluminium is formed are the semifabricated ones, commonly referred to as "semis".

The valuable properties of aluminium make the semis useful for shaping into different products of everyday use. There are over 3000 applications of aluminium known in the world, but india is only aware with 300 applications of it. Broadly, its industrial use is limited i.e., utensils, electrical, consumer durables, transportation, building and construction, canning and packaging, chemical processing, defence equipments, and one upcoming site namely electronics. Utensils made from aluminium are of Easy workability, attractive colour, lightness, strong affinity for

oxygen, and nontoxicity due to which it is cheaper in market . While, the moderate thermal conductivity and moderately high melting point make it an inferior substitute for using it in cooking utensils.

(i) **Electrical: Electrical conductor (E.C.)** grade aluminium of 99.950–99.995% purity is used in transmission lines as well as in appliances. Its high electrical conductivity and ductility when hot make it a good and cheap substitute for copper in transmission lines. But, nevertheless, it is an inferior substitute, because of its lower conductivity for the same diameter. Besides, lower tensile strength makes it more susceptible to snapping, and lower than-copper melting point makes it unsafe in case of short circuit. To compensate for the lower conductivity thick wires are used. Although this itself does not make the wire heavy due to its low specific gravity, its low tensile strength and consequent susceptibility to snapping requires the use of a core of steel wire around which the aluminium wire is stranded (aluminium conductor with steel-reinforced center), and this makes the cable heavy with a tendency to sag. But, primarily because of low cost and consequent security against theft, and less possibility of short circuits, aluminium wires are widely used in India for high and low tension overhead power transmission outdoor.

(**ii) Transportation:** the primary criteria for using aluminium in parts of the bodies of cars, trucks, vans etc., are Strength combined with light weight, natural and coated colours, corrosion resistance, and recyclability. in bumpers, in engine parts, in door panels of railway coaches and in aircrafts

(**iii) Building and construction:** Strength combined with light weight, natural and coated colours; corrosion resistance and easy workability into any shape – strips, bars, angles, corrugated sheets, partition panels, perforated strips, and door and window panels –are the things which make the commercial grade (CG) aluminium a good material in this sector. When used in roofing sheets, high heat reflectance and low emissivity add to its suitability.

Pyrite

Color of pyrite is brass yellow (often tarnished to dull brass). It consists of bright metallic luster only when it is formed at high or low temperatures, pyrite usually occurs in small quantity, in igneous, metamorphic and sedimentary rocks worldwide.

Pyrite: sometime get confused with gold due to its color, metallic luster and high specific gravity.

But they can easily be distinguished through some of the properties like, Gold is very soft and will bend easily with pin pressure but Pyrite is brittle, and thin pieces will break with pin pressure. Gold leaves a yellow streak, while pyrite’s streak is greenish black.

Some pyrites can contain 0.25% of impurity of gold by weight or more. Although this is a tiny fraction of the ore, the value of gold is so high that pyrite might be a worthwhile mining target.

Gemstones are made through pyrites occasionally. It is fashioned into beads, cut into carbochons, faceted, and carved into shapes. Most of the jewelry stones made from pyrite were called "marcasite" but they are actually pyrite.

Non metallic minerals

The non metallic minerals lack the properties of metallic minerals such as a bright metallic luster, hardness, density and good conductors of heat and electricity non metallic minerals reserves consist of stone quarries and clay and sand pits; chemical and fertilizer mineral deposits; salt deposits; deposits of quartz, gypsum, natural gem stones, asphalt and bitumen, peat and other non metallic minerals other than coal and petroleum.

Mica

Mica is one of the useful mineral used in electrical and electronics industry because of its excellent strength and low loss power and insulating properties.

The main mica minerals are:

(i) Muscovite also known as white mica or potash mica.

(ii) Biotite known as black mica or magnesium iron mica

(iii) Phlogopite, i.e., amber mica or magnesium mica

(d) Zinnwaldite also termed as lithium iron mica

(e) Roscoelite or vanadium mica

(f) Fuschsite, i.e., chromium mica

Mica and its uses

Insulations 94% of the Mica is produces only in Asia. India is the largest producer of Mica in the world, Produces 80% of the total production of Mica in Asia. Bihar in India itself produces 50% of India's, 45% of Asia's and 40% of the world. Andhra Pradesh and Rajasthan also are in production of Mica in India. Other Asian Countries produces Mica are China and Siberia. India is the Main Exporter of Mica in the world.

. It is used in lubricant oils and decorative wall papers in powder form. Muscovite, phlogopites splitting are used in making of build-up mica or micanite and other insulation products.

Figure 5.3: Mica resources in Asia

Source: Author

Mica Production in Asia(2013)	
Country	**Production (Metric Ton)**
India	**14,250**
China	**780,000**
Korea	**30000**

Source: United States Geological survey (2013).

Limestone

Limestone is a sedimentary rock. Generally Over 10% Limestones are found to be a sedimentary rock, limestones are made from skeletal fragments of marine organism such as coral, forams and molluscs.

Limestone and its uses

It is the raw material for the manufacture of quicklime, stake lime, cement and mortar.

Pulverized limestone is used as a soil conditioner to neutralize acidic soils (agricultural lime).

It is crushed for use as aggregate- the solid base for many roads as well as in asphalt concrete.

Geological formations of limestone are among the best petroleum reservoirs.

Glass making, in some circumstances, uses limestone.

It is added to toothpaste, paper, plastic, paint, tiles and other material as both white pigment and cheap filler.

Purified, it is added to bread and cereals as a source of calcium.

It is often used in medicines and cosmetics.

Dolomite

Dolomite mineral is used in the formation of common rocks. It is the most important component in the formation of sedimentary rock known as dolostone and in the formation of metamorphic rock known as dolomitic marble.

Variety of colours can be seen in dolomite such as, brown, pink, green, gray, , white black. Also colorless sometimes.

Dolomite and its uses

Dolomite is majorly used in industries and in construction sites.road base material is formed by crushing and sizing of this metal, an aggregate in concrete and asphalt, railroad ballast, rip-rap or fill. in oil and gas reservoir rock dolomite also plays an important role. Due to conversion of calcinite to dolomite, reduction in volume occurs, This reduction in volume makes the dolomite a reservoir rock and a target of oil and gas drilling. by producing pores spaces in the rock that can be filled with oil or natural gas that migrate in as they are released from other rock units.

Magnesite

The most common form of magnesite is white, microcrystalline, porous masses that are dull in luster, and have the appearance of unglazed porcelain. Because they are porous, they adhere to the tongue when licked

Magnesite is found in various colours like gray, white, yellow, brown, etc.

Magnesite and its uses

Magnesite is used as an insulating material because it is an important ore for magnesium. White colored magnesium is also very useful it can be used as a minor collector’s gemstone, polished into beads and spheres as well as carved into figures. Magnesite is also useful for chemical industry as it can also be used as a binder in flooring material. It works as a catalyst and filler in the preparation of magnesium chemicals and fertilizers and also in production of synthetic rubber. .

Gypsum

Gypsum most commonly found in layered sedimentary deposits in association with halite, anhydrite, sulphur, calcite and dolomite, it is an evaporate mineral. It is white, gray, yellow, red etc. in color.

Gypsum and its uses

Gypsum is the raw material for cement, and plaster of Paris, etc. this material can also be used in agricultural fields and soil fertility and nourishment.

Energy resources

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

Energy can be generated from fuel minerals like coal, petroleum, natural gas, uranium and from electricity.

Energy resources can be classified as conventional and non conventional sources,

Conventional sources include: firewood, cattle, dung cake, coal, petroleum, natural gas and electricity.

Non conventional sources include solar, wind, tidal, geothermal, biogas and atomic energy.

Firewood and cattle dung cake are most common in rural India.

According to estimate more than 70% energy requirement in rural households is met by these two: continuation of these is increasingly becoming difficult due to decreasing forest area. Moreover, using dung cake too being discouraged because it consumes most valuable manure which could be used in agriculture. Commercial Fuels**:** e.g. coal, lignite, petroleum products, natural gas and electricity Non-commercial Fuels: e.g. fuel wood, cow dung, agricultural waste. .

Renewable Resources of Energy:

Renewable sources of energy are those natural resources which are inexhaustible and can be used to produce energy again and again. Examples are solar energy, wind energy, geothermal energy, tidal energy, water energy and bio energy. Atomic minerals are inexhaustible sources of energy when used in fast breeder reactor technology.

Non-Renewable Resources of Energy: Those natural resources which are exhaustible and cannot be replaced once they are used. Examples are fossil fuels such as coal, oil and gas which together supply 98% of the total world energy demand today.

CONVENTIONAL SOURCES OF ENERGY

Coal

Coal is a very important energy resource for the whole world, in todays modern world the use of coal is increasing day by day as energy for large vehicles is dependent on the large scale production of coal. Coal is the energy resource in which the whole world is depends on, for its better future. Coal is found inside the earth in the form of layered rocks. The major particles found in coal are carbon, oxygen, hydrogen, smoke etc.

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

As you are already aware that coal is formed due the compression of plant material over millions of years.

Coal,therefore ,is found in a variety of forms depending on the degrees of compression and the depth and time of burial. Decaying plants in swamps produce peat. Which has a low carbon and high moisture contents and low heating capacity. In india coal occurs in rock series of two main geographical ages namely Gondwana,a little over 200 million years in age and in tertiary deposits

Which are only about 55 million years old. The major resources of Gondwana coal, which are metallurgical coal, are located in damodar valley.

Jharia, raniganj, bokaro are important coalfields. The Godavari, Mahanadi , son and wardha valleys also contain coal deposits.

Tertiary coals occur in the north eastern states of Meghalaya, asaam, arunanchal Pradesh and Nagaland.

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

Figure 5.4 Coal resources in Asia

Source: Author

Coal Deposits & Production in Asia (2016)	
Country	**Coal Production(million Ton)**
China	**1685.7**
India	**288.5**
South Korea	**0.8**
Japan	**0.7**
Vietnam	**22**
Pakistan	**1.8**

Classification of Coals

Depending on the relative proportions of fixed carbon, moisture and volatile matter the coal is classified, from high to low rank, as follows : (i) Anthracite, (ii) Bituminous, (iii) Senic Bituminous, and (iv) lignite or brown coal.

Anthrasite: Anthracite is the highest quality hard coal. Composition of carbon in this type of coal is 90%-95%. It can be used as a common energy resource in household works.

Bituminus: This coal has been buried deep and subjected to increased temperature,it is the most popular coal in commercial use. Percentage of carbon which is found in this type of coal is 75-90%, metallurgical coal is high grade bituminous coal which has a special value for smelting iron in blast furnaces.

Lignite: It is a low grade brown coal, which is soft with high moisture content. The principal lignite reserves are in neyveli in tamil nadu and are used for generation of electricity.the percentage of carbon found in this coal is 45-70% . it is used in making low grade petroleum and in producton of wax.

Coals are also classified according to percentage of volatile matter into two types:

(i) **Low Volatile Coal**. This type of coal have good cooking properties with ash content of up to 24%, it is known as a good cooking coal due to its low percentage of volatile matter , between 20 to 30 with relatively lower moisture content and is generally known as cooking coal

(ii) **High Volatile Coal.** this type of coal have bad cooking properties and is known as non cooking coal,it is know so due to high content of volatile matter about 30% with 10% moisture content .it is mainly used for steam raising because it is a free burning coal. it can be used in industries for heating purpose and steam raising in thermal power plants

PRODUCTION:

Among the world asia cover 27% in production of coal. Coal producing countries in asia are china,india,japan, north and south korea , turkey, Taiwan etc. China is a country which occupies 16% of the world and 55% of asia coal reserves, after America china is the largest coal producing country. About 20 % of coal in total of the world are hidden securely in china.

India accounts for 4 % of world and 14% of asia coal reserves, two states Bengal and bihar are the most famous states for coal reserves.

Japan has about 2% of the world and 8% of total asia coal reserves, Kyushu island of japan is famous for coal production.

Petroleum:

After coal petroleum or mineral oil is the second most important energy resource.

In comparison to coal, petroleum is easy to transport from one place to another. In todays world the demand for automobiles are increasing day by day so as the need of energy for running these automobile ,this need can be fulfilled by petroleum. The development of a new and modern world also depends on petroleum that is why in future as the demand for automobile will increase the demand for petroleum will also increase.

Petroleum provides fuel for heat and lighting, lubricants for machinery and raw material for a number of manufacturing industries.

Petroleum refineries act as a “nodal industry” for synthetic textile, fertilizer and numerous chemical industries.

Most of the petroleum occurrence in india are associated with anticlines or domes, it occurs where oil is trapped in crest of the upfold. The oil bearing layer is a porous limestone or sandstone through which oil may flow. The oil is prevented from rising or sinking by intervening non-porous layers.

Petroleum is found in fault traps between porous and non porous rocks. After cleaning many kinds of products are made like wax,Vaseline etc.

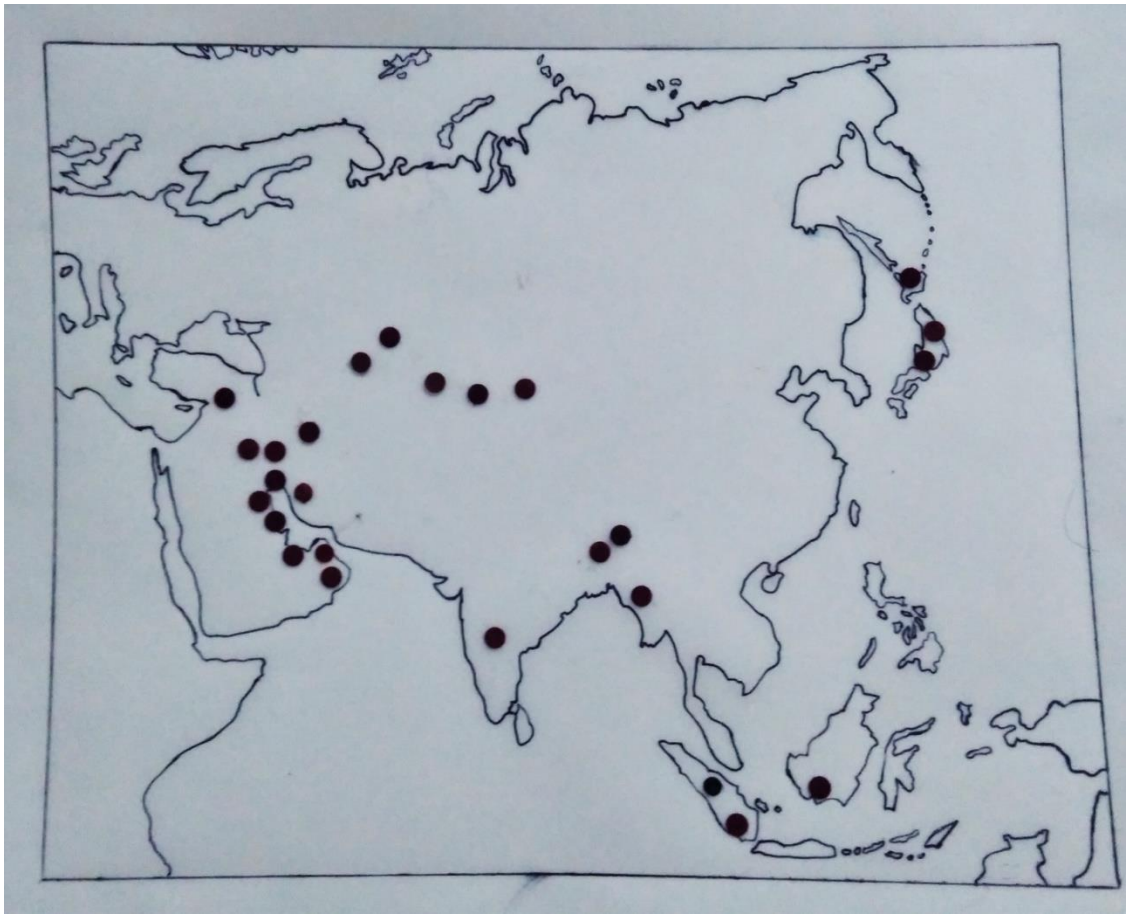
Reserves and Production:

Asia accounts for about 40% of oil and petroleum production in the world. In 1992 in the world the production of petrol was about 317 metric ton, in this Asia produced 126 crore metric ton. West and south Asian countries produce the largest amount of petroleum. in 1992 west and south Asian countries produced 91 crore metric ton of petroleum which was 75 % of Asia and 30 % of the total world production at that time.

The western and southern Asian countries which produce the maximum amount of oil are Iran, Iraq, south Arabia, Kuwait, Qatar, Bahrain, turkey, Israel etc.

A South-east Asian country which produces petroleum is Indonesia, china, Malaysia, etc.

Figure 5.5: Petroleum resources in Asia



Source: Author

Petroleum Deposits & Production in Asia (2016)	
Country	**Production(bbl/day)**
Saudi Arab	**10,460,710**
Iran	**3,990,956**
Iraq	**4,451,516**
China	**3,980,650**
India	**734,180**
Qatar	**15,22,902**
Syria	**30,000**
Kazakstan	1,595,199
Turkey	49,497

Source: U.S energy information administration

In the world south-west Asia is the highest petroleum producing area. Largest amount of petroleum can be found in this region of the world. In the south west Asian region there are different oil mills which are connected through pipelines.

Major countries of south west region where petroleum is found are:

Saudi Arabia: after America south Arabia is the world largest oil producing country.

Iran: after Saudi Arabia Iran is the largest oil producing country in the world. But due to the war and internal struggle of Iran the oil production has decreased.

Iraq: after Saudi Arabia and Iran, Iraq is the largest oil producing country in the world.

Kuwait: after Saudi Arabia, Kuwait has a secured and largest oil reserve. Kuwait stands 4th in Asia oil producing countries.

Qatar: it has about 24 oil mills, Dukhan is the highest oil producing region in Qatar, moreover in Dohar there is also a oil producing factory for large production of oil.

Syria: to find the amount of oil produced in this country still some companies are working on it. For now banyas is the highest oil producing region in Syria.

Major countries of south east region where petroleum can be found are:

Indoasia: indoasia is the highest oil producing country in south east region, the major oil region in indoasia are java and borneo.

China: many regions of south china where oil can be found.

5.4 CONCLUSION

Land, a critically important national resource, supports all living organisms including plants as well as every primary production system such as roads, industries, communication and storage for surface and ground water, among others. The soil profile of land determines its ability to serve socio-economic needs. It has been estimated that more than 5,000 million tones of top soil is eroded annually along with about 5 million tones of nutrients. About a third of this is lost to the sea, while the rest builds the silt load in reservoirs and river beds leading to floods. About 38% of the area in India suffers from moderate to high degree of water-based erosion, most of which needs suitable soil and water conservation measures such as Watershed Development. Arid areas suffering from moderate or high degree of soil loss comprise up to 4% of the geographical area. Therefore, about 42% of the country's area requires soil & water conservation efforts on a priority basis.

The earth has a limited supply of mineral resources and depletion of these resources are not in the interest of the human race or planet. Even so many people are economically, politically, or culturally motivated to continue to use of mineral resources in a manner that is not sustainable. Advocating for the sustainable use of mineral resources requires a holistic knowledge of the cultural and environmental factors involved. Scientifically literate and informed people can make the difference between expecting the depletion of key resources and creating a more stable and sustainable world for future generation.

- Demand for mineral resources will continue to grow.
- We are unlikely to run out of mineral resources.
- Nonetheless, there will be many challenges for both developed and less developed countries.

5.5. SUMMARY

Land is the most important natural resource, it consist of many kinds of rock surfaces, minerals etc.

71% of earth surface is covered by water and remaining 29% of the total surface is covered by land. Land use involves the modification of natural environment it involves5 influencing factors, topography, soil, climate, water, sunshine.

Mineral resources are substances that occur naturally in rocks of earth's crusts, everything we use is made up of minerals. Extraction of minerals is done by mining, drilling, and quarrying, iron ore, copper, manganese, bauxite, coal are some of the important minerals.

Aluminum is obtained from bauxite ore. Mineral resources are of two types' metallic minerals and non metallic minerals.

Metallic minerals are those that are lustrous, malleable, and shiny some of the metallic minerals are iron ore, manganese, chromite, copper. On metallic minerals are those that lack the properties of metallic minerals such as bright metallic luster, hardness, density, and good conductivity. Some of the non metallic minerals are mica, limestone, dolomite, magnesite etc.

Energy resources are those which help to develop a country economic condition. different forms of energy resources include fuel wood, animal waste etc. energy resources can be classified into four types, commercial fuels(e.g. coal) , non commercial fuels(e.g. fuel wood), conventional resources(e.g. fossil fuels), renewable energy resource(e.g. solar energy), non renewable resources(e.g. crude oil).

5.6 GLOSSARY

- **Demarcation:** the action of fixing the boundary or limits of something.
- **Swampy boundaries:** very wet, soft land.
- **Arable land:** capable of being ploughed and used to grow crops.
- **Marsh:** waterlogged
- **Wilderness:** an uncultivated region.
- **Abundant:** existing or available in large quantities.
- **Resistance:** the refusal to accept something.
- **Native mineral:** elements that occur in nature in uncombined form with distinct mineral structure.
- **Specific gravity:** another term for relative density.
- **Seabed:** the ground under the sea.
- **Alloy:** a metal made by combining two or more metallic elements.
- **Corrosive:** tending to cause corrosion.
- **Pour filling:** to fill small holes.
- **Tarnished:** lose or cause to lose luster.
- **Prehistoric:** relating to or denoting the period before written records.
- **Neurotoxin:** a poison which acts on the nervous system.
- **Brittle:** hard but liable to break easily.
- **Indispensible:** absolutely necessary.
- **Aggregate:** a whole formed by combining several separate elements.

5.7. ANSWER TO CHECK YOUR PROGRESS

Q.1. which of the following is not a land use

(a) Soil erosion

(b) Planting trees

(c) Agriculture

(d) Fallow land

Q.2. which one of the following is not a producer of copper

(A) Madhya Pradesh (b) Karnataka (c) Jharkhand (d) Gujarat

Q.3. where are placer deposits found

(a) Mountains (b) cities (c) river valleys (d) in rocks

Q.4. which of the following is a (conventional source of energy

(a) Sun (b) tide (c) biomass (d) coal

Q.5.The coal has the highest percentage of carbon content

(a) Anthracite (b) bituminous (c) Peat (d) lignite

Q.6.which one is the leading producer of iron ore in the world

(a) Antarctica (b) Europe (c) Asia (d) Africa

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5.*10 TERMINAL QUESTIONS*

Q.1 Differentiate between high volatile coal and low volatile coal?

Q.2. Describe the types of energy resources with examples.

Q.3 Describe the qualities of pyrites.

Q.4 Define the two types of mineral resources.

Q.5 What is the uses of coal and petrol

Q.6 There is various ways in which you can save energy at home. State any five ways.

Q.7 Why is it necessary to conserve our energy resources? How it can be conserved?

UNIT 6 : FOREST RESOURCES

6.1 OBJECTIVES

After studying this chapter you will be able to:

- Explain the distribution of various types of forest in Asia.
- Understand the different measures taken by countries and associations in Asia to conserve forests
- Explain the impacts of biodiversity loss in Asia due to deforestation.

6.2 INTRODUCTION

Forest is an integral part of the Earth; we depend on them to survive from the air we breathe to the wood we use. In addition, to provide animal habitats and human livelihoods, forests also protect watersheds, prevent soil erosion, and mitigate climate change. Current research suggests that forests currently cover less than 10% of the Earth's surface (or less than 30% of the total surface). As an essential part of our biosphere, forests function as habitats for organisms that contain about 90% of the world's biodiversity in the world, in addition to being modulators of hydrological flow and soil conservation. Asia is the biggest continent, where all the climate regions of the world are present. Thus almost all the vegetation that is found elsewhere in the world is also present here. However, as observed, the variability of natural vegetation is more evident than the physical and climatic variability in Asia.

6.3 FOREST AS A RESOURCE

Forest has always been a vital resource to support the significant large population of the continent. To understand the forest resource of Asia, it is first necessary to see the distribution of various forest types. In Table 6.1, the forest area covered in each country of Asia is specified. The forest resources of Asia can be divided based on climate into different regions:

1. **Tropical Wet Evergreen Forest:** This type of forest is mainly found in Malaysia, Indonesia, South Philippines, South China, Thailand, East India, Bangladesh, the western part of Deccan Plateau, and Sri Lanka. The region typically experiences the precipitation of more than 200 cm. These forests are evergreen around the year and do not shed the leaves in a particular season. The trees found here are dense, tall, and have broad leaves. The dense forests sometimes do not even allow the sunlight to reach the ground. The trees are generally 30m to 60m in height. The trees are covered with different vines hanging from the trees. Such forests found in India, Bangladesh are less dense than found in Malaysia, Indonesia that is much nearer to the Equator. The main tropical trees found

here are mahogany, ebony, rosewood, etc. These dense forests are the adobe of rich biodiversity in the form of flora and fauna.

2. **Tropical Deciduous Forest:** These forests are extended in India, Myanmar, Thailand, North Philippines, North-East China plain. These regions experience moderate precipitation of 100 cm to 200 cm. Most of the rainfall occurs in the rainy season of three to four months; the rest of the year, the precipitation is relatively low. In the autumn season, the trees of these forests shed their leaves. The forests have trees with broad leaves. These forests are also called 'monsoon forests'. The main trees of these forests are teak, mango, sandalwood, mulberry, guayacan, etc. These forests are less dense, and the wood is softer than the tropical evergreen forest. These trees have a lot of economic importance in the form of building woods, industrial uses, etc. Out of the total tropical deciduous forest in the world, Asia possesses 17.5% of its share.

3. **Savanna Grass and Bushes:** This vegetation is found in the warm regions with precipitation between 50cm to 100 cm. The main areas extend from Pakistan, northwest Pakistan, Central Deccan, South East Arab Peninsula, and North China. Due to the scarcity of water and more evaporation, the trees are very less in the area. The grasses and bushes are predominant here. Depending upon the quantity of precipitation, there is a change in the quantity and height of trees.

4. **Desert Vegetation:** This type of vegetation is found where the rainfall is scanty. These dry areas are present in the hot, subtropical, and temperate parts of the continent. It is extended extensively all across the continent from the Arabian Desert, Thar desert, Iran, Afghanistan, Turkistan, Gobi desert, the temperate region of Tarim Basin, to Siberia and highlands of Tibet. In the tropical deserts, the vegetation is different than the temperate deserts. Here the trees with thick bark, long roots, prickly and smooth leaves are found that prevents water from evaporating through their thick barks and smooth leaves. Acacia, hawthorn, kikar, and other thorn bushes are the natural vegetation of such deserts. In temperate deserts like Gobi and Tarim basin most of the parts are uninhabited and deserted, while at some places, palm trees and grasses can be spotted near the water. The trees are pretty rare in this part of the world. Moving to the northern coastal part of Asia, it is extremely cold, and the land is covered with snow for the most of the year. The region is called 'tundra.' In the higher tundra, there are mosses of flowering plants and shrubs in spring, while in middle tundra, willow, birch, and aspen trees are found. A similar climate is found in the high altitude of Himalayas.

5. **Tropical and Subtropical Mixed Forests:** These forests are found in South and Central China, south Japan. There is an average amount of rainfall and heat in these parts, resulting in dense forests. However, these parts are relatively colder than the tropical regions. The evergreen trees are found in coastal regions, while deciduous types of trees are found inland. Except for south-eastern mountain ranges, Nanshan Mountain, Sinling mountain range, and western highlands, these forests have been cut in China everywhere at the expense of agriculture. The main trees in the forest are bamboo, laurel, beech, fir, camphor, chestnut, oak, etc.

6. **Mixed Temperate Forests:** These forests are generally found between 40^0 North to 60^0 North in Asia that extends from North China, North and Central Japan, Korea and South-Eastern Siberia. Further, they are also found in the middle altitudes of the Himalayas in India and Nepal. The climate of the region is not very extreme, so the trees both of broad leaves and conical leaves can be found there. The broad-leaved deciduous trees shed their leaves in the autumn in the effect of the extreme colds in the winter. Such trees are chestnut, alder, elm, oak, birch, beech, maple, and walnut. While the conical leaves trees found here are fir, silver pine, larch, and sand pine. The woods from these forests have economic importance. The soil found in these forests is brown in colour.

7. **Temperate Dry Evergreen Forests:** These forests are mainly found in Turkey, Siberia, North-western India, parts of Pakistan, coastal regions of Israel, and Iraq. In these parts, the summers are hot and dry, but winters are humid and cold. The precipitation is less than 100 cm. That is the reason why the trees found here are less in height. To overcome the heat and less precipitation, the trees are equipped with special qualities and are green for the whole year. The trees' roots are long so that they can collect the moisture from deep down the soil. To prevent evaporation during the summers, they have smooth and thick leaves and thick bark. The trees found in these forests are juniper, willow, olive, walnut, etc. Out of the total forest of this type in the world, Asia has 47.5% in its share.

8. **Temperate Grass or Steppes:** The Steppes are extended to these main regions in Asia-in Central Asia near 50^0N latitude, lowlands of western Siberia and semi arid regions of Mongolia, western part of Manchuria and some parts of Tibetan Plateau. These regions have inland location. The temperature in winters can reach -18^0C and summer temperature reaches to maximum 20^0C. The precipitation occurs in summers with an average measure of 40 to 50 cm. So, the extreme winters and mild summers with less rainfall are the hindrances for the growth of trees. These grasses are soft, small, and fluffy. Bushes and small trees can be found near the lakes. These grasslands are home to the small tribal groups practicing transhumance.

9. **Coniferous Forests:** Below the tundra belt from Ural Mountains to Pacific Ocean between the latitudes of 55^0N and 66^0N the coniferous forests are extended which is also called 'Taiga'. These forests have conical leaves trees and softwood. The winters are harsh here and have a short summer. To counter the snow in winters the trees have conical shape, the conical leaves also have a low rate of evaporation. The main trees are Spruce, Larch, Firs, and Pines. Out of the total coniferous forest in the world, Asia comprises of 33.**6%.**

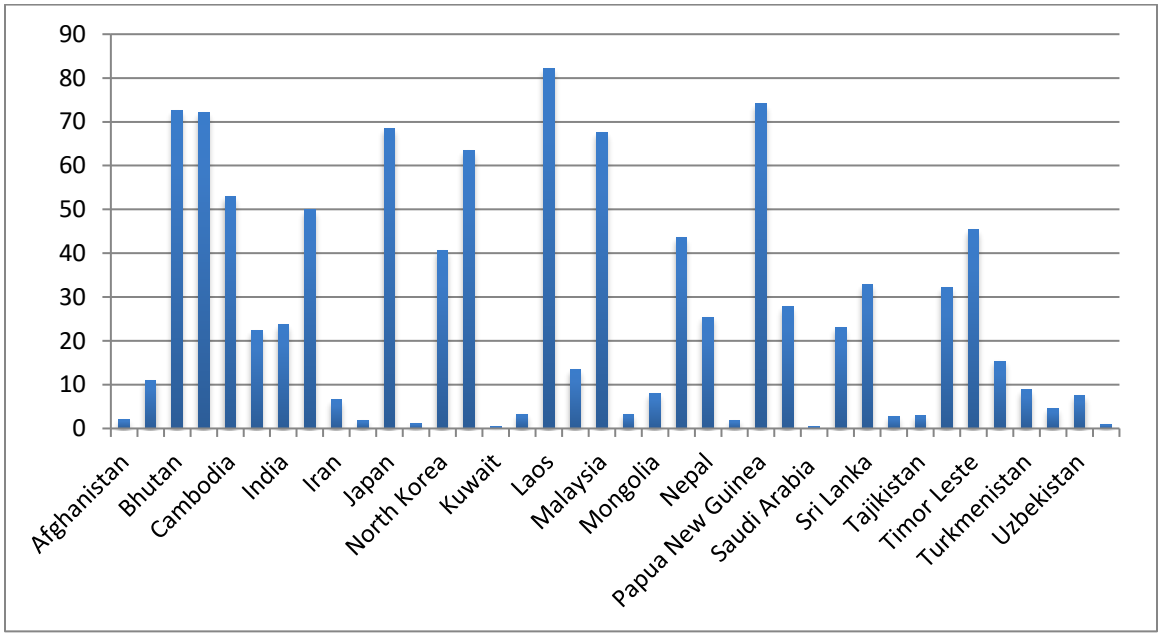
Characteristic of forest of India

1. Out of the total forests in world 38% of forests are found in Asia.
2. The broad leaf forests in Asia are 42.4%, while 57.6% are conical leaf forests.
3. The hard wood forests in Asia are 25% of the total in the world.
4. Out of the total broad leaved forests in world 17.5 % is in Asia.
5. Out of the total conical leaved forests in world 33.6% is in Asia.

Table 6.1

S.No	Country	Forest Area (%)	S.No	Country	Forest Area (%)
1	Afghanistan	2.1	20	Maldives	3.3
2	Bangladesh	11.0	21	Mongolia	8.0
3	Bhutan	72.5	22	Myanmar	43.6
4	Brunei	72.1	23	Nepal	25.4
5	Cambodia	52.9	24	Pakistan	1.9
6	China	22.4	25	Papua New Guinea	74.1
7	India	23.8	26	Philippines	27.8
8	Indonesia	49.9	27	Saudi Arabia	0.5
9	Iran	6.5	28	Singapore	23.1
10	Iraq	1.9	29	Sri Lanka	32.9
11	Japan	68.5	30	Syria	2.7
12	Kazakhstan	1.2	31	Tajikistan	3.0
13	North Korea	40.7	32	Thailand	32.2
14	South Korea	63.4	33	Timor Leste	45.4
15	Kuwait	0.4	34	Turkey	15.4
16	Kyrgyz Republic	3.3	35	Turkmenistan	8.8
17	Laos	82.1	36	United Arab Emirates	4.6
18	Lebanon	13.4	37	Uzbekistan	7.5
19	Malaysia	67.6	38	Yemen	1.0

Bar Graph 6.1: Forest Area in Percentage of different countries in Asia (Source: FAO, 2016)



Forest Area of Major Asian Countries (in %)

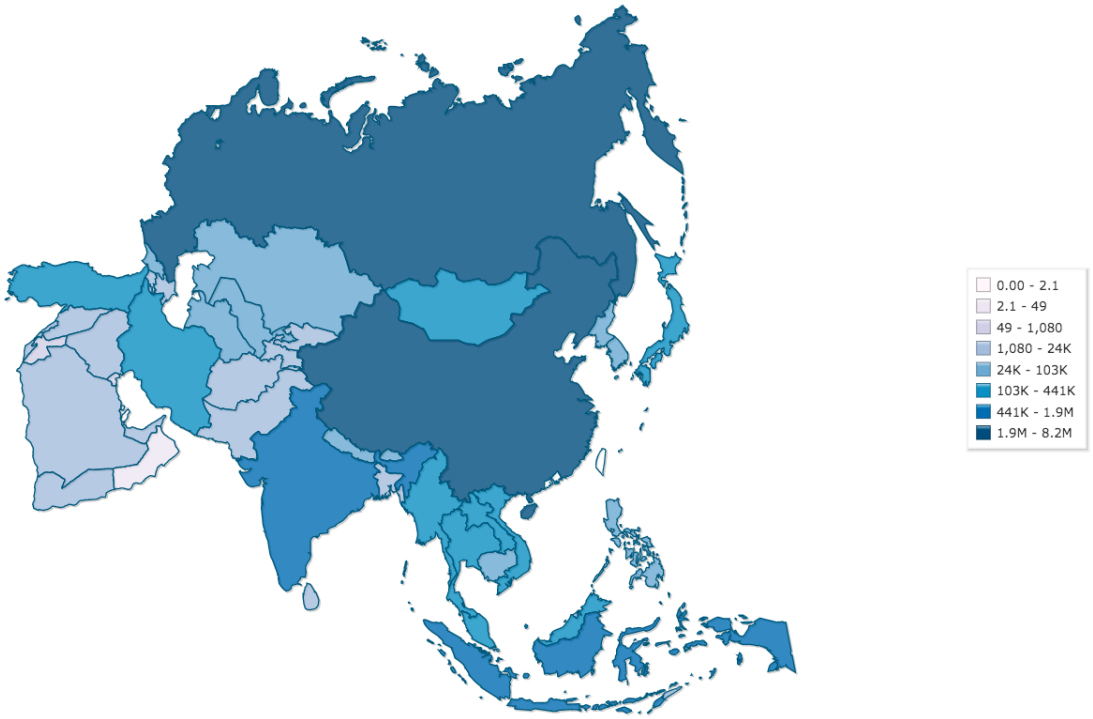


Figure 6.1: Forest Area of Different Countries in Asia in square km. (FAO)

6.4 FOREST CONSERVATION IN ASIA

Asia has lost two-thirds of its original forests. The remaining non-tropical forests, disturbed and fragmented to varying degrees, are found mainly in less biologically rich mountain regions (mountain forests have a high proportion of local endemic species). Between 1980 and 2000, Asia lost almost a third of its tropical forest cover. Asia, in which net forest loss occurred in the 1990s, reported net growth in 2000–2010, mainly due to large-scale afforestation in China and despite a continued high net loss of forests in many countries in South and Southeast Of Asia. During 2000–2005, primary forest losses were the fastest in Cambodia, the Democratic People's Republic of Korea, Indonesia, Mongolia, Papua New Guinea, and Vietnam, which accounted for a quarter of all world losses during this period. After gaining independence, India lost 4,696 m of forest land for non-forest purposes, but currently, the forest area has stabilized.

Southeast Asia experiences the highest annual deforestation rate in the world due to its growing population's dependence on timber, fuel wood, and other forest products adding to it is conversion of forests for agricultural, industrial and urban purposes. Southeast Asia lost 555,587 km^2 of forests between 1980 and 2007. By 2007, forest cover of the entire ASEAN region was recorded at 43 per cent, comprising 5 per cent of the global total. Southeast Asia's forest area declined at an annual average rate of 20,578 km^2 from 1980 to 2007. Regrowth of secondary forests partially mitigates the overall effect on species biodiversity from clearing pristine habitat, as do tropical tree crop and tea plantations. The rapid growth of large oil palm plantations in Indonesia and Malaysia, and especially in areas previously covered by primary tropical forests, is a major factor in biodiversity loss, causing land degradation and habitat loss for many species. The pulp and paper industry is currently expanding in tropical Asia, with large areas of natural forest cleared of cellulose fiber, which are often replaced by monoculture plantations to meet long-term demand. Biodiversity can stabilize, but at a lower level.

Due to growing demographic pressure on the world's largest inhabited continent, deforestation and environmental degradation are a serious problem. The government of various Asian countries should work on the discussion of forestry issues and afforestation measures. Many countries have developed policies to conserve all these critical forests. To get an idea, let's take a look at the policies of some of these countries:

1. **China:** China is one of the countries most affected by deforestation in the wake of the so-called development to uplift its economy in the last 2-3 decades. It has only 22.2% forest area (Table 6.1), which is quite significantly low. China has 134 million hectares of forest, of which about 65 percent is natural. In connection with natural disasters, China

has prioritized the conservation and protection of natural forests with logging to move to forest plantations. The current 10-year plan provides new plantations, both fast-growing forest plantations and protective plantations, in a 1: 4 ratio. More than half of the plantations are in the southern region, while natural forests are mainly in the northeast and southeast.

For decades, Chinese forests were devastated when logging and logging turned into agricultural land. Biodiversity was lost, and floods and soil erosion became major problems without these trees to maintain balance in the ecosystem. There were disastrous consequences. Losses from floods in the summer of 1998 reached only $ 20 billion. In response, China established the Natural Forest Conservation Program (NFCP).

NFCP targeted sensitive areas that have deteriorated significantly over the past five decades, such as areas around the upper reaches of rivers and other upper reaches of large rivers. An essential part of the NFCP was the general ban on logging in natural forests, rather than switching to other sources of wood.

Deforestation has led to a reduction in China's forests for decades, but between 2000 and 2010, the country experienced a net increase in forest cover. Over the course of a decade, significant recovery can be observed in approximately 1.6% of China, while 0.38% continued to lose tree cover.

In recent years, China has surely prioritized from wood production to ecological reconstruction. China has implemented a wide range of additional measures to both increase its area of forest cover and improve the quality of its forests and forest management. Among key forestry initiatives, China continues to implement programs related to:

a. Natural forest protection
b. Conversion of croplands to forest
c. Desertification control for areas in the vicinity of Beijing and Tianjin
d. Shelterbelt development in the ‘Three Norths’ and the Yangtze River Basin regions
e. Voluntary planting including greening of flatlands and development of gallery forests.

The Chinese government's 'National Forest Protection and Utilization Plan (2010-2020)' gives priority to improving forest management through comprehensive silvicultural interventions, rigorous compliance with permitted forest cuts, intensification of efforts to application to reduce illegal forest activities, strengthen forest fire prevention efforts and improve biosecurity measures to prevent and control outbreaks of forest pests and

diseases. In addition, 114.4 million hectares of forest have been incorporated into the program of protection of natural forest resources.

2. **India:** India is a large and diverse country. Its territory includes regions with the highest rainfall in the world in the form of very dry deserts, coastline to alpine regions, river deltas, and tropical islands. The diversity and distribution of forest vegetation are large. Types of Indian forests include tropical evergreen, tropical deciduous, and swamp, mangrove, subtropical, and mountain, shrub, subalpine and alpine. These forests support diverse ecosystems with diverse flora and fauna.

   India had a commercial problem of deforestation, and forest cover was quickly disappearing. The government then passed the 1980 Forest Conservation Act. The law helps preserve forests and protect forest lands. It restricts the use of forest land for commercial purposes without a thorough regulation process.

   Over the past 20 years, India has changed the direction of deforestation. United Nations experts report that India's forests and forest cover have increased. In a study conducted in 2010 by the Food and Agriculture Organization of the United Nations, India is among the ten countries with the most substantial forest area coverage in the world (the remaining nine are the Russian Federation, Brazil, Canada, United States of America, China, the Democratic Republic of the Congo, Australia, Indonesia, and Sudan).

   In 2003, India established the National Forestry Commission to analyse and evaluate the policies and laws of India, their impact on Indian forests, their impact on local forest communities, and make recommendations for achieving sustainable forest and environmental security in the country. India. The report gave more than 300 recommendations, including:

   - India must adhere to rural and livestock development policies to address the problems of local communities who need to find affordable cattle fodder and grazing. To prevent the destruction of local forest cover, fodder must reach these communities through reliable roads and other infrastructure throughout the year.

   - The Forest Law Act may be detrimental to forest conservation and environmental safety. The Forest Rights Act has become law since 2007.

   - The government should work closely with mining companies. Revenues from the lease of mines should be combined into a special fund to preserve and improve the quality of forests in the region where the mines are located.

- The authority to declare environmentally sensitive areas should belong to every Indian state.

- The mandate of state forest corporations and state monopolies must be changed.

- The government should reform the regulations and laws that prohibit the felling and transit of wood in India. Sustainable agroforestry and agricultural forestry should be promoted through financial and regulatory reforms, especially on private land.

3. **Thailand:** As a result of its policy to conserve all remaining natural forests and other protected areas, the Thai government is promoting an increase of 60:40 plantations between private and public. Plantations will restore land and supply wood to the domestic market. The pursuit of large plantations was faced with strong opposition from the villagers, who believed that they benefit the rich. Since 1992, efforts have been on small plantations with local participation, but with minimal success. As a result of the ban on logging, illegal logging in neighboring countries intensified, which put pressure on other countries.

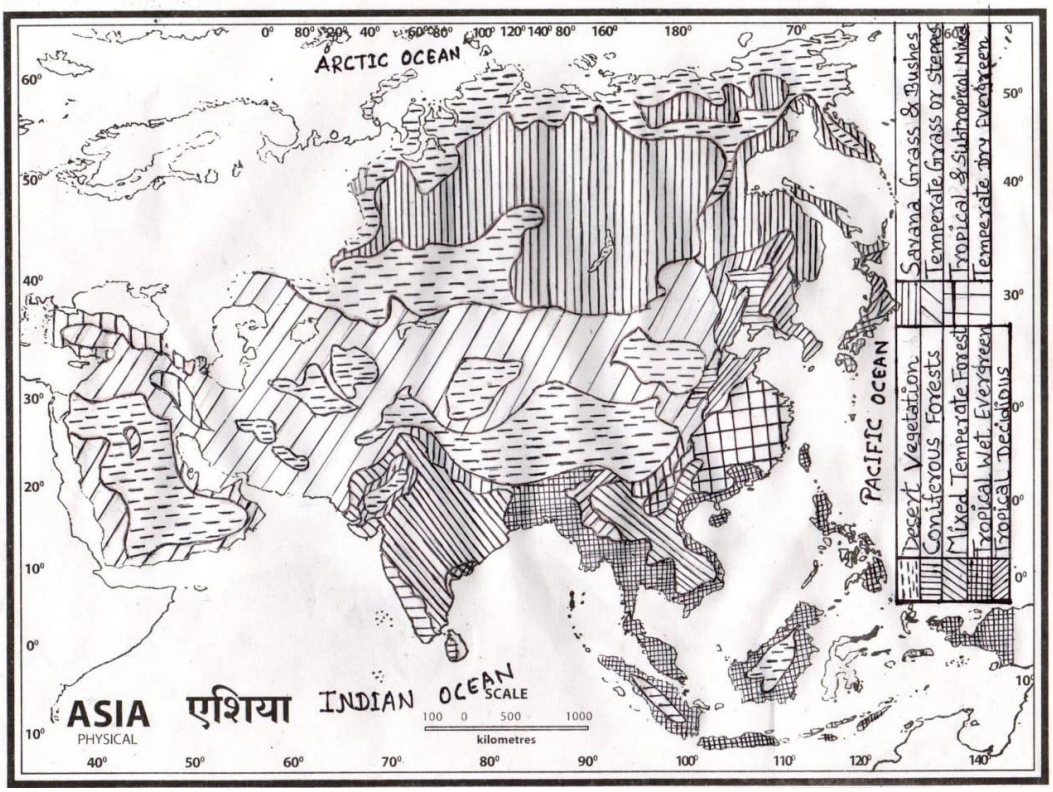
4. **Sri Lanka:** The2 million hectares of natural forests are owned and managed, including any harvesting and sale of timber, by the state. There are 130,000 hectares of plantations, of which more than 92,000 hectares are state-owned. Planting began in the late 1920s, and it is mainly teak, eucalyptus, mahogany and pine. Prior to the prohibition of harvesting in 1989, in some forests, the harvest was about 980,000 m^3, with 44% natural forests, about 8% plantations, and the rest was non-timber, such as home gardens, rubber and coconut plantations. At this time, Sri Lanka was almost self-sufficient in wood, most of which (90 percent) went to wood fuel. The planned harvest from plantations for the current period was to be 90,000 m^3, but probably about a third of this. Plantations suffered from poor management, inappropriate species, attacks, as well as fires and damage to elephants. Home gardens and other non-forest plantations, combined with the import of logs, lumber and panel products, help fill the gap.

5. **Singapore**: In 2009, the National Biodiversity Strategy and Action Plan were launched in Singapore. It identifies five key strategic goals: the conservation and protection of biodiversity, including biodiversity in politics and decision-making, improving knowledge, improving education and public awareness, and strengthening international partnerships and cooperation.

6. **Japan:** In 2013, the Government of Japan developed the "Plan for Dynamism through Agriculture, Forestry, and Fisheries and Local Communities," which calls for transforming forestry into a growing industry, encouraging forest shell activities through forest management and maintaining and creating demand for wood by developing new products and technologies.

7. **Taiwan:** Among the strategies and plans developed in other countries, in 2008, Chinese Taipei launched the Green Forestry Plan; By 2015, about 30,352 hectares of new forests were created, which ensured the "participation" of Chinese Taipei in the goal set in the APEC Leaders' Declaration in Sydney in 2007. Chinese Taipei has four main afforestation goals:
    a. regeneration of degraded state-owned forest land
    b. planting coastal forests and forests on outlying islands
    c. provision of incentives and guidance to encourage reforestation of slope land
    d. planting forests in lowland areas

Figure 6.2: Distribution of different Forest Types in Asia



Source: Author

6.5 FOREST AND BIODIVERSITY ISSUES IN ASIA

Asia covers 14 per cent of the world but contains half of the world's population, with population density eight times higher than the global average. Asia has recorded the world's highest number of threatened species. The sharp decline in tropical species populations indicated in the Living Planet Index mirrors widespread habitat loss in those regions. Southeast Asia, which has a higher number of endemic species compared to the rest of Asia, ranks third in Asia in terms of threatened endemic plant species, with China and Japan ranked first and second, respectively. According to the IUCN Red List, India has 413 globally threatened faunal species, which is approximately 4.9 per cent of the world's total. The five principal pressures directly driving biodiversity loss are either constant or increasing in intensity.

Among the world's tropical regions, Southeast Asia has the highest rate of habitat loss, almost the entire area is considered a biodiversity hotspot because of the high number of threatened endemic species, and future land use changes with economic growth are expected to cause extinctions across a wide range of taxa. Southeast Asia fell short of achieving the 2010 Biodiversity Target in the Convention on Biodiversity Framework. Of the 47,915 species assessed, 2,517 are threatened due to deforestation, hunting for wildlife, as pets and for medicinal use, climate change, pollution, population growth, and other causes.

Birds and mammals used as food and medicine, on average, face a higher risk of extinction than the species as a whole, due to combined overuse, loss of habitat and other factors. They quickly move to the higher risk category.

About two thirds of terrestrial biodiversity is in the forest ecosystem. Many endemic plant and animal species that depend on the health of the forest ecosystem are at risk, in particular due to the loss and degradation of their habitats. The development of forests, mining, the construction of dams and oil and gas fields opens the way for further degradation or demining for conversion to agriculture, plantations, livestock and urbanization.

Mammals: Mammals are at the highest risk of extinction in South and Southeast Asia due to hunting and habitat loss. Southeast Asia has the largest diversity of mammalian species in Asia, but without critical points of species richness. Centres of endangered species are concentrated in regions with a high degree of human exposure. Limited habitats in Asia are typical in southern India and Sri Lanka, in southwestern China, in Vietnam, Taiwan, Malaysia, Indonesia, and the Philippines. Critical points for threatened species are found in the Western Ghats in India, in parts of Sumatra, Borneo, Sulawesi and Papua New Guinea, as well as in the foothills of the Himalayas south of Singapore. Large charismatic mega fauna such as rhinos, tigers, elephants,

and orangutans face significant pressure, in part because of their large habitat requirements (including predator-prey), which are faced with increasing demand from logging, livestock farming, and wildlife trade. Even the smallest mammals, such as lizards, face similar threats.

Birds: One in eight, or 324, of the 2,700 species of Asian birds is at risk of global decline, including 41 critical, 66 endangered and 217 vulnerable. Another 317 threatened species are close to the worldwide threat category, giving 664 (25 percent) of the species in the Asian zone of birds of global conservation interest. Bird species face a particularly notable increase in the risk of extinction in Southeast Asia. Deforestation, conversion and degradation of natural forests, meadows and wetlands are the most important causes of danger to birds. Exploitation for human use, the second most common threat category, affects more than 50 percent of all threatened bird species; about 70 percent of the hunt for food and sports, and about 30 percent - for trade in wild birds. The most critical and endangered bird species are vulnerable because they have limited ranges and specialize in a particular type of habitat and are often found in areas and habitats that undergo the fastest cleaning.

6.6 CONCLUSION

In this chapter, you learnt about the various forest types that are present in Asia. We discussed the distribution, types and characteristics of the forest resources found in Asia. Then later, we discussed the conservation measures that are taken into account in Asia, which is home to degrading forest resources. The approach taken discusses the problems and steps taken by some of the important countries in Asia regarding the conservation of its forest resources. Further, the chapter is concluded with the effects on biodiversity and its possible conservation in Asia.

6.7 SUMMARY

In this chapter, we focused on the different types of natural vegetation that are found in Asia. The forest types range from tropical, temperate to tundra type with a range of different kinds of vegetation depending upon the temperature and precipitation. The distribution of these forest types all across Asia depends upon these climatic parameters. The different types of forests show different characteristics and distribution. The natural vegetation also affects the habitat and economy of the region with its resources like timber. They support a variety of trees and biodiversity that can be considered as the primary forest resource.

Asia is an abode of rich forest resources and contains a large share when compared to the rest of the world. However, the continued race for development and overpopulation are some of the problems that are reducing its rich forest cover. In the past, Asia has lost two-thirds of its original

forests. The various countries in Asia have understood the problem and passed the laws that protect the forests. Further, many countries have improved upon their forest cover through significant afforestation measures. There is also a problem of declining biodiversity with Asia being the most populous continent; the biodiversity is under extreme pressure. The various species of mammals and birds have already been extinct, and many are threatened to be gone. The forest conservation measures are the only hope for revival and protection of these species in which many countries of the continent are working on the positive note.

6.8 GLOSSARY

Afforestation: The process of planting trees, or sowing seeds, in a barren land devoid of any trees to create a forest.
APEC: Asia Pacific Economic Cooperation

Biodiversity: The variety of plant and animal life in the world or in a particular habitat, a high level of which is usually considered to be important and desirable.

Coniferous: Coniferous trees have needles instead of leaves, they don't change color in the fall, and they use cones instead of flowers to spread their seeds.
Deforestation: The permanent removal of trees to make room for something besides forest.
Deciduous: Deciduous trees have broad leaves that change colour in the fall and spread their seeds using flowers.
Forest Right Bill: An Act in India to recognize and vest the forest rights and occupation in forest land in forest dwelling Scheduled Tribes and other traditional forest dwellers who have been residing in such forests for generations.
Hotspot: Hotspot of biodiversity hotspot is a biogeographic region with significant levels of biodiversity that is threatened by human habitation.
Silviculture: The practice of controlling the growth, composition/structure, and quality of forests to meet values and needs, specifically timber production.
Steppes: An ecoregion characterized by grassland plains without trees apart from those near rivers and lakes.
Temperate: It occurs in the middle latitudes, which span between the tropics and the polar regions of Earth.
Tropical: The region surrounding the equator.

6.9 ANSWER TO CHEK YOUR PROGRESS

1. Which region of Asia has the highest annual deforestation rate in the world? _____.
2. What are the main targets of NFCP in China?
3. When is Forest Conservation Act passed in India? _____.

4. Tropical Wet Evergreen Forests are found in the regions with precipitation more than _____.
5. Name any three countries of Asia where Tropical Deciduous Forests are found.
   (i)_____ (ii) _____ (iii) _____.
6. What is the general latitudinal range of Mixed Temperate Forests in Asia?
   _____.
7. Name any three trees of Temperate Dry Evergreen Forests in Asia.
   (i)_____ (ii) _____ (iii) _____
8. Name three countries of Asia with maximum forest area in percentage within its total land area.
   (i)_____ (ii) _____ (iii) _____.

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6.11 SUGGESTED READINGS

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- Geography of Asia by Tirtha Ranjit
- Regreening the Bare Hills: Tropical Forest Restoration in the Asia-Pacific Region by David Lamb

6.12 TERMINAL QUESTIONS

1. Explain in brief the major forest types found in Asia.
2. What are the major forest conservation measure being practiced in Asia?
3. What are monsoon forests? Give their distribution in Asia.
4. Give a brief description of Tropical Evergreen forests in Asia.
5. Where are the steppes found in Asia?

BLOCK- 3 POPULATION & SETTLEMENT

UNIT 7 : POPULATION: GROWTHS, DISTRIBUTION & DENSITY

7.1 OBJECTIVES

•To understand the concept of Population Growths.
•To understand and discuss Distribution of Population & Factors influencing the distribution of population.
•To know the meaning of density of population and distribution pattern
•To know the population composition in reference to sex ration and occupational with suitable example.

7.2 INTRODUCTION

Population growths, distribution and density are one of the most important topics of Geography of Asia. It is significantly important, because man has brought tremendous change over the earth surface. At present, man is the single most important powerful geographical factor transforming the earth surface at an unparalleled pace. Scientific and technological achievements of man have reached dizzy heights and nothing now seems to be beyond his reach. Man has walked on the surface of the moon. Scientists are at the threshold of achieving superconductivity, which will usher in revolutionary changes in global civilization. Man has tools to change the climatic conditions. Man's scientific advancement has resulted into acid rain, global warming, atmospheric pollution, ozone depletion, ecosystem across the world. The study of human population and its spatial patterns are thus of vital importance.

The objectives of the unit point out that in succeeding study, we will discuss the population growth, distribution of population and factors affecting it, density of population and distribution pattern, sex ration and occupational composition of population.

7.3 POPULATION GROWTHS

The term indicates that population growth is the increase in the number of individual's population in particular area. Increase in the number of people that reside in a country, state or city. To determine whether there has been population growth, the following formula is used: (birth rate + immigration) – (death rate + emigration). Businesses and governmental bodies use this information to make determination about investing in certain communities or regions. Global population growth amounts to around 83 million annually, or 1.1 % per year. The global population has grown from 1 billion in 1800 to 7.6 billion in 2017.

Population Growth Rate

The "population growth rate" is the rate at which the number of individuals in a population increases in a given time period, expressed as a fraction of the initial population. Specifically, population growth rate refers to the change in population over a unit time period, often expressed as a percentage of the number of individuals in the population at the beginning of that period. This can be written as the formula, valid for a sufficiently small time interval. Population growth has three responsible factors for population change.

Birth Rate: If the births exceed deaths, within a given year there will be a net population **increase.**

Death rate: If the death exceeds births, within a given year there will be a net population decrease.

Migration: The permanent or semi-permanent change of a person's place of residence is called migration. Immigration increases population of a place whereas emigration decreases population of a place.

Trends of population growth in the world

In the early stages of the development (before 1 A.D) the birth and death rate was small therefore the size of population was also small. The world population was below 300 million. In the 16th and 17th centuries the population growth was rapid. It was due to expanding world trade. The world population increased to 1 billion. In 18th century after Industrial revolution world population increased rapidly and by 1930 it reached 2 billion. In 19th century due to scientific and technological advancements in transportation, sanitation, medical advancements and introduction of biotechnology the world population grew very rapidly, the world population reached 3 billion. Since last four decades the world population has increased rapidly and it was about 6 billion in 2000. The trend of population growth in the world from 1955 to 2018 is clearer by the following table.

Table 7.1 Trends of population growth in the world, 1955 to 2018

Year (July 1)	**Population**	**Yearly % Change**	**Yearly Change**
2018	7,632,819,325	1.09 %	82,557,224
2017	7,550,262,101	1.12 %	83,297,821

2016	7,466,964,280	1.14 %	83,955,460
2015	7,383,008,820	1.19 %	84,967,932
2010	6,958,169,159	1.24 %	83,201,955
2005	6,542,159,383	1.26 %	79,430,479
2000	6,145,006,989	1.33 %	78,706,515
1995	5,751,474,416	1.53 %	84,106,191
1990	5,330,943,460	1.81 %	91,432,333
1985	4,873,781,796	1.80 %	83,074,052
1980	4,458,411,534	1.79 %	75,864,867
1975	4,079,087,198	1.97 %	75,701,910
1970	3,700,577,650	2.07 %	72,196,992
1965	3,339,592,688	1.94 %	61,276,032
1960	3,033,212,527	1.82 %	52,193,998
1955	2,772,242,535	1.80 %	47,193,563

Source: Worldometers

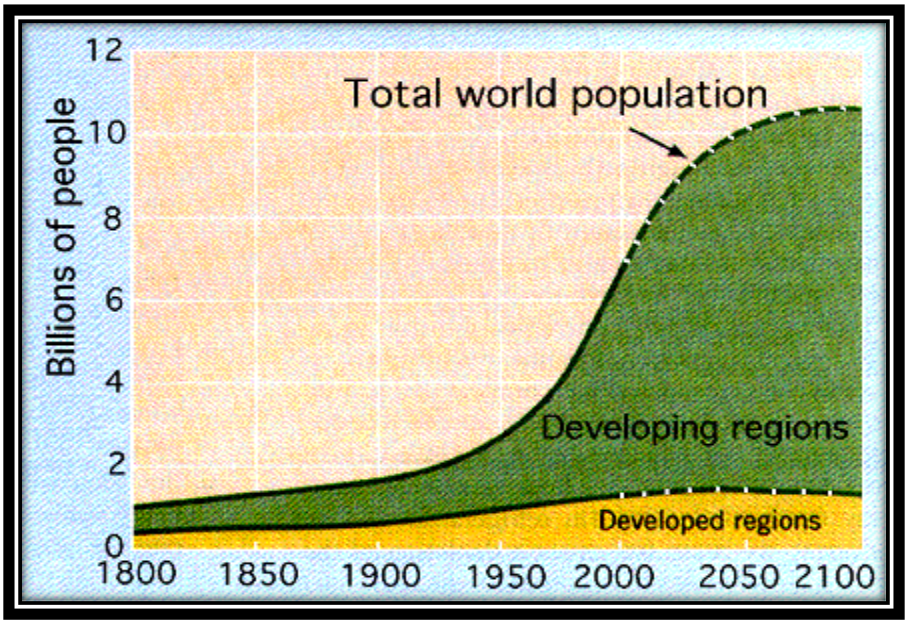
The table tells that 2018 has world lowest growth rate with 1.09 % whereas year 1970, consists 2.07 % the lowest population growth. The percentage of population growth is continuous increasing from 1955 to 1990 but after 1995 the increasing rate gradually fall down. There are difference between the growth rate of developed countries, developing and underdeveloped countries. The develop countries has very low or sometimes negative growth rate whereas on the other hand developing and underdeveloped countries are facing the problem of high and very high growth rate.

Thus we can say that the world's population is growing very rapidly. In 1800 the world's population reached 1 billion. In 1990 it reached 6 billion people (Fig.7.1). This rapid growth in population has been called a population explosion. The major reasons for population change,

whether in an individual country or for the whole world, is the change in birth and death rates. The birth rate is the number of live babies born in a year for every 1000 people in the total population. Death rates are number of people dying per 1000 people. When birth rates are higher than death rates, the population of an area will increase.

Over the past 150 years improvements in health care and sanitation around the world have led to a drop in the death rate. While birth rates have dropped in MEDCs, (More Economically Developed Countries) birth rates are still high in LEDCs. (Less Economically Developed Countries). Therefore the number of people in the world has grown rapidly. Life expectancy can be used as an indicator of the overall 'health' of a country. From this figure you can also determine many features of a country e.g. standard of living. As a general rule the higher the life expectancy the healthier (or developed) a country (Fig.7.1**)**.

Fig.7.1 Population Growth in the world, 1800 to 2100



Source: Author

Demographic Transition Theory

This theory describes and predicts the future population of any area. The theory explain that population of any region changes from high births and high deaths to low births and low deaths as society progresses from rural agricultural and illiterates to urban industrial and literate society. These changes occur in stages which are collectively known as the demographic cycle. As a country changes from a rural society into an urban society there are changes in its demographic trends. These changes are represented in three stages, these are:

Primitive Demographic growth: a. in this stage the birth and death rates are high because people reproduce more to compensate for the deaths due to epidemics and variable food supply. b. Life expectancy is low. c. The population growth rate is slow. d. Most of the people are engaged in agriculture where large families are an asset. e. People are mostly illiterate and have low levels of technology. f. Two hundred years ago all the countries of the world were in this stage. It is basically found in primitive agriculture dominated countries.

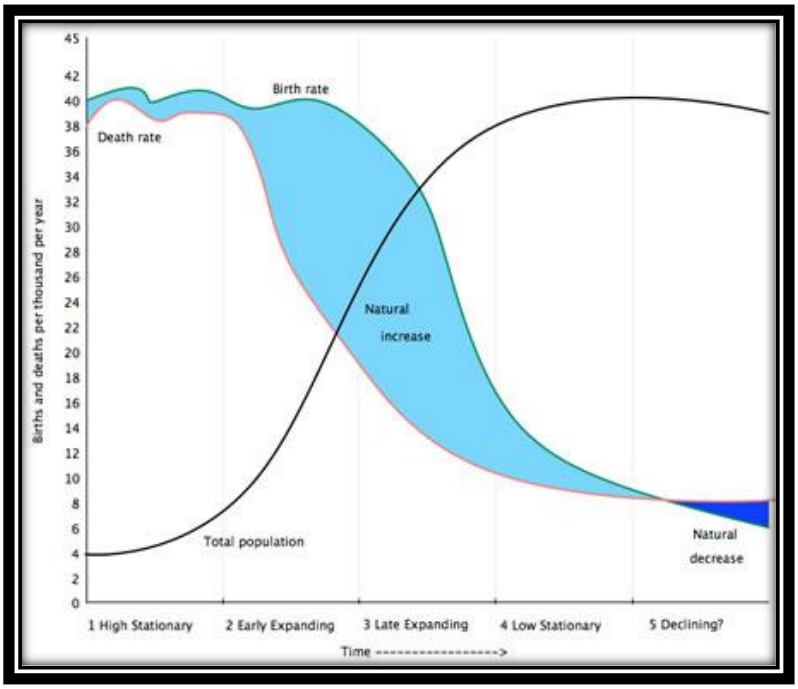
Expanding or youthful demographic: a. in this stage birth rate remains high. b. Death rate decline due to technological advancements in health and improvements in sanitation conditions. c. Because of this gap between death and birth rate the net addition to population is high and the population growth is rapid.

Late expanding demographic: a. in this stage the birth and death rates declines. b. The population becomes urbanized, literate and has high technical knowhow and deliberately controls the family size. c. The population is either stable or grows slowly.

The Demographic Transition Model

The Demographic Transition Model attempts to show how population changes as a country develops. The model is divided into four stages (Fig.7.2).

Fig.7.2 The Demographic Transition Model



Source: Author

Stage:1
Birth rate and death rate are high - low natural increase - low total population

Stag:2
Birth rate is high - death rate is falling - high natural increase (population growth

Stage:3

Falling birth rate - low death rate - high natural increase (population growth)

Stage:4
Birth rate and death rate is low - low natural increase - high total population

The Demographic Transition Model does not take into account migration.

Consequences of both the population growth and population decline

Population change whether negative or positive is taken seriously. **Population decline results:** a. Negative growth in population indicates that resources that supported a population have become insufficient to maintain the population. b. Under negative growth the basic structure of the society may become unstable. c. In developed countries government is taking steps to increase population by tax exemption, accepting immigrants. **Population growth results:** d. Positive growth shows prosperity and progress of a country. e. Positive growth may become problem after a level when the land and other important resources become insufficient. f. Growing population put pressure on existing resources and problems of environmental degradation and pollution become common. g. Government takes steps to control the population increase.

Malthusian theory of population growth

Thomas Malthus was an English clergyman the book 'An Essay on the Principle of Population 'was first published anonymously in 1798, but the author was soon identified as Thomas Robert Malthus. The book predicted a grim future, as population would increase geometrically, doubling every 25 years, but food production would only grow arithmetically, which would result in famine and starvation, unless births were controlled. Malthus regarded ideals of future improvement in the lot of humanity with skepticism, considering that throughout history a segment of every human population seemed relegated to poverty. He explained this phenomenon by arguing that population growth generally expanded in times and in regions of plenty until the size of the population relative to the primary resources caused distress:

"Yet in all societies, even those that are most vicious, the tendency to a virtuous attachment is so strong, that there is a constant effort towards an increase of population. This constant effort as

constantly tends to subject the lower classes of the society to distress and to prevent any great permanent amelioration of their condition".

Proposed solutions

Malthus argued that two types of checks hold population within resource limits: positive checks, which raise the death rate; and preventive ones, which lower the birth rate. The positive checks include hunger, disease and war; the preventive checks, abortion, birth control. Malthus argued against a variety of imaginable solutions. For example, he satirically criticized the notion that agricultural improvements could expand without limit.

7.3 DISTRIBUTION OF POPULATION & FACTORS OF THE DISTRIBUTION OF POPULATION

Population distribution is the spread of people across the world.. The term refers to the arrangement or spread of people living in a given area and includes how the population of an area is arranged according to variables, such as age, race or sex. In terms of continents and countries the world's population is very ill – balanced. More than half of world's people live in Asia (excluding the USSR) which accounts for only one-fifth of the world's land area, while North, Central and South America together, occupying more than a quarter of the land surface, have only one-seventh of the population. The African continent also accounts for a quarter of the land surface but has just over one tenth of the world population. On the other hand Europe, its area is only tenth of the world population. On the other hand Europe, the area only with one twenty-fifth of the total, has about one-ninth of the world's people.

The distribution within the continents is also uneven. In Asia, China, alone, with more than 1000 million people, accounts for half the Asian and a quarter of the world population. The Indian subcontinent has a further 1000 million people. In Europe too, the population is unevenly distributed. Russia is the largest country in the world and has 144 million people, according to 2016, but only 8 people per square km. In Africa and the Americas people are for the most part spread very thinly across the land, leaving large sections such as northern Canada, south-western USA, the Sahara desert, and the Amazon forests practically uninhabited.

Table 7.2 Population distributions in different continents, year 2017.

Region	**Population (2017)**	**Yearly Change**	**Net Change**	**Density (P/Km²)**	**Land Area (Km²)**		
Asia	4,504,428,373	0.94 %	41,751,642	145	31,033,131		

Africa	1,256,268,025	2.55 %	31,187,515	42	29,648,481		
Europe	742,073,853	0.08 %	626,695	34	22,134,900		
Latin America	645,593,253	1.02 %	6,544,614	32	20,139,378		
Northern America	361,207,811	0.73 %	2,614,001	19	18,651,660		
Oceania	40,690,786	1.43 %	573,354	5	8,486,460		

The table (7.2), tells that population distributions are very low in economically develop continents like Europe, North and South American continents and very high in other continents as Asia, Africa. Broadly, 90 per cent of the world population lives in about 10 per cent of its land area. The 10 most populous countries of the world contribute about 60 per cent of the world's population. Of these 10 countries, 6 are located in Asia (China, India, Indonesia, Pakistan, Bangladesh, and Japan).

Factors influencing the distribution of population

The unevenness in the distribution of world population may be attributed to the following factors given in the (table 7.3).

‘

Table7.3: Factors influencing the distribution of population

Physical Factors	Highly Populated Areas	Low Populated Areas
Relief (shape and height of land)	Low land which is flat e.g. Ganges Valley in India	High land that is mountainous e.g. Himalayas
Resources	Areas rich in resources (e.g. coal, oil, wood, fishing etc.) tend to densely populated e.g. Western Europe	Areas with few resources tend to be sparsely populated e.g. Hill region of Himalayas
Climate	Areas with temperate climates tend to be densely populated as there is enough rain and heat to grow crops e.g. UK	Areas with extreme climates of hot and cold tend to be sparsely populated e.g. the Thar Desert and Laddak

Human Factors	High Density	Low Density
Political	Countries with stable governments tend to have a high population density e.g. India, Singapore	Unstable countries tend to have lower population densities as people migrate from e.g. Afghanistan.
Social	Groups of people want to live close to each other for security e.g. Bengali in Bengal, Punjabi in Punjab	Other groups of people prefer to be isolated e.g. Gujjars
Economic	Good job opportunities encourage high population densities, particularly in large cities in Mumbai Greater Noida.	Limited job opportunities cause some areas to be sparsely populated e.g. region of Garhwal and Kumauni in Uttarakhand

Thus we can say that the factors influencing the population distribution are grouped into two categories: Physical factors and human factors and further divided into sub categories. Physical factors include:

Physical factors include:

Availability of water: People prefer to live in areas where fresh water is easily available for drinking, and for cattle, crops, industries and navigation. E.g. it is because of this that river valleys are among the most densely populated areas of the world.

Landforms: People prefer living on flat plains and gentle slopes rather than on mountainous and hilly areas. This is because plain areas are favorable for the production of crops and to build roads and industries. Whereas, the mountainous and hilly areas are unfavorable for the development of transport network, agriculture and industries. E.g. the Ganga plains are among the most densely populated areas of the world while the mountains zones in the Himalayas are barely populated.

Climate*:* Areas with a comfortable climate, where there is not much seasonal variation have high population. Whereas, extreme climates such as very hot or cold, deserts and heavy rainfall are uncomfortable for human living and have low population. E.g. Mediterranean regions were inhabited from early periods in history due to their pleasant climate.

Soils: Fertile soils are important for agricultural and related activities. Therefore, areas which have fertile loamy soils have more people living on them as these can support intensive

agriculture. E.g**.** the Gangatic plain and Nile river plain are densely populated due to the fertile soil.

Human Factors include:

Economic factors

Minerals: Areas with rich mineral deposits attract Mining and industrial activities therefore skilled and semi–skilled workers move to these areas for employment and make them densely populated. E.g. Katanga Zambia copper belt in Africa is one such good example.

Urbanization: People migrate in the cities for better employment opportunities, educational and medical facilities, and better means of transport and communication and good civic amenities. Mega cities of the world continue to attract large number of migrants every year.

Industrialization*:* Industrial belts provide job opportunities and attract large numbers of people. These include not just factory workers but also transport operators, shopkeepers, bank employees, doctors, teachers and other service providers. E.g. the Kobe-Osaka region of Japan is thickly populated because of the presence of a number of industries.

Social and Cultural factors

Religion: Some places attract more people because they have religious or cultural significance. E.g. in USA people of different nationalities prefer their own regions where common culture and traditions are present.

Political factors

Political unrest and wars*:* In the same way – people tend to move away from places where there is social and political unrest. E.g. refugees from Ethiopia, Bangladesh, Sudan, and Sri Lanka have moved out from their own countries.

Government policies: many a time's governments offer incentives to people to live in sparsely populated areas or move away from overcrowded places.

7.5 DENSITY OF POPULATION – DISTRIBUTION PATERNS

Population density

Population density is a measurement of the number of people in an area. It is an average number. Population density is calculated by dividing the number of people by area. Population density is

usually shown as the number of people per square kilometre. For humans, population density is the number of people per unit of area, usually quoted per square kilometer, Commonly this may be calculated for a county, city, country, another territory or the entire world. The world's population is around 7,500,000,000 and Earth's total area (including land and water) is 510,000,000 square kilometers. Therefore, the worldwide population density is around 7,500,000,000 ÷ 510,000,000 = 14.7 per km sq. If only the Earth's land area of 150,000,000 km^2 is taken into account, then population density increases to 50 per km sq. This includes all continental and island land area, including Antarctica. If Antarctica is also excluded, then population density rises to over 55 people per km sq.

Thus, several of the most densely populated territories in the world are city-states, microstates and dependencies. These territories have a relatively small area and a high urbanization level, with an economically specialized city population drawing also on rural resources outside the area, illustrating the difference between high population density and overpopulation. Cities with high population densities are, by some, considered to be overpopulated, though this will depend on factors like quality of housing and infrastructure and access to resources. Most of the most densely populated cities are in Southeast Asia, though Cairo and Lagos in Africa also fall into this category.

Table 7.4 Population density and other concern elements in different continents, 2017.

Region	**Population (2017)**	**Yearly Change**	**Net Change**	**Density (P/Km²)**	**Land Area (Km²)**
Asia	4,504,428,373	0.94 %	41,751,642	145	31,033,131
Africa	1,256,268,025	2.55 %	31,187,515	42	29,648,481
Europe	742,073,853	0.08 %	626,695	34	22,134,900
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Oceania	40,690,786	1.43 %	573,354	5	8,486,460

The table (7.4) tell us that population density is very low in economically develop continents like Europe, North and South American continents. It is very high in other continents as Asia, Africa with most densely populated areas.

There are few methods to calculate the population density among them arithmetic density is the most common way of measuring population density, several other methods have been developed to provide a more accurate measure of population density over a specific area, All these methods with illustration are given below for you:

Arithmetic density: The total number of people / area of land (measured in square kilometers)

Physiological density: The total population / area of arable land

Agricultural density: The total rural population / area of arable land

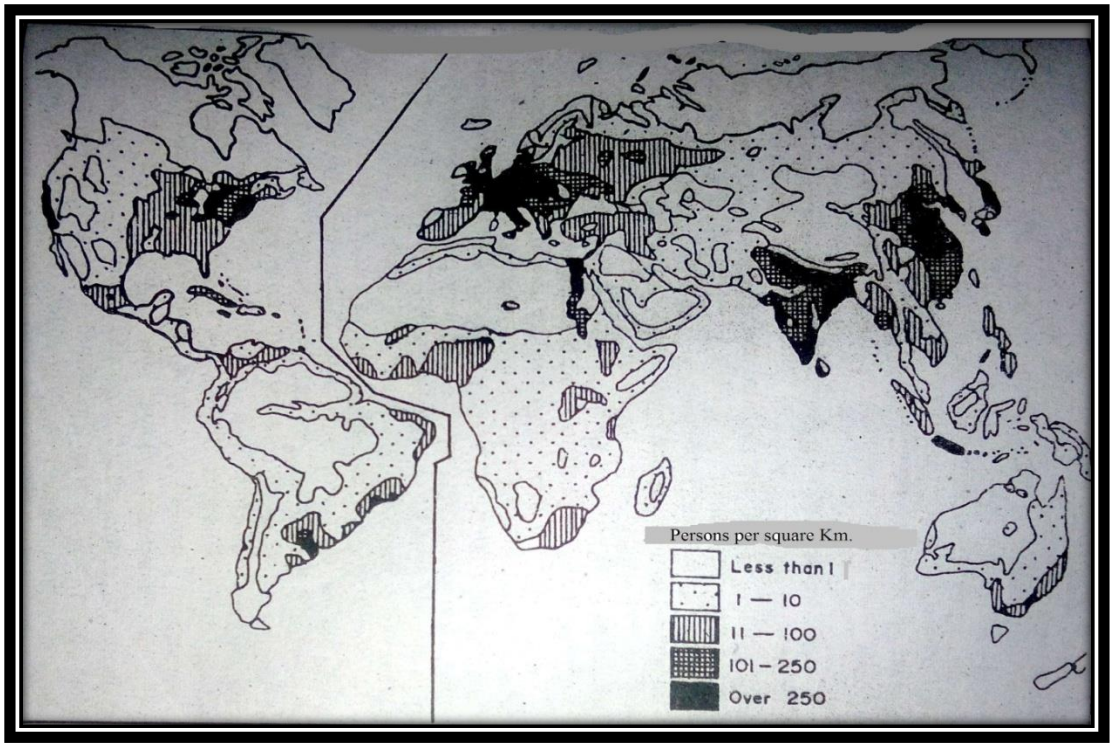
Urban density: The number of people inhabiting an urban area / total area of urban land.

Distribution Pattern

The single most striking fact about the world population is that it is not uniformly distributed. Moreover, the population distribution pattern has continuously changed with space and time. In reality, nearly half of the world population is clustered on just 5 percent of the land. While about 33 percent of the total land area is virtually uninhabited. The spatial distribution of people with its great unevenness is one of the important questions of population geography to study the distribution pattern of world population.

If we examine a map of world population (fig 7.3), it becomes clear that there are certain regions which are densely populated and other areas which are densely populated and other areas which seem to be blank and under populated.

Fig. 7.3 World Population Density



Source: Google

Densely Populated Regions

There are four areas in the world where the average density of population is more than 100 persons per sq. km. These are: 1. East Asia (China, Japan, Korea, and Taiwan).

2. South and Southeast Asia (India, Indonesia, Bangladesh, Pakistan).

3. North-West Europe (UK, France, Germany). 4. The Northeastern Coast of North America.

All these areas of dense population lie in the northern hemisphere and are so placed that more than 75 percent of the world's population is now concentrated between the Tropic of Cancer. Of these, China and the subcontinent of India having large populations from the earliest times. Europe is less ancient, and the USA became densely populated only during the last two hundred years. Except Japan, the population of East and South Asian countries is living mainly in rural areas. The European and American population agglomerations could become large because of certain factors as development of urban areas and also other favorable conditions. Singapore (100%), Belgium (95%), the Netherland (88%),

Scattered Populated Regions

A part from the above described four major regions of dense population, there are isolated and scattered nuclei of dense population. Among these small centers of dense populations, the deltas of Melong, Menam, and Irrawaddy rivers as well as the Indonasiean island of Java are important.

Sparsely Populated Regions

As it is previously point out that, over 70 percent of the land surface is sparsely populated. In general, the hot, cold, arid and mountainous areas are sparsely populated. All the sparsely populated areas have an irregular and sporadic type of settlement. In these regions, large areas remain uninhabited, whereas relatively small areas are habited with people. Sparsely populated regions may be classified under the following categories:

Deserts, and semi- arid areas, The polar caps (Tundra and Antarctica), The lofty and rugged mountains, The Equatorial dense forests.

Thus the individual organisms that make up a population can be more or less equally spaced, dispersed randomly with no predictable pattern, or clustered in group. These are known as uniform, random, and clumped dispersion patterns, respectively. The pattern of places, where people live.

7.6 POPULATION COMPOSITION

In the population studies, the population composition assumes great significance as its attributes like age, sex, marital composition; fertility and mortality have considerable impact

on other demographic and socio-economic characteristics of population, such as growth, migration, working force, dependency burden, occupational pattern, etc.

Let us study two important attributes of population, i.e. sex-ratio and occupational composition.

Sex ratio

Sex Composition of the human population is one of the basic demographic characteristics, which is extremely vital for any meaningful demographic analysis. The sex composition of a population refers to the distribution of the people by sex. Changes in sex composition largely reflect the underlying socio-economic and cultural patterns of a society in different ways. Sex ratio defined here as the number of females per 100 males in the population, is an important social indicator to measure the extent of prevailing equity between males and females in a society and influences directly the incidence of marriage, birth, migration, economic activities, etc. development programs may also have differential impact on male and females quality of life.

Thus the ratio between the number of women and men in the population is called the Sex Ratio. The sex-ratio is balanced in countries where death rate of boys and girls are equal. It has been observed that in European countries, number of females is more than males, thus, Europe has high sex- ratio. Rising sex ratio has been recorded since the early 1980s and has since continued to increase with no signs, so far of reversing. The sex-ratio was recorded as 943 in 2011 which has declined from the 972 as recorded in 1901.

Occupational Composition

The utilization of human resources for the socio-economic progress of a nation through industrial and occupational structure, labour force participation has of immense importance. The proportion of workers engaged in various occupations pictures the socio-economic development of a region. Occupation always related to agriculture, industry and service sectors. Occupation is the kind of work performed by an individual while industry is the branch of economic activity to which he is connected. Occupational gender segregation is said to exist when women and men are differently distributed across occupations regardless of the nature of job allocation. The occupations in India reveal that females are more concentrated than males. This may be due to their preference to remain in their own places even accepting lower jobs. When comparing the occupational structure of each state with that of India. It is found that for males the highest concentration of job score in Delhi followed by Goa and Kerala in 2001 and 2011.

Throughout the region of developing countries, male workers are more than female workers; however, the distribution of population by sex shows that almost equal proportion of both the sexes in all countries. However, females are more into traditional occupations and certain regions of the developing country are still in backward level of development. So, majority of the women's contribution to economic productivity of the region is low. For example, it analyses that even after 60 years of the initiation of Five Year Plans with prioritization on different sectors of the economy, the occupational gender segregation exist in India. Occupational gender wise

integration is a sign of progress which ensures proportionate participation of women in economic activities. So, measures should be taken by the planners and policy makers to absorb more women in modern large enterprises and thereby expand economic development.

Workers are then, classified as main workers and marginal workers. Those who worked for more than 6 months (183 days) in the reference period are termed as main workers. Workers who worked for less than 6 months (183 days) in the reference period are the marginal workers. Workers are distributed according to the occupation in which they are engaged into four broad categories namely, cultivators, agricultural laborers household industrial workers and other workers. If a person engaged in cultivation of land owned or leased from government, private persons or institutions for payment of money, or share of the harvest is classified as cultivators. A person who works on another person's land for wages in money or kind or share is regarded as agricultural laborers. Household industry is defined as an industry conducted by one or more members of the household at home or within the village in rural areas and only within the precincts of the house where the household lives in urban areas. All workers other than those who are not in the above categories are termed as other workers. Thus the study of occupational composition provides way of progress.

7.7 CONCLUSION

Thus we can say that the term "World Population" refers to the human population (the total number of humans currently living) of the world. The current world population is 7.6 billion as of January 2018 according to the most recent United Nations estimates elaborated by World meters. World population is expected to reach 8 billion people in 2023 according to the United Nations (in 2026 according to the U.S. Census Bureau). The "population growth rate" is the rate at which the number of individuals in a population increases in a given time period, expressed as a fraction of the initial population Global human population growth amounts to around 83 million annually, or 1.1 % per year. The global population has grown from 1 billion in 1800 to 7.6 billion in 2017. Population distribution refers to the way people are spaced over the earth's surface. Factors influencing the distribution of population are fertile plains with favorable climate and highly industrialized and urbanized areas are four areas in the world, where density is more than 200 persons per sq. km. These are East Asia, South and Southeast Asia, North-West Europe, and the Northeastern Coast of North America. population density refers to the ratio between numbers of people to the size of land in a country. It is usually measured in persons per sq. km. Population density rises to over 55 people per km^2. However, over half of the Earth's land mass consists of areas inhospitable to human habitation, such as deserts and high mountains, and population tends to cluster around seaports and fresh-water sources. The composition of population includes different attributes as age structure, sex-ratio and occupational structure.

7.8 SUMMARY

The unit comprises four objectives first was population growth it refers to the change in number of people of a territory during a specific period of time. This change may be positive or negative. It is usually expressed in terms of percentage or numbers. The current world population is 7.6 billion as of January 2018 according to the most recent United Nations estimates elaborated by World meters. Population growth is not even in all over the world, with the highest growth rates in Sub-Saharan Africa and the lowest in Europe. For example, from 1950 to 2010, Sub-Saharan African grew over three and a half times, from about 186 million to 856 million. On the other hand, Europe only increased by 35%, from 547 million in 1950 to 738 million in 2010. As a result of these varying population growths, Sub-Saharan Africa changed from 7.4% of world population in 1950 to 12.4% in 2010, while Europe declined from 22% to 11% in the same time period. According to United Nations population statistics, the world population grew by 30%, or 1.6 billion humans, between 1990 and 2010. In number of people the increase was highest in India (350 million) and China (196 million). Second objective was population distribution; the term refers to the way people are spaced over the earth's surface. The distribution of population is uneven in all over the world due to the few factors as verse climatic conditions, undulating surface, lack availability of minerals, disturb political system etc. The population density is the third objective for the unit it refers to the ratio between numbers of people to the size of land in a country. It is usually measured in persons per sq. km. The fourth objective of the unit express that population composition assumes great significance as its attributes like age, sex, marital composition; fertility and mortality have considerable impact on other demographic and socio-economic characteristics of population, such as growth, migration, working force, occupational pattern, etc. Sex ratio defined as the number of females per 100 males in the population, it is an important social indicator. There is balance sex-ratio in develop countries wheras not balanced in developing and underdeveloped countries. The utilization of human resources for the socio-economic progress of a nation through industrial and occupational structure, labour force participation has of immense importance.

7.9 GLOSSARY

- **Population growth:** Population growth refers to the change to the change in number of people of a territory during a specific period of time.
- **Population distribution:** Population distribution refers to the ratio between numbers of people to the size of land in a country.
- **Population density:** Population density is a measurement of the number of people in an area or the ratio between numbers of people to the size of land in a country.
- **Residential density:** The number of people living in an urban area / area of residential

- **Agricultural density:** The total rural population / area of arable land
- **Physiological density:** The total population / area of arable land
- **Arithmetic density:** The total number of people / area of land
- **Population explosion:** The rapid growth in population has been called a population explosion.

7.10 ANSWER TO CHECK YOUR PROGRESS

Q. 1 Explain three factors responsible for population growth in the world.
Q.2 Describe the trends in the population growth in the world.
Q.3 Describe the three-stage model of Demographic Transition Theory.
Q.4 What do you understand by Population distribution?
Q. 5 What are sparsely populated area?
Q.6 Mention four areas of high density of population in the world.
Q.7 Mention different areas of low density of population in the world.

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7.13 TERMINAL QUESTIONS

Q.1 Define the terms Population density.
Q. 2 What do you understand by Population distribution?
Q. 3 Define the terms Population growth.
Q.4 What is population explosion?

UNIT 8 : SETTLEMENT TYPES & PATTERN

8.1 OBJECTIVES

After reading this unit, you will be able to:
Understand the concept of types of settlement;
Analyses and discuss pattern of settlement.

8.1 INTRODUCTION

The first requirement of dwelling is that to provide shelter against the more serious environmental stresses. The nature and the intensity of these stresses vary from place to place so the settlement types and patterns are also varying to each other. The study of settlement is basic topic to regional geography because the form of settlement in any particular region reflects Man's relationship with the environment. According to F.S. Hudson "Purposeful occupation of a land portion with the object of living is called human settlement." Sir C. A. Dioxides also define the term as "Human settlement includes very temporary-settlements (where the ground has simply been leveled enough for a night's sleep), semi- permanent settlement (from nomadic tents to space ships) and permanent settlement (from very small to enormous one)". Thus human settlements are organized groupings of human habitation. Two types of settlements are urban, which are densely populated, and rural, which are sparsely settlements. Both types of settlements have gradually grown up with the passage of time in different way and geometrical design. These different ways of settlements are known as settlement patterns. According to Geographers settlement is "The science of human settlements, including city or community planning and designing." Thus it is interesting to study different types and patterns of rural settlements as well as factors affecting them. The detail description about settlement types and patterns are here:

8.3 TYPES OF SETTLEMENT

There are endless varieties of settlements on the basis of different factors but the most obvious type is into towns and villages. This is not merely a matter of size. In some areas of dense population villages may be very large, e.g. in China villages may house several thousand people. On the other hand, towns may be very small, smaller than many villages for example in Germany some small towns may only have a population of several hundred. The basic difference between towns and villages is that in towns the chief occupation of the people is engaged in agricultural work. Some other occupation of the people is trade or industry of one kind or another while in villages most of the people are engaged in agricultural activities. Some other occupations are found in villages such as fishing, lumbering or mining (primary activities). Sometimes such villages can be distinguished from towns with similar occupations by the smaller scale of their

operations, the lack of a commercial or shopping center and by their lack of industries.

SETTLEMENT PATTERN

Settlement pattern is the way the settlement is arranged. It is the physical appearance of the settlement. Most of the settlement patterns are formed along the culture and physical feature like roads,
is the only pattern that is composed of more than one settlement pattern. A nodal settlement pattern typically includes a city with a compact settlement pattern in the center and a nearby sub-urban area with an ordered settlement pattern that surrounds the city. Together, these two patterns railways, around water bodies, flat lands and any other. Hence a settlement pattern is the way a population disperses over a particular area. Settlement patterns are defined by size, shape and population size. Topography and climate are the two major influences on settlement patterns.
Linear settlement, scattered settlement, compact settlement and ordered settlement are the most common settlement patterns. Linear settlements occur along major highways or rivers, and are long and narrow in shape. Scattered settlement patterns are common in rural areas. This pattern occurs when homes are located significant distances apart, and there is no central cluster of homes or businesses. Compact settlement patterns are most often found in cities. Despite the name, compact settlements can be very large if the population is concentrated in one area, ordered settlement patterns occur when homes are designed on a grid pattern. Most sub-urban areas are examples of ordered settlement patterns.
A nodal settlement pattern form a nodal settlement pattern. So it is clear that a settlement pattern refers to the way that buildings and houses are distributed in a rural and urban settlement. Settlement patterns are of interest to geographers, historians, and anthropologists for the insight they offer in how a community has developed over time.
Two types of settlements are urban, which are densely populated, and rural, which are sparsely populated. The detail about types of settlement with pattern and factors responsible for its developments are given below:

RURAL SETTLEMENT

Rural settlements are an important aspect of settlement and human Geography, because they show the complex relationship of human occupancies of land and the environment. According to Enayat Ahmad (1965) ‘type’ mean the characteristics grouping of rural dwellings in that well defined parcel of ground which is known as ‘Mauza’, but this definition is useful only in local consideration. In a regional framework the term type indicates ‘the relationship between settlements within the space’ (Doxiadis, 1968). M. Aurrousseau (1920) expressed it as ‘arrangement of rural settlements as geographical entities to express the grouping of dwellings and their interrelationship’. These rural settlements are comparatively small and simple agglomeration at favorable and convenient site, primarily influenced by environmental factors

and later on by socioeconomic development of human groups. Generally every settlement is different from the other, but with some generalization, it is possible to classify them into many groups. Thus it is interesting to study different types and patterns of rural settlements as well as factors affecting them.

Thus the people living in the rural areas, all over the world, are engaged and dependent on various primary occupations, viz., agriculture, dairying, cattle keeping, fisheries, forestry and mining. Out of these, agricultural is the most important occupation. Consequently, the functions of most of the peoples of rural settlements are generally agricultural. A part from cultivation of crops and domestication of animals, the rural settlements also perform other functions as religious, social judicial etc.

Characteristics of Rural Settlement

• In the form of village, surrounded by farms With Small population.
• Occupation such as forestry, farming, fishing mining, tourism.
• Service provided is in limited range and mostly for every day needs.
• Close knit communities and the atmosphere is quiet.
• Dominance of community feeling.

Rural Advantages

• More natural environment.
• Better social/support network.
• Less stressful environment.
• Perceived as safer.
• Class differences are not as distinctive.

Rural Disadvantages

• Limited transportation available.
• Social network can lead to strain (in the case of small town gossip).
• Limited employment opportunities.
• Slower social, political progress.
• Less immediately available social services.

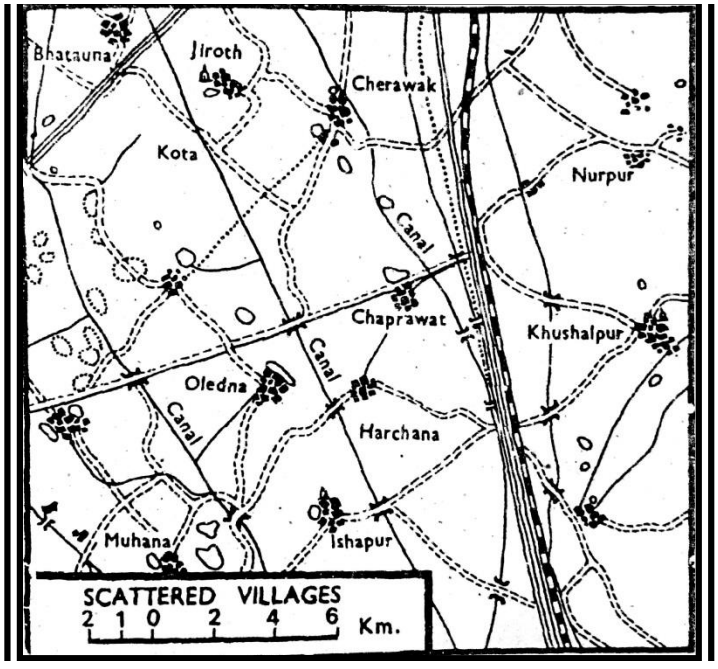
Factors affecting the types of rural settlement

There are two factors, physical and cultural, responsible for various settlement types in rural areas. They are also known as agglomerating factors. In physical factors relief, fertility of soil, amount of rainfall, dry land and defense are included, while in cultural factors landuse, land tenure, cropping pattern, and caste system, social relationships and means of transportation are included. The compact farm villages are common features of great fertile river valley plains. Similarly in flood affected area, few elevated sites are also having compact settlements. Settlements are generally found near water bodies. Availability of different sources of water gives rise to compact settlements. In low water table area where the construction of wells is costly, settlements around these wells are compact. However in the high water table area where

wells can be dug easily, hamlets, semi-compact settlements are commonly found. On uniform relief, the settlements tended to concentrate in compact form, while in rugged land dispersed settlements are found. Also in the areas of harsh climate and infertile soil dispersed settlements are more common. Cultural factors such as land tenure system of agriculture, peaceful conditions, and social customs in relation to untouchable give rise to dispersion. Rail road network attract the settlers to settle in dispersed manner. Similarly modern technology, developments in agricultural, political or administrative decisions, religious or social conditions are also important in the study of settlement types. The settlements of a region may be classified on the basis of their size, shape, time and function. Rural settlements are usually classified into two extreme types i.e. compact and dispersed with number of intermediate stages. In the former settlement type, houses are piled at one place or well-knit along streets while in the latter every family residence remains scattered in the village in association with its respective form. The causes of agglomeration are related to concentration of water point, types of agriculture, means of transportation, economic activity. Most of the world's settlements are rural and they are stable and permanent. They are of three types:

Dispersed Settlements or Isolated Settlement Type: The settlement is characterized by units of small size which may consist of a single house to a small group of houses. It varies from two to seven huts. Therefore, in this type, hamlets are scattered over a vast area and does not have

Figure 8.1: Dispersed Villages in Punjab Doab



Source: Text book

any specific pattern. Such type of settlements are found in tribal areas of central part of Indiacovering Chhota Nagpur plateau, Madhya Pradesh, Rajasthan,in the hills of north Bengal,Jammu & Kashmir, Punjab Doab region,(fig. 8.1) Tamil Nadu and Kerala.

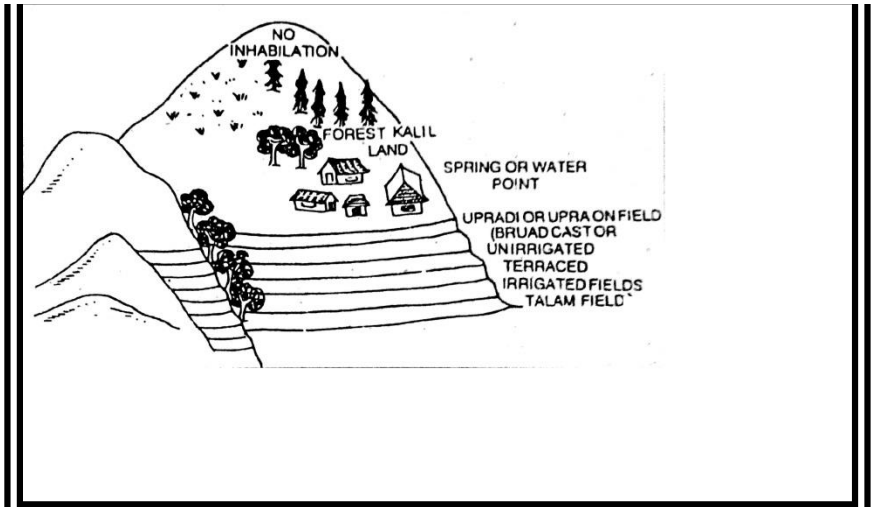
Compact/Clustered/Nucleated Settlement Type: These settlements have closely built up area. Therefore in such settlements all the dwellings are concentrated in one central sites and these inhabited area is distinct and separated from the farms and pastures. These settlements are distributed over the entire northern Indo-Ganga plain (from Punjab in the north-west to West Bengal in the east), Orissa coast, basins of Mahanadi in Chhattisgarh, coastal areas of Andhra Pradesh, cauvery delta of Tamil Nadu, Maidaus of Karnataka, lower Assam and Tripura, in the valleys of Siwaliks etc. Such settlements generally range from a cluster of about thirty to hundreds of dwelling of different forms, size and functions.

Semi- Compact Settlement Types: The dwellings or houses are not well-knitted. Such settlements are characterized by a small but compact nuclear around which hamlets are dispersed. It covers more area than the compact settlements. These settlements are found both in plains and plateaus depending upon the environmental conditions prevailing in that area. Such settlements are situated along streams in Manipur Mandla and Balaghat districts of Madhya Pradesh, and Rajgarh district of Chhattisgarh.

Pattern of Rural Settlements

The rural settlements have different shapes and sizes. The site of the village, and the surrounding topography and terrain influence the shape and size of a village. In fact, the pattern of rural settlement is the result of a series of adjustments to the environment which have been going on for centuries. In the valleys (fig.8.3) and the mountainous areas the pattern of settlement is generally linear for example the settlements patterns on southern slopes of Himalaya (fig.8.2). while in the fertile plains their shapes may be rectangular; near the lakes and ponds the settlements are of circular or semi-circular type, and at the cross roads, the shape may rectangular, circular, or triangular. In exceptional cases the settlement pattern resembles to nebular form and on the river meander semi- circular pattern develops. The rural settlements may be broadly classified under the following patterns:

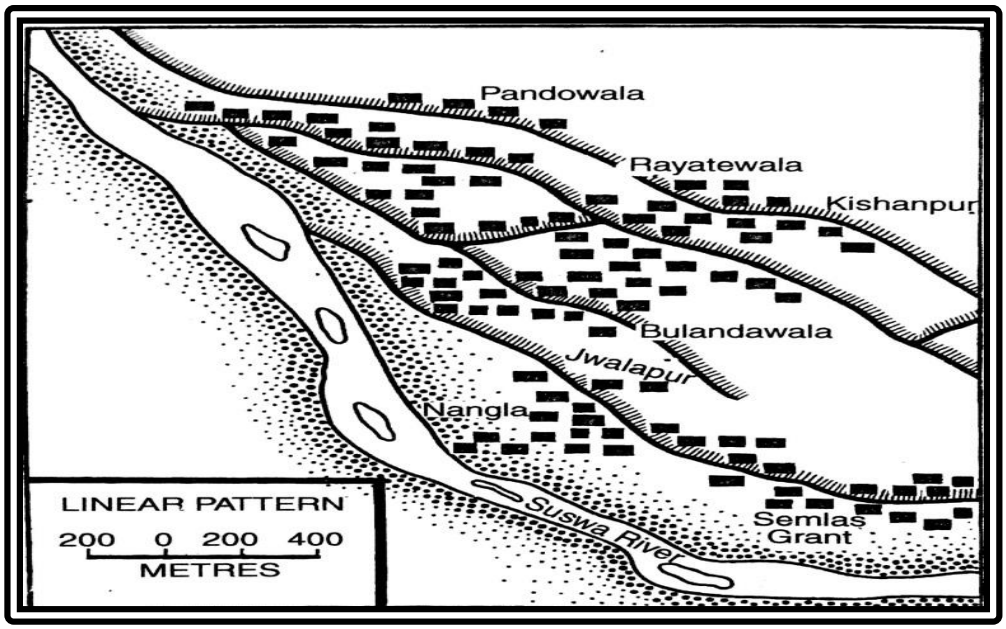
Figure 8.2: Settlements Patterns on Southern Slopes of Himalaya



Source: Text book

Linear Pattern: It is commonly found along main roads, railways, streams, etc. It may have a single row of houses arranged along the main artery. For example rural settlements found along the sea coast, river valley (fig. 8.3, doon valley), mountain ranges etc.

Figure 8.3: Linear Pattern- along with Suswa River (Doon valley)



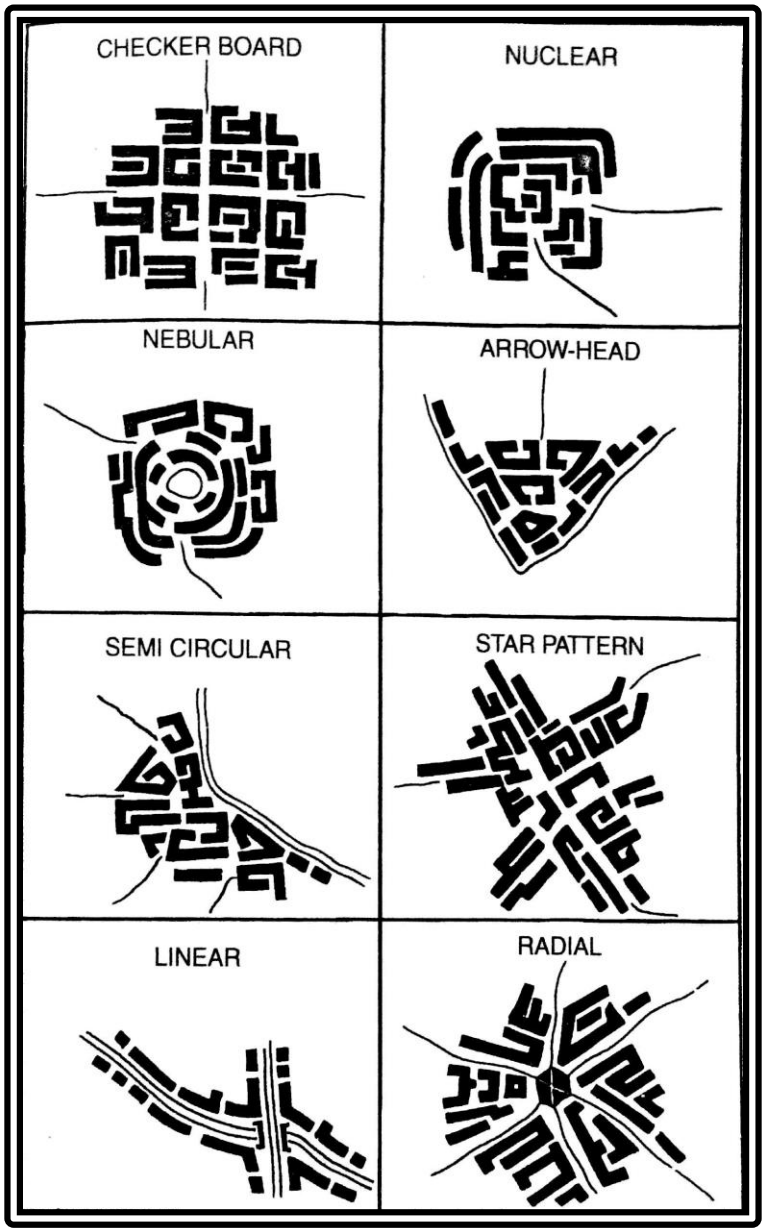
Source: Text book

Rectangular Pattern: This is a very common type which develops around the rectangular shape of agricultural fields as it is common to find a system of land measurement based on square

units. Village paths and cart tracks also confirm to the rectangular field patterns and run through the village in north-south and east-west directions. Accessibility to farms and fields and connectivity to other settlements lead to rectangular shape of settlements. The settlements of coastal Maharashtra and Andhra Pradesh and either side of Aravali hills, etc. are the examples.

Square Pattern: This is basically a variant of rectangular type. Such a pattern is associated with villages lying at the crossing of cart tracks or roads and also related to features restricting the extension of the village outside a square space. These features may include an old boundary wall, thick orchards, a road or a pond.

Figure 8.4: Main Patterns of Rural Settlements

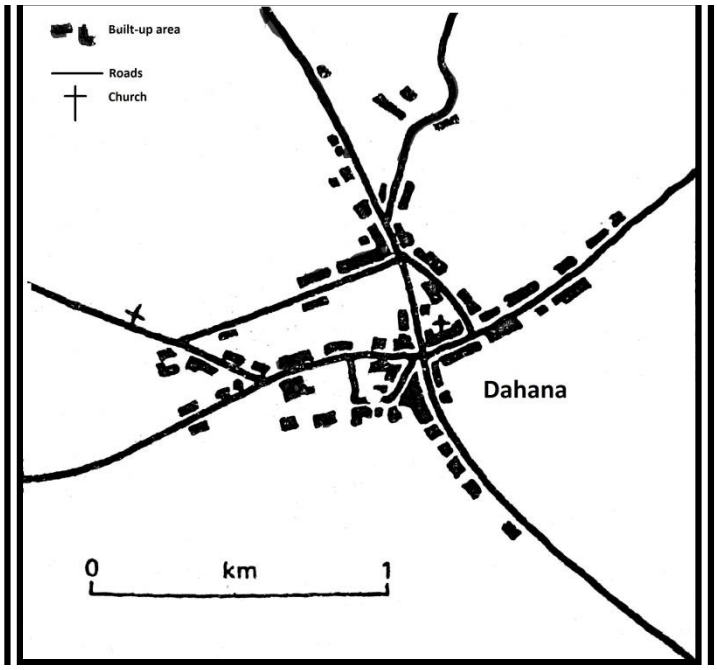


Source: Text book

Circular Pattern: In the upper Doab and Trans – Yamuna districts, Malwa region, Punjab and Gujarat, large villages are characterized by a very high degree of compactness. The outer walls of dwellings adjoin each other and present a continuous front so that when viewed from outside, the
Villages look like a walled and fortified enclosure pierced by a few openings. The round form was a natural outcome of maximum aggregation for the purpose of defense during the past.

Star Like Pattern: the star like settlements develop on the sites and places where several metalled or unmetalled roads converge. In the star shaped settlement, houses spread out along the sides of roads in all direction. This pattern is common to both villages and towns and is caused mostly by new development, spreading out along the major roads. This type of settlement is the characteristic of the countryside of plains of Ganga, U.P (fig. 8.5), Punjab and the Sutlej-Yamuna plains.

Figure 8.5 : Star- shaped village in U.P



Source: Text book

Radial Pattern: In this type, a number of streets converge on one center which may be a source of water (pond, well), a temple or mosque, a center of commercial activity or simply an open space. Thus, the streets seem to be radiating from a common center. Examples are settlements near Gurushikar, Mount Abu in Rajasthan, Vindhyachal in Uttar Pradesh, etc.

Checker Board Pattern: This is a type of settlement found generally at the junction of two roads. The village streets meet each other at an angle or are parallel to each other. This pattern is common in the northern plains.

Fan Shaped Pattern: This is seen where some focal points or line is situated at one end of the village. A focal object may be a tank a riverside, a road, an orchard, a well or even a place of worship. Such patterns are common in the delta region where the dwellings simply follow the fan shaped profile of the delta as in the case of Mahanadi, Godavari, Krishna, Cauvery, Himalyan foothills.

Nebular Pattern: When the shape of a settlement resembles to nebula. It is known as a nebular settlement. The arrangement of roads is almost circular which ends at the central location or the nucleus of the settlement. Generally, the size of nebular settlement is small and they develop around the house of the main landlord of the village or around the mosque, temple or church. There are several villages of this type in the Ganga- Yamuna doab.

Semi- circular pattern: The semi-circular pattern develops along the bend of streams and crescent shaped meanders. On the arcuate bends of river meanders, a special form of settlement known as horse shoe pattern. Villages of Ganga, Yamuna, and Son are the example of such pattern.

Arrow pattern: This pattern of rural settlement is found near cape or meanders of river. Here the number of houses is increases towards outwards from inner side. The examples of such pattern are the villages of Bay of Khambat, cape of Kanyakumari, Sonar River in Madhya Pradesh etc.

Now the patterns of rural settlements are clear with examples. So in further description we will discuss the urban settlement.

Urban settlement

An Urban settlement is a concentrated settlement that constitutes or is part of an urban area. It is an area with high density of human-created structures. According to R.E. Dickinson “Functions are the driving force of city life, and influences to a very large extent its growth and morphology.” the development of urban area is depend on the non-primary activities practices in the city. So the majority of people are engage in non-rural activity. They work in office, shops and factories, operate machinery, and provide health care or other services. Urban settlement can be small like 1000 people or can be as large as Tokyo-Yokohama in Japan with over 30million people. The urban settlements are differentiated from the rural settlements on the basis of certain characteristics, such as the size and density of population, economic basis, administrative basis, and the number and quality of public utility services.

Characteristics of Urban Settlement

Large cities and towns, dense population and tertiary occupation are few important characteristics of urban settlement. So majority of higher paying jobs/careers develop

transportation and communication facilities, develop infrastructure, hospitals, colleges, universities, market etc. are advantages of urban settlement. Pollution, crime etc. are few disadvantages of it.

• In the form of towns and cities.
• They are large, both in population and area.
• Has functions such as business, manufacturing, government cultural center.
• Wide range of services offered including specialized service.
• Traffic and pollution problem.
• Health Medical clinic Hospital Education centers as University, Shopping General store, market Shopping mall Finance Moneylender, co-operative National bank Transport Bus service Airport.

Urban Advantages

• Services: Proximity to major and varied services.
• Employment: Majority of higher paying jobs/careers are found there.
• Current: art, fashions, politics, and higher culture.
• Multi-cultural (which I personally see as a plus).
• Transportation: Mass transit, buses, taxis etc.

Urban Disadvantages

• More crime.
•Pollution: more people, more waste, more noise, less trees and nature...etc.
• Impersonal and sometimes isolating.

The general factors that affect urban settlement patterns

1) The kind of resources found in the area. Mineral, precious metals and energy resources have helped in the development of towns. The most obvious example of resource based towns are the mining towns and fishing ports.
2) The transportation methods available at the time of settlement. There is not even a single town in the towns are the creation of the routes. The traders stay in the night at a convenient point which leads to the development of small town. The stopping places along the main roads in the past were marked by inns and shops, round which sometimes development the houses of artisans, carpenters and serviceman. Jodhpur, Bikaner, Jaisalmer (India) are some of the examples of towns which developed along the cross-roads in deserts. Whereas many modern towns have developed at big railway junctions. The railway junctions of Mughalsarai (U.P.), Siliguri (West Bengal) are the examples of railway towns.
3) The role played by the government policy. There are so many facilities provided by govt. in capital cities so the compact settlement type develop in cities.
4) The navigable rivers also helped in the origin and development of towns. In the past rivers had been the important routes of trade and many of them like Volga, Hugli, Danube

etc. are still the most busy navigable rivers. In India, the cities of Allahabad, Patna, and Bhagalpur are the example of towns which developed because of navigation and trade through the Ganga.

5) Seaways also afford sites favorable to town growth. The ship converges at certain places along the sea coasts. The straits, in this connection, offer the most ideal positions for the development of towns. The modern towns such as Port-Said, Ismailia and Suez on the Suez Canal and Mumbai, Kolkata are the good example of a town developed because of their location on international trade routes.
6) Mountain crossing by traders and travelers has also helped in the development of towns and cities. At the foothill and near the mountain passes the mode of transportation used to be changed. Jammu, Kalka, Haldwani, Kotdwar are few examples of such towns in India.
7) Towns and cities also develop on attractive places where visitors, tourists and holiday-makers prefer to visit. Hill stations in India as Shimla, Dalhousie, Nainital and Mussorie etc, are the examples of such cities.
8) Religious and Cultural factors also attract the people towards the holy and religious places throughout the history. A site may also be associated with the life of a religious leader, e.g. Jerusalem, Vatican City, Mecca, Medina, Amritsar, Hardwar, and Puri.
9) Educational centers like universities and colleges may also lead to the development of towns and cities. The cities of Oxford and Cambridge in England, Harvard in USA, and Kharagpur (India) are some of the examples.

Types of Urban Settlements

Like rural settlements, urban settlements are classified on various bases. However, classification based on size and functions are most common. Let us discuss them one by one.

Classification based on Population size

According to population size, census of India classifies under centers into six classes. Class wise urban settlements and their population are given below in a table 8.1

Classification of urban settlement

Class	Population
Class I	1, 00,000 and above
Class II	50,000- 99,999
Class III	20,000-49,999
Class IV	10,000-19,999
Class V	5,000- 9,999
Class VI	less than 5,000

Another classification of urban settlement is as:

Town	- Places which have less than one lakh population
City	- Urban centers having population between one lakh to one million.
Metropolitan Cities	- Cities having population in between one million to five million.

Mega cities - Cities having more than 5 million population.

Thus an urban settlement is a concentrated settlement that constitutes or is part of an urban area. It is an area with high density of human-created structures. These geometrical patterns are usually in squares and rectangles and are well laid out. Thus the five major patterns of urban settlements are given here for you:

The Compact or Nucleated Settlements

In such settlements, houses are built close to each other. They generally develop close to a railway station, a well, a quarry or an industrial site.

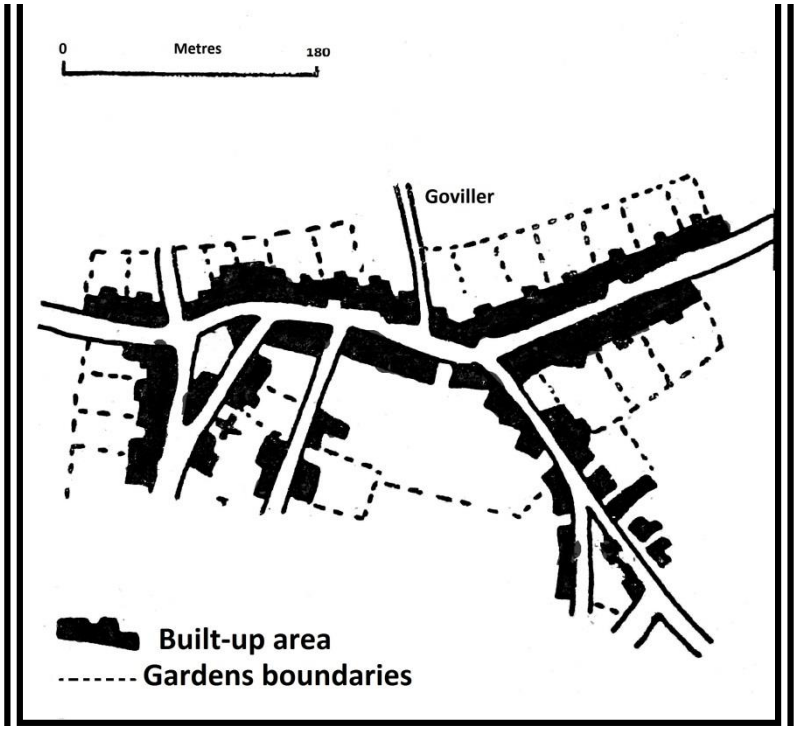
The Scattered or Dispersed Settlements

In such settlements, houses or the individual farmhouses are isolated or scattered and located away from each other. They develop mostly in the plateau, forested or hilly areas.

The Linear Settlements

Such settlements generally develop along either sides of roads (fig.8.6), railways, rivers or canals. The flood plains in hilly areas mostly have linear settlements.

Figure 8.6: Linear Settlements



Source: Goviller, Lorraine

The Radial or Star- shaped Settlements

Such settlements are common in towns and villages, where the dwellings spread out in several directions from a central point, which is either around a big water body or where many routes join together.

The Rectangular Settlements

The patterns of such settlements are determined by the nature of junction of two or more routes. When they cross each other at right angles, the dwellings are built along the routes in all

directions, thus forming rectangular settlements.

Thus it is clear now that like rural settlements, urban settlements are also having different type of patterns.

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Rural Settlement VS Urban Settlement

• Population Density the U.S. Census Bureau defines urban settlements as areas with more than 50,000 people and at least 1,000 people per square mile; In contrast, rural settlements contain less than 2,500 people, at a density between one and 999 people per square mile.

• Transportation Network rural transportation networks consist of local and county roads with limited inter connectivity to rail and bus lines. Urban settlements contain highway infrastructure as well as airports and light or heavy commuter rail.

• Economy Urban areas are dependent on a global economy of import and export, whereas rural economies rely on a local and agricultural-based economy with dependencies on services, such as hospitals and educational establishments in nearby urban centers.

To distinguish between different types of settlements, people often classify settlements as either urban or rural. Urban settlements are usually large. That is, they are densely populated with many people. Rural settlements, on the other hand, are generally small. That is, they are sparsely populated. There's a low density of population, so there are few people in rural settlements.

Often, urban settlements have mostly non-agricultural occupations, while rural settlements have mostly agricultural occupations. For example, many farmers live in a sparsely populated area, and official workers live in a densely populated city.

8.4 CONCLUSION

Thus we can say that settlement means originally, people built their homes together for companionship, safety and to share services. Over a long period of time, many villages grow as more people want to live in them. This creates a distinct shape or pattern of land use Whereas the pattern and type of settlement are decided by various factors for example climate, relief, soil, availability of water, other facilities as near to market, govt. Support, road connectivity, peace and security etc. Most of the world's settlements are rural and they are stable and permanent. They are of three types: Compact Settlements based on farming. These are mostly found in highly productive alluvial plains. Semi-Compact Settlement is a transitional phase in the growth of compact settlement. The emergence is because of the difference of semi-arid regions from humid regions and marginal productive land to that of fertile land. Dispersed Settlement- These are generally found in hills, plateaus and grasslands.

Pattern of settlement is defined as the relationship between one house and building to another. It can be identified by reading and observing a local scale map. The pattern of settlement deals with compact and semi-compact only. The socio-cultural factors like caste structure or a functional need of people has a close bearing on its shape and size. Rural settlements are an important aspect of settlement Geography, because they show the complex relationship of human occupancy of land and the environment. It may be classified under different patterns as: Rectangular, Linear, Circular, Semi-circular, Star-like, Triangular, and Nebular Pattern. The settlements is linear in valleys and mountainous areas, rectangular in fertile plains, circular near the lakes and ponds, triangular at cross roads and in exceptional cases it resembles the nebular form and on river terraces it is star-type. Primary activities as forestry, farming, fishing mining, tourism are commonly practiced in the village. More natural and less stressful environment etc. are the basic characteristics and advantages of rural settlement whereas limited employment opportunities and limited transportation availability, less social and political progress are few disadvantages of it. Ecological factors as undulating surface, fertile soil, favorable climatic conditions and water supplies etc. On another side non-ecological factors as supporting economic, social, political and religious factors are responsible for the development of rural and urban both settlements. Urban settlement is a concentrated settlement that constitutes or is part of an urban area. It is an area with high density of human-created structures and the people engaged in tertiary activities. So good economic status and high living standard of individual is meaning of urban settlement. Compact, scattered, linear, radial and rectangular are the settlement types of urban settlement. Thus it is clear that a settlement pattern refers to the way that buildings and houses are distributed in a rural and urban settlement. Settlement patterns are of interest to

geographers, historians, and anthropologists for the insight they offer in how a community has developed over time.

8.5 SUMMARY

Now it is summarize that a settlement is a general term used in archaeology, geography, landscape history and other subjects for a permanent or temporary community in which people live, without being specific as to size, population or importance. A settlement can therefore range in size from a small number of dwellings grouped together to the largest of cities with surrounding urbanized areas. Earth estimated to be formed about 4 billion years ago. Homo Sapiens (the one existing species of man) believe to date from about 500,000 B. C. Earliest man did not settle anywhere as they wandered around in search of food. They did not know how to construct buildings so lived in the open. Occasionally took shelter on top of trees to protect themselves from wild animals. Towards Settled Habitation they moved up to 10,000 B. C.-5,000 B. C. Some of the earliest settlements began to take shape. Settlements then consisted of groups of houses built by the side of agricultural fields, and a burial ground. Some inhabitants continued to live in caves and wander around for hunting animals - more as a pastime rather than as a necessity. Settlements can broadly be divided into two types- rural and urban. The basic differences between rural and urban settlement is the function. Rural areas have predominantly primary activities, whereas urban areas have domination of secondary and tertiary activities. A settlement type refers to the way that buildings and houses are distributed as in a rural and urban settlement. Settlement patterns are of interest to geographers, historians, and anthropologists for the insight they offer in how a community has developed over time. Settlement pattern is the way the settlement is arranged. A settlement pattern means the shape of a settlement. The shape of early settlements was usually influenced by the surrounding landscape. Originally, people built their homes together for: companionship, safety and to share services. Over a long period of time, many villages grow as more people want to live in them. This creates a distinct shape or pattern of land use a dispersed settlement pattern is where the buildings are spread out and is often found in upland areas; a nucleated settlement pattern is where a lot of buildings are grouped together and is often found in lowland areas; a linear settlement pattern is where the buildings are built in lines and is often found on steep hillsides. It is the physical appearance of the settlement. Most of the settlement patterns are formed along the physical feature like roads, railways, around water bodies, flat lands and any other.

8.6 GLOSSARY

- **Settlement pattern** • Settlement pattern is the way the settlement is arranged. It is the physical appearance of the settlement. Most of the settlement patterns are formed along

the physical feature like roads, railways, around water bodies, flat lands and any other.

- **A settlement hierarchy** • is a way of arranging settlements into a hierarchy based upon their population or some other criteria.

- **Urban settlement** • An Urban settlement is a concentrated settlement that constitutes or is part of an urban area. It is an area with high density of human-created structures.

- **Dispersed** • they are small groups of buildings. Those are separated from the next group by several km.

- **Radial Town** • Dwelling are located to around the center. Street circle around it.
- **Nucleated** • these are place where building are clustered around the central point. The central point can be town square, religious center, road junction or a mine. Maximum use of land in nucleated setting.
- **Linear settlement pattern** • where the buildings are built in lines and is often found on steep hillsides.

- **Radial settlements** • These are called circular settlements because of their circular shape and they are also known as star shaped settlements because the streets in the settlement start from the nodal point which creates a star like shape.

8.7 ANSWER TO CHECK YOUR PROGRESS

Q.1 What is the definition for settlement pattern?
Q.2 What different settlement patterns are there**?**
Q. 3 What are the three general factors that affect rural settlement patterns?
Q. 4 What are the factors that affect urban settlement
Q. 5 What are five major patterns in urban settlement?
Q.6 What are the two major basis on which you differentiate between rural and urban settlements?
Q.7 where do you find dispersed settlements? Give two examples.

8.8 REFERENCES

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8.10 TERMINAL QUESTIONS

Q.1 What is settlement?
Q.2 Write the meaning of dispersed settlement.
Q.3 What is nucleated settlement?
Q.4 Write the meaning of Radial settlements.

BLOCK 4 - ECONOMY

UNIT 9 : AGRICULTURE

1.1 OBJECTIVES

After reading this unit you should be able to:

- Know about types of farming in Asia
- Discuss the salient features of Asia
- Explain the various crops in Asia
- Gain knowledge about distribution and production

9.2. INTRODUCTION:

Agriculture plays an important role in Asian economies. Despite the mountain systems , plateaus, steep hills, rugged terrain, deserts, the vast tropical forest and the saltwater environments, Asia still make the primarily an agricultural region and it is among the top list in farm producers in the world. Development of sound technologies and improvement of seeds through green revolution have made the region to sustain agricultural growth. Hence, it is the land of farmers. More than 2.4 billion people in the region rely on agriculture for their livelihoods.

Many researchers have argued that the first agricultural revolution originated in Asia and which involved the domestication of plants and animals. The plants domesticated were rice, wheat, yam, palm, banana etc. And seed agriculture (uses seeds for plant reproduction) which is the most common type of agriculture originated in Middle East Asia 9000 years ago in the basin of the Tigris and the Euphrates in Iraq. Barley and Wheat were mostly likely to be the first crops cultivated in Asia and other plants such as rice, sugarcane, oats, cabbage, beans, eggplant, millet and onions were also originated in Asia. Since then agriculture has been the main occupation of the people of Asia.

9.3 TYPES OF FARMING:

a). Shifting Cultivation (Jhum Farming)

Shifting cultivation is also called as rotational farming or Sweden cultivation. This type of farming is practiced by tribal peoples, hill tribes or aboriginal people in Asia. Such type of farming is characterized by burning of forest to clear the land for cultivation, when the soil is no longer fertile the farmer move to another plot of land to start the same process. It is known as Ladang in Indonesia, Caingin in Philippines, Ray in Vietnam. This type of farming could be traced back to about 8000 BC in the Neolithic period which witnessed the remarkable and revolutionary change in man's mode of production of food as from hunter and gatherer to become food producer. The production of the crops is only for the family. However, the increasing human population and continues practiced of shifting cultivation has put tremendous

pressures on forest and land. The area under forest and grass lands decrease in large amount in Philippines, Indonesia, Thailand, India and China which accelerates soil erosion and also contribute to the change in climatic variations. Forest fire, landslides, frequent occurrences of flood and drought condition are some of the environmental degradation due to continues practiced of shifting cultivation in the region.

Figure 9.1: Clearing of Forest for Shifting Cultivation

Source: Google

b). Subsistence farming:

This is a traditional farm of agriculture practiced in Asia since man started domestication of plants. Farming is more oriented in grain such as rice, wheat etc. Hence it is also called oriented grain farming. Here the typical farm is much smaller and agriculture is carried on with the help

of animal and man power to produce enough food for the consumption of the family. Such type of farming can be seen in east and south Asia.

c). Plantation Farming:

Plantation agriculture is a type of commercial farming where a single cash crop is grown for profit. It is usually done in the countries that have a tropical climate with high annual temperatures and rainfall. Plantation farming is started in early 18th and 19th centuries by westerners and western companies in Asia. The Asian regions are suitable for the plantation crops like tea, coffee, rubber, banana and spices due to its different topography location and variation in monsoon. And such type of farming involves large land areas. For example, in Malaysia, an oil palm plantation usually hasaround40 hectares land. Some of the important plantation farming is sugarcane plantation in Philippines; rubber plantation in Malaysia, Indonesia, Thailand, Sri Lanka, Myanmar, India; tea plantation in India, Sri Lanka, Indonesia; banana plantation in India, Thailand, Malaysia, Philippines.

Figure 9.2. Tea Plantation and Aerial View of Banana Plantation in South Asia

Source: Google

d). Mixed Farming:

In this method of farming, crops are grown with a combination of food and fodder together with livestock rearing. For example plantation of crops like rubber, oil palm, coconut, coffee, tea and cocoa with association of others crops such as pepper and spices. It is found mainly in the humid agro-ecological zone but also extends into moist sub humid areas of Malaysia, Indonesia, Thailand, Cambodia, Philippines, Vietnam and Southern China. This type of farming has been a traditional sources for export earnings in Indonesia and Malaysia and it also a target for substantial private and public investment.

SOME INTERESTING FACTS

- The first agricultural revolution started in Asia.
- Agriculture is more oriented to grain farming, specially rice and wheat.
- 90 per cent of rice production and consumption occur in Asia region.
- Agriculture employs around 70 per cent of the labour force in Asia.
- Green revolution have helped increase agriculture productivity and also helped the Asian countries to come out from famine and starvation in 1970s and 1980s.
- China is the world's largest consumer of fertilizers.

9.4. SALIENT FEATURES OF ASIAN AGRICULTURE:

a) Asia is home to the citizens of Afghanistan, Armenia, Azerbaijan, Bahrain, Bangladesh, Bhutan, Brunei, Cambodia, China, Georgia, India, Indonesia, Iran, Iraq, Israel, Japan, Jordan, Kazakhstan, Kuwait, Kyrgyzstan, Laos, Lebanon, Malaysia, Maldives, Mongolia, Myanmar (Burma), Nepal, North Korea, Oman, Pakistan, Philippines, Qatar, Russia, Saudi Arabia, Singapore, South Korea, Sri Lanka, Syria, Tajikistan, Thailand, Timor-Leste (East Timor), Turkey, Turkmenistan, United Arab Emirates, Uzbekistan, Vietnam, and Yemen.
b) Farm size small owns an average of about 1 hectare of land per family.
c) Asia has a inequitable distribution of farmland, in India more than 25 per cent of agriculture land is owned by less than 5 per cent farming families.
d) The green revolution process in mid 1960s was the engine for transformation of agriculture in Asia.
e) The growth of GDP begin in Asia with the strong economic pushed from the Asian tigers" (i.e. the Republic of Korea, Singapore, China, Hong Kong Special Administrative Region and Taiwan Province of China) in the early 1960s.

f) More than half of the population in Asia lives in rural areas: Wide spread poverty, growing inequality, unemployment, rapid population growth and rely on agriculture for their livelihoods.
g) Agriculture growth is associated with the environment degradation such as soil erosion, depletion of soil fertility, declined of water table, ecosystem acidification and loss of biodiversity etc.

9.5. LAND USE AND LAND HOLDING IN ASIA

Asia has 30 per cent of the earth land area with more than 60 per cent of the world population. The size of the land holding is small. According to the World programme of Census of Agriculture (WCA) 2000,the average size of holding in Asia is only about 1 hectare and the average number of parcels per holding is 3.2. The present pattern of land use in Asia is due to the many factors like topography, soils, climate, technologies and human activities. And predominance of forest is the result of the excessive rainfall of monsoon. The fertile soil of rivers basin and increase in human population brought large portion of land under cultivation while the desert and mountain pastures of central Asia impeded the agriculture and the production is very low as compare to other Asian countries. Currently, there has been a constant change in the pattern and type of land use due to the increasing population, development activities and technologies improvement. Urbanization and industrialization have encroached upon land under forest, barren and waste land. The total area under forest in East Asia, South-South East Asia and West central Asia shows 257,047 ha, 292,804 ha and 43,511 ha respectively in 2015.Asia has30.8 parent of land under arable while 4 percent is used for permanent crops and 65.4 percent consists of permanent meadows and pastures.

In East Asia the land under pasture is 99.5 per cent while in China, it account of 75.8 per cent of its agricultural land. South and Southwest Asia have the maximum arable land of 69.3per cent. However, China and India together account about 28 per cent of Asian arable land and Japan has the highest proportion of arable farmland (93.3 percent).

9.6. MAJOR CROPS OF ASIA

Agriculture continues to be the dominant constituent in Asian economy. Varieties of crops are grown depending upon the location and climatic conditions.

Rice (OryzaSativa):Rice is the most important food crop of the people of Asia. It is believed that the origin of rice is from the Pearl River valley region of Ancient China about 8,200 – 13,500 years ago. Later it was spread to Southeast and South Asia region. More than 90 per cent of rice is produced and consumed in Asia. Therefore, income from rice alone contribute about 20- 30 per cent of GDP. The condition of growth is ideal and it occupies the most fertile region and wet land in the river valley and low lands. It can also be grown even in high altitude

(mountain and steep hill areas) with proper water controlling terrace systems with a maximum water logging for the cultivation. East Asia along contribute about 25 per cent of world area is under rice cultivation.

Climatic Condition	Soil	Distribution
1.The average temperature requires is 10° C to 21° C during sowing period and 35°C to 37°C during harvesting period. 2. Rainfall ranging from 100-200 cm.	It is grown in heavy clay and clay loams, alluvial soils, red and lateritic soils.	The lower valley and delta of the Yangtze kiang basin, River valley of southern and central **china**; south eastern coastal plain, Kyushu, Honshu and Shikoku Island, Setouchi plain of **Japan**; **Vietnam; Thailand; Philippines; Indonesia; Lao; Myanmar; India; Bangladesh; Pakistan.**

Rice continues to be the most important food source in Asia. China leads the world with the production volume of 207.675MT in 2015.India rank second with a production volume of 155.682 MT. Production in Indonesia is 70.593 MT, Vietnam 44.503 MT, Thailand 37.254 MT, Bangladesh 34.683 MT, Myanmar 34.250 MT, Philippines 19.832 MT and Japan 11.573 MT making the Asian region, largest rice growing region of the world.

Wheat (Tritiumspp):Wheat is second most important food grain of Asia after rice. It is a Rabi crop, sown in the winter and harvested in the beginning of summer. It requires a favourable climatic condition with well developed irrigation facilities .It is cultivated intensively in India (Punjab, Haryana and Uttar Pradesh) and different parts of China. China is the largest producer of wheat in the world having a land of 30.5 million hectare for wheat cultivation which supports the livelihoods to the large number of farmers.

Climatic Condition	Soil	Distribution
1. Cool and moist climate during growing period and dry warm climate during harvest. 2. It requires of temperature of 10° C to 15° C in winter and 21°C to 26° C in summer 3.Rainfall of 15 to 75 cm 4.Light winter showers increase the yield	Well drained loams and clayey loams, sandy loams, black and alluvial soils. Irrigation is essential for good yield in all types of soils	Punjab, Haryana, Uttar Pradesh **(India)** ; Hopei, Honan , Kansu, Shantung, Shensi **(China);** Honshu and Hokkaido Islands **(Japan);Bangladesh; Pakistan.**

At present about 60 per cent of the wheat crop is used for food. It is more demand with the increasing population and mostly utilized for weight reduction and psychological wellness. Only 17 per cent is use for animal feed and 12 percent for industrial products. China and India are the main producers of Wheat in Asian Region producing 125.6 MT and 94.3 MT annually in 2015.

Sugarcane (Saccharumofficinarum): Sugarcane was first cultivated in South East Asia and later introduced to Egypt in 645 A.D. It is a commercial cash crop and used for the extraction of sugar, falernum, molasses, rum, cachaça, ethanol and gur etc. Sugarcane cultivation and productivity differ widely from region to region depending upon the topography, soils and climatic condition. It is usually grown in two seasonsi,e December to Mayand June to September. According to Food and Agriculture organization (FAO), sugarcane is cultivated on about 26×10^6 hectares (6.425×107 acres) of land worldwide. This crop requires abundant supply of water and it could not tolerate severe frosts. Therefore sugarcane is cultivated in the tropics and subtropics between 22°N and 22°S and some up to 33°N and 33°S of the equator.

Climatic Condition	**Soil**	**Distribution**
1. Short and cool dry winter season during harvesting. 2.Temperature of 15°C to 26°C is require 3.Rainfall of 150 cm	Deep and rich loamy, Black soils with maximum amount of nitrogen.	Maharashtra , Uttar Pradesh, Punjab, and Bihar **(India)**; Lahore, Sialkot, Gujarat, Multan, Montgomery **(Pakistan)**

India ranked second in the production of sugarcane and largest exporters of sugar worldwide and estimated to produce 341,400 TMT in the year 2015. China is also one of the largest producers of sugarcane having an annual production of 125,500 TMT. Even though, china imports sugar from other countries due to high domestic consumption. Myanmar is the largest market source for china. The annual production of sugarcane in Thailand is 100,100 TMT and it is increasing steadily due to the ideal distribution of rainfall and improved in cane varieties. And Sugarcane industry is a major source of economy for 10 million people in Pakistan. Its annual production is estimated to be around 63,800 TMT. They exports sugar to the neighboring countries of Afghanistan and Tajikistan. Philippines ranked eight worldwide producing around 31,900 TMT. Even though the farms in Indonesia are poorly managed, Indonesia produces around 33,700 TMT of sugarcane annually.

Tea (camellia sinensins): Tea is believed to be originated in southwest China as a medicinal drink and one of the most important beverage crops in Asia. It is a tropical and sub-tropical plant which requires a heavy rainfall for its growth but stagnant of water is not good for the plant. Thus tea cultivation needs well drained land such as mountain slopes. And it is a labour intensive crop which requires cheap and skilled labour particularly at the time of plucking the tea leaves. Therefore, the large population and cheap labour of Asia provide the ideal condition for the growth of tea. This industry also provides employment to the millions of people specially the women's. Depending on the manufacturing technique tea is classify into green, black, oolong, white, yellow and compressed tea.

Climatic Condition	**Soil**	**Distribution**

1. Hot and humid climate 2. Temperature of 24° C to 30°C. 3.Rainfall ranging from 150 to 375 cm. 4.Alternate waves of warm and cool winds	Acidic soil without Calcium and rich in iron and manganese. Well drained, deep and friable loams. Virgin forest soils rich in humus and iron content.	Sichuan, Yunnan and Shandong **(China);**Assam, Darjeeling (India),Honshū, Shikoku, Kyūshū, Hokkaidō island **(Japan); Indonesia; Vietnam; Iran;**Kandy, Matale, Matara,Uva**(Sri Lanka).**

Tea is considered to be the most popular beverages in the world. It is therefore consumed worldwide in all levels of society due to its low cost and it has a huge global beverage market. China, India, Sri Lanka, Vietnam, Indonesia, Japan etc. produces a varied range of teas. In 2015, China recorded an annual production of about 1,640,310 MT and it is the largest producer of tea in the world, approximately 35 per cent of the total amount of tea is produced in the world. Some of the largest tea producing countries in Asia continent is India 966,733 MT, Sri Lanka 340,000 MT, Vietnam 217,000 MT, Iran 158,910 MT, Indonesia 150,478 MT, Japan 85,990 MT etc. According to Food and Agriculture organization (FAO), the production of green tea is expected to grow at a considerably faster rate compared to other types of teas.

Coffee (coffea Arabica): Coffee is the second most important beverage crop after tea in Asia. It originates from Abyssinia Plateau (Ethiopia) in 11th century .The ideal conditions for the plantation of coffee are found along the Equatorial zone called "The Bean Belt," located between latitudes 25 degrees north and 30 degrees south. Coffee cultivation requires slopes to drain the water as stagnant water is harmful. Thus it is grown at the elevations ranging from 600 to 1,600 metres above sea level. It also requires cheap and skilled labour.

Climatic Condition	**Soil**	**Distribution**
1.It requires hot and humid climate. 2.Temperature ranging from 15°C to 28°C 3.Rainfall 150 to 200 cm, well distributed throughout the year 4.Dry weather at the time of ripening.	Rich well drained fiable loams.	Western ghats and **Nilgiris (India)**; Sumatra,Java, and Sulawesi **(Indonesia);Vietnam and Thailand.**

Coffee production in Asia is increasing due to the improvement in the seed quality and available of the cheap skilled labours. It gives an employment to the millions of people. Vietnam is familiar with Vietnamese coffee which has an annual production of about 1,650,000,000 kilograms in 2015 ranking into second largest coffee producing nation in the world. Much

expansion is occurring in Indonesia giving the highest production in the region and it is also known worldwide for its best quality coffee. It is estimated to produce over 660,000,000 kilograms of coffee beans in 2015. An annual production of 349,980,000 kilograms of beans is produced in India.

Rubber (Haveabrasiliensis): Plantation of rubber is done in the equatorial zone where the rainfall is very high throughout the year. It is located between the latitudes of 10° C North and South of the equator. The ideal condition for rubber plantation in Asia is found in southern Thailand, Vietnam, Myanmar and Malaysia.

Climatic Condition	Soil	Distribution
1.Temperature of above 21° C 2.Rainfall ranging from 300 to 400 cm	Rich well drained soil varying from laterite to fine alluvium or clayey loams	China, Thailand, Vietnam, Myanmar , Malaysia, Laos

Rubber industry began to develop in 1800s and demand increases with the invention of the solid and the pneumatic rubber tier. About 50 parent of natural rubber is consumed by China, India and Malaysia. Thailand recorded the highest production of rubber with an annual production of 3,348,897 MT. Follow by Indonesia 3,088,400 MT, Malaysia 996,673 MT, India 891,344 MT, Vietnam 789,635 MT, China 659,600 MT, Philippines 547,861 MT and Sri Lanka 143,000.

Cotton (Gossypiumspp): Cotton is the most important fiber crop and mostly grown in tropical and sub-tropical regions. Cultivation of cotton requires number of geographical and economic factors such as suitable climate, soils, and irrigation facilities and available of cheap labours. It provides the basic raw materials to cotton textile industry.

Climatic Condition	Soil	Distribution
1.Temperature varying between 21°C to 30°C. 2. It requires frost free. 3. Average annual rainfall of 50 to100 cm.	Deep black soils (regur),alluvial,	The yellow Plain , the lower Yangtze Kiang basin, The western Chinese semi-Arid Area ,The Middle and Upper Yangtze Kiang Valley (China); Punjab, Haryana, Gujarat and Rajasthan (India); Bangladesh and Pakistan.

Asia has the largest area under cotton cultivation in the world. It is mostly concentrated in China, India, Bangladesh and Pakistan. China is the top cotton producing country in the world. It is estimated to produce 6,841,593 MT in 2015. Available of cheap labour and frost free throughout the year make the country best region for the cultivation of cotton.

Jute (corchorusspp): Jutes a crop of Asia. It is concentrated in India and Bangladesh especially in the Ganges Delta. About 90 per cent of world jute is cultivated in these two countries. It requires special characteristic of climate and soils.

Climatic Condition	Soil	Distribution
1.It requires temperature varying from 22°C to 35°C 2.Rainfall of above 150 cm 3.Average relative humidity ranging between 80 to 90parents.	Alluvial soil and also grown in clayey and sandy soil.	India, Bangladesh , China, Thailand ,Myanmar, Pakistan, Nepal, Bhutan, Vietnam, uzbekistan

About 9 millions of people of Asia are directly involved in jute related industry. The countries like Bangladesh and Nepal, earned from the export of Jute. But the demand for jute packaging material is decreasing due to the competition with the others industrial product. Currently India is the world largest jute production country accounting for about 57 per cent production in 2012. Most of the jute producing areas went to Bangladesh at the time of partition in 1947. But, most of the jute mills remained in India. It is estimated to produce 43 per cent of the world total jute in Bangladesh. China 2 percent, Uzbekistan 0.6 per cent and Nepal 0.5 per cent.

Maize (American corn): Maize is an important cereal crop in Asia. Today it the staple food after rich for a large population in rural areas and mountainous regions around the globe specially primary source of food for the poultry and livestock industry. And it is also consumed in variety of ways making important row materials for industry. Thus, it is an important source of income for many farmers in Asia.

Climatic Condition	Soil	Distribution
1.Temperature ranging from 21°C to 25°C. 2.Annial rainfall of 60 cm to 110 cm 3.It requires a 140 frost-free days.	Deep, rich soils of the sub-tropics with abundant nitrogen content.	Uttar Pradesh, Bihar, Himachal Pradesh, Rajasthan (India);Philippines; Vietnam; China.

Though rice has long served as the staple food in Asia but due to the changing dietary patterns maize products has increasingly replaces rice. Asia contribute about one-third of world total production of maize with Indonesia taking the lead in terms of corn producer in Asian region follow by Philippines and Vietnam. The use of high-yielding hybrid maize varieties has led to

yield increases in the region with the irrigation facilities giving it more favorable for the growth of maize in Asia. In 2014, it is estimated to produce 19 million metric tons of corn in Indonesia. The annual corn production in India is estimated to be around 42.3 million metric tons. Production in china has undergone a significant increase over the past 25 years; it is estimated to produces 224.9 million metric tons.

Banana (Musa sapientum): Bananas are the most important fruit produced in Asia. Native is believed to be in the tropical regions of south East Asia. Banana is cultivated and distributed in various climatic conditions but commercial plantations are primarily found in equatorial regions between 30° North and South of equator.

Climatic Condition	Soil	Distribution
1.Temperature ranging of 15°C to 35°C 2.Relative humidity of 75 to 85 per cent. 3.Raninfall of 650 to 750 mm	Deep, well-drained, forest loam, rocky sand, marl, red laterite, volcanic ash, sandy clay,even heavy clay and alluvial soils.	Uttar Pradesh, Bihar, Himachal Pradesh, Rajasthan **(India);** Hainan, South-West of Guangdong, Guangxi's (**China);Thailand; Philippines and Indonesia.**

Banana is one of the economically important fruits crop due to its raising demand around the globe. It is grown in many countries and total annual world production is estimated to be 86 million tonnes of fruits. With an annual output of about 29.82 million tonnes, India leads the globe in banana production in 2015. Other Banana producing countries are China (11.64 MT), Philippines(9.45 MT), Indonesia (6.34 MT) and Thailand.

Coconut (cocusnucifera): The Asia region produces around 90 per cent of the world coconut products. Coconuts are tropical trees and found in coastal areas or on the fringes of deserts. It plays a very significant role in Asian economy especially for the rural areas. It is use as row materials for many industries products such as cosmetic, soap manufacturing, hair oils, food etc.

Climatic Condition	Soil	Distribution
1. Diurnal variation of temperature of 27°Cto 50°C 2. Annual rainfall of 800-2500mm 3. Relative Humidity of 80-90 per cent.	Alluvial Sandy, Alluvial Coastal, Sandy, Laterite Red and Black Soils.	India; Philippines; Thailand; Sri Lanka and Indonesia.

Plantation of coconuts in Asia is mostly concentrated in coastal areas and Islands of India, the Philippines, Thailand and Indonesia. About 90 per cent of global supply of coconut comes from Asian region. It is the vital source of income for many farmers in Asia. Philippines and India have dominated the market with the annual production of 15,353,200 MT and 11,930,00 MT respectively in 2014. And around 2513,00 MT is produced annually in Sri Lanka.

Pineapple (Ananas comosus): Pineapple having its native in southern Brazil and Paraguay area in the Amazonic basin. And it is the second most important fruits cultivated after bananas contributing about 20 per cent of the world production. Pineapple is found in tropical region between 30° North and South of Equator.

Climatic Condition	Soil	Distribution
1.It requires an optimum temperate ranging between 21°C to 23°C. 2.A well-distributed rainfall of 150 cm per year.	Sandy loams, laterites and slightly acidic soils.	East and the West Coasts of the Gulf of **Thailand**; Northern Mindanao, Soccsksargen and Bicol Region **(Philippines)**, Guangdong, Hainan, Guangxi and Yunnan provinces **(China)**, **Indonesia**, North East Hill, Karnataka, West Bengal **(India)**.

Thailand, Philippines and China are the main countries producing pineapple in the world. Pineapple is mostly consumed in the producing country and demand is also increasing from the last 10 years. It is estimated to produce 2,458,420 MT 9.9 per cent of the total world production in Philippines. And other leading ASEAN countries in Pineapple production are Thailand 2,209,351 MT, Indonesia 1,837,155 MT.

Potato (Solanumtuberosum): Potato is a tuberous and starchy crop which is use for preparing alcoholic beverages , papers and boards, polylactic acid for use in plastic products etc. Its domestication stated in Peru but most of the rapid expansion is occurred in Asia. This crop is a very accommodating and adaptable plant and produce well without ideal growing conditions. The consumption of potato in Asia is almost the half of the world potato supply due to its huge population. China is now the biggest potato producer, and almost one-third of the world potatoes are harvested in China and India. It is estimated to produce 95,941,500 Mt in 2013. In India the production of Potato is estimated to be 45,343,600 MT nearly 12 per cent of the total global potato production.

Climatic Condition	Soil	Distribution
1. Day time temperature of 38°C during the hottest part of the growing season and nights are cool with average temperate of about 18 °C.	Loam and sandy soil.	Uttar Pradesh, West Bengal, Bihar, Gujarat, Madhya Pradesh, Punjab etc.**(India);** Heilongjiang, Jilin, Liaoning, Inner Mongolia, Hebei, Shanxi, Shaanxi, Ningxia, Gansu, Qinghai and Xinjiang **(China)**; Thailand; Chandina, Gozaria, Shibganj

		,Pirganj**(Bangladesh).**

9.7. CONCLUSION

Asia is basically an agricultural region. Majority of the region's population is still dependent on agriculture for its livelihoods. Besides supporting the huge population of Asia with basic food requirements, agriculture also provide raw materials to many agro-based industries. This gives employment to the labour force and increases the GDP growth, making Asia continent one of the largest agricultural market in the world. The topographical and climatic condition of China and India have favoured to utilize the maximum amount of land under agriculture, producing various food grains, commercial crops, plantation crops and horticulture. Thailand, Philippines and Indonesia also export many crops and fruits like Pineapple, Banana, and Coconuts worldwide.

9.8. SUMMARY

The first agriculture revolution occurred in Asia and it is a native to many plants and fruits including rice, tea, turmeric, eggplant, jute, sugarcane, banana, kiwifruit, orange etc. Despite the change in land use pattern due to increase in population and expansion of land for human activities, Asia is making remarkable progress in agricultural productivity. The fertile arable land in the major river valleys of Yellow River, Yangtze River in China and Ganga River in India has led to the good production of crops. Introduction of green revolution in mid 1960s has transformed the agriculture system of Asia. Thus, making the Asian region one of the largest exporters of agriculture products in world.

9.9. GLOSSARY

Adaptable: It refers to the conditions that man is able to adjust to new environment.

Agricultural region: the delimitation of an area where an agricultural activity is predominant.

Agricultural revolution: it refers to the great progress made in agriculture in Europe during the 18^{th} and early 19^{th} centuries particularly improvement in technology and increased in crop productivity.

Agricultural transformation: it is an era by which individual farms move towards more specialized production.

Agro-ecological zone (AEZs): geographical areas having similar climatic conditions and have the ability to support agriculture.

Arable land: it is a land that can be used for the cultivation of crops.

Commercial: the process of making profit.

Domestication: it is to convert the wild plants and animals to domestic uses mainly for the generations of breeding.

FAO: Food and Agricultural Organization of the United Nations, established in 1945.

Fringe: A transitional zone between two boundaries.

Green Revolution: the introduction of High Yield Varieties (HYV), fertilizers and pesticides which led to the high production of crops in a short time.

MT: Metric Tonne which is used for measuring the weight**.**

Native: origin or growing naturally in a particular region

Neolithic period: it is the cultural period of the stone age in 10,000 BC which is characterized by the development of agriculture and the making of polished stone implements.

Landuse: the process of modification and management of natural environment into a manmade environment.

Land holding: it is an area of land that is owns or rent by someone.

Livestock rearing: it a domestication of animals mainly in an agricultural setting such as goats.

Region: it refers to the homogeneity particularly climate in an area.

Tropical: Region found in an area with high temperature and very heavy rainfall.

9.10. ANSWER TO CHECK YOUR PROGRESS

1. Which crop requires maximum amount of nitrogen?

a) Potato

b) Wheat

c) Rice

d) Sugarcane

2.Where is the rice originated from?

a) Ganga river valley region

b) Pearl River valley region

c) Delta of the Yangtze kiang basin

d) Setouchi plain

3.Which crop requires water-logging for its cultivation?

a) Tea

b) Coffee

c) Rice

d) Potato

4.In which season is the highest yield of wheat obtained?

a) Zaid

b) Kharif

c) Rabi

d) All of these

5.Which Plantation crop is originated from Abyssinia Plateau (Ethiopia) in 11th century?

a) Coconut

b) Coffee

c) Tea

d) Rubber

6.What is the average temperature for the cultivation of rubber?

a) 21°C

b) 35°C

c) 22° C

d) 25°C

7.Which one of the following country has the largest production of coconut in the world?

a) India

b) Indonesia

c) China

e) Sri Lanka

8.Which is not prepared from potato?

a) Alcohol beverages

b) Paper

c) Polylactic acid

d) Cosmetic

9.What is the average annual production of maize in India?

a) 19 million metric tons

b) 42.3 million metric tons

c) 224.9 million metric tons

d) 59.9 million metric tons

10. Which of the country are the maximum consumers of fertilizer in the world?

a) India

b) Pakistan

c) China

d) Bangladesh

Ans: 1(d),2 (b), 3 (c),4 (c), 5 (b),6 (a),7 (c), 8 (d), 9 (b) and 10 (c).

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9.13.TERMINAL QUESTIONS

Q 1. What is shifting cultivation and discuss the environment impact due to shifting cultivation?

Q 2. Bring out the different between Plantation farming and Mixed farming?

Q 3. When is the economic development took place in Asia .Give reasons?

Q 4. Explain the landuse and land utilization of Asia?

Q 5. Bring out the Salient features of Asian Agriculture?

UNIT 10 : INDUSTRIES

10.1 OBJECTIVES

After reading this unit you should be able:

- To learn about different types of Industries
- To know about different industries in Asian countries including India
- To learn about industrial regions of India
- To study about the major industrial regions of major Asian countries

10.2 INTRODUCTION

Industries are signs of development; it refers to production of goods and services. In other words, industries refer to extraction of material from the nature and conversion of the raw material in to consumable goods. The goods produced by industries are either directly consumed or used by consumers or are used by other industries for further production. Post Second World War the growth in manufacturing and high tech industries shaped the Asian industries and economic settings. Japan showed notable growth in the manufacturing sector post the Second World war, then countries like South Korea, Malaysia and Taiwan also showed promising growth and in recent times along with India and China many other Asian countries are growing in the industrial manufacturing sector. West Asian countries like UAE and Iran's economic growth though attributed mainly to the presence of huge oil deposits, contribution of other industries is also increasing in these countries. However, Asia's industrial output, even though increasing yet is comparatively low in the world.

The challenge with Asia's industrial development is its regional heterogeneity, while some countries are showing major industrial growth and development, there are some countries still struggling for proper industrial growth. For instance, countries in East Asia such as Japan, South Korea, China, Hong Kong, Singapore etc., have grown faster, similarly the oil rich west Asian countries such as Saudi Arabia, Iran, UAE, etc. have developed economy. However, many South Asian countries still are underdeveloped and poverty driven, hence yet to develop. In this module you will learn about different categories of industries based on different parameters, for instance, industries are classified on the basis of productions, labor force strength, ownership status, raw materials used etc. Asia's industrial regions including India's industrial regions and its economy are also discussed here in this module.

10.3 TYPES OF INDUSTRIES

Industries are classified on the basis of different features

On the basis of production industries are further classified as primary, secondary and tertiary industries.

Primary industries uses raw material derived from nature for production of goods. Agriculture, mining, fishing, forestry etc. are primary sector activities, which involves extraction of natural resources. In the Pre-World War period Agriculture and Pastoral activities dominated Asian economy. It was only post the Second World War that Asian economy moved towards industrialization.

The secondary industries use materials from primary industries to manufacture products. Manufacturing and construction industries are part of secondary sector industries. Manufacturing units are further classified as small scale, medium scale and large scale industries or factories on the basis of capital investment and labor strength. The manufacturing sector of the East Asian countries has wide range starting from small tows to big cars, all are produced at global scale in countries like China, South Korea, Japan, Taiwan etc., e.g. Honda, Samsung etc. are world's leading Asian manufacturing organizations. Though manufacturing industries dominate Asia's economy, but its contribution varies country wise such as in Hong Kong manufacturing industries contribute 8% to GDP whereas in Qatar its contribution was about 31% in 2012 and in India it is 16%.

The tertiary industries though not produce physical products but create utility services for a price. The growth in the tertiary sector of a country is the sign of development. The tertiary sector has the potential to contribute substantially in the Asian Economy. This sector also known as service sector involves banking, insurance, medical, educational services etc.

On basis of strength of labor force the industries are called small scale, medium scale and large scale industries.

The small scale industries are generally owned by individuals, who hire smaller number of people, uses locally available raw material and their production generally meet the local demands. Small scale industries are widespread in the developing countries and provide source of income for millions. Small scale industries generally uses lower level of technology and are labor intensive and are flexible in nature, thus can easily adapt to changes. In most Asian countries, units or industries with less than 100 employees are considered as small scale industries.

The medium scale industries are also labor intensive industries, this industries hire more number of people than medium scale industries but less than large scale industries. Different countries have different guidelines to refer an industry small scale or medium scale. In India, for instance

the medium scale industries can only make investment between 5 crore to 10 crore on plants and machineries.

A large scale industry hire large number of people, involves huge investment and consumes huge amount of energy. A large scale industry requires skilled labors to operate machineries and good transport system to transport raw material as well as finished goods. The large scale industries cannot operate in isolation, in fact, these industries requires support of other service sectors such as banking, insurance etc. to operate smoothly. These industries undertake mass scale production at lower costs.

On the basis of raw material used, industries are classified as agro-based, mineral based, forest based and pastoral based industries.

Agro- Based Industries uses agricultural products as raw material for manufacturing finished products such as jute textile industry, cotton textile industry, vegetable oil industry etc. The agro based industries provides employment opportunities to the locals. The agro based industries results in commercialization of agricultural products, it is profitable for the farmers, as more than 70 % the India's and other Asian countries population depend on agricultural products.

Mineral Based Industries uses minerals as raw materials derived from nature such as iron, aluminum, cement industry etc. This industry uses metallic and non-metallic minerals, which are vital for many heavy industries and are important for growth.

Forest based industries as the name suggests uses forest products to manufacture other secondary products such as paper industry, rubber industry, Ayurveda medicine industry etc.

Pastoral based industries uses animal products as raw material for further productions such as leather industry, shoe industry, dairy products industry etc.

On the basis of ownership industries are classified as private sector, public sector, joint and cooperative sector industries.

Private sector industries are owned by individuals, families or firms such as Reliance industries in India is privately owned similarly, Mistubishi Financial industries in Japan etc. are privately managed and owned industries.

Public sector industries are management by states, center or their agencies like Durgapur Steel plant, India, Bangladesh textile mills cooperation etc.

Joint Sector industries are jointly managed by state agencies and private firms such as Maruti Udyog industries in India.

Cooperative sector industries are run by group of people mainly primary producers. AMUL dairy in India is a successful endeavor of cooperative sector.

On the basis of finished goods industries are also classified as heavy and light industries.

Iron and steel industries are example of **heavy weight** industries, which uses heavy raw material to produce heavy weight finished goods. This is the basic industry for many manufacturing industries. These heavy weight industries are located in the sites where raw material is available in abundance and where the transport system is fully developed for easy transport of finished products.

Light weight industries uses light weight raw material and produces light weight finished goods such as electric appliances etc. Light weight industries also use lesser amount of power and raw material.

Exercise A:

1. Identify at least five items used by you, which are derived from pastoral based and forest based industries.

10.4 INDUSTRIAL REGIONS

East-Asian countries like Japan, China, South Korea and south-east Asian countries like Singapore, Malaysia and west Asian country like Iran, United Arab Emirates are some of the major industrial countries of this continent. Like India, these countries also have industrial belts clusters. You have already learnt about major industrial regions of India, now you will learn about industrial regions of two highly industrialized countries of Asia namely Japan and China.

Following are **China's major industrial region** is:

1. Manchurian Industrial region: Manchurian industrial zone covers areas such as Penki, Fushun, Anshan, Dairen and Mukden. Steel industry, shipyards, machineries, locomotive industry, chemical industry, cement plants, lubricating oil industry etc. are some of the common industries in this region. This is mainly a region of heavy industries.

2. **Lower Yangtze Industrial Region:** In this region textile, food, leather, electronics, utensils industries are common. Shanghai is the major industrial city of this region; the other major cities are Soochow, Hang Chow, Ningp and Nanking.

3. ***Lower Yangtze Industrial Region****: In this region textile, food, leather, electronics, utensils industries are common. Shanghai is the major industrial city of this region; the other major cities are Soochow, Hang Chow, Ningp and Nanking.*

4. Tientsin and Beijing Region: This region is also a major industrial region covering cities of Beijing, Tagshan, Tientsin and Peking. Nearness to coal reserve and coal fields has contributed to the growth of engineering and metallurgical industries.

5. **Middle Yangtze Industrial Region:** In this region, heavy industries such as metallurgical, shipbuilding, steel work industry, railway equipment industry etc. is majorly found. Sichuan (Szechwan) Industrial zone is part of this region.

6. **Si Kiang Delta Region:** Port of Canton is the main industrial center of this region. Textile industry, Jute industry, and even iron work and machine factories are found in large number in this region.

Major Industrial regions of Japan are:

Japan is the most industrialized country of Asia. Japan is the largest producer of electronic equipment's and second largest manufacturer of automobiles. Following are some of its major industrial zones/ regions:

1. Tokyo-Yokohoma Region: This region spread across Kawasaki, Tokyo and Yokohoma cities. Kawasaki is known for heavy industries, Tokyo for electrical engineering industries and Yokohoma for ship building, oil refineries, port industries and petrochemical industry

2. Osaka, Kyoto and Kobe Region: This region boast of heavy industries primarily Kobe has ship building industry, oil refineries, petrochemical industry etc. Osaka has fertile land, which support cotton production, hence this town is also known as cotton textile town.

3. Nagoya industrial region: Third prominent industrial region is nagoya industrial region. This region is famous for aircraft manufacturing, textile mills and electrical engineering industry.

4. **Northern Kyushu region**: Kokura, Yumata, Fukuoka and Moji are the major industrial towns of this region. 90% of Japan's industrial output comes from this region. Nearness to

Chikuho coalfield contributes to the growth of heavy industries of this region primarily the iron and steel industry.

Beside the above four mentioned regions, Japan has many industrial town, which contributes towards the industrial development of the country.

The **other highly industrialized countries** in **Asia** are Taiwan, Hong Kong, South Korea, Singapore, Malaysia and UAE. Taiwan's industrial development depends on both light and heavy industries. Heavy industries like Iron and steel, chemical and aluminum industry and light industry such as toy making, plastic, textile industry, etc. hugely support Taiwan's industrial economy. Linhai Industrial park and Changhua Coastal Industrial park are well developed industrial clusters of Taiwan.

Hong Kong's economy is depended on its tertiary sector activities such as financial services, tourism, medical services etc. However, it is also famous for some of its light weight industries such as Jewelry, toys industry, electronics, plastics, handbags, footwear, watches etc. Kwan Tong district is one of the important industrial centers of Hong Kong.

South Korea is also emerging as a prominent industrial country in Asia. Southeastern Maritime industrial region is South Korea's major industrial zone. South Korea's strong industrial base is supported by steel industry, aircraft manufacturing industry, automobiles, shipbuilding and electronics industry.

Even with limited area and population, Singapore has emerged as one of the most industrially developed countries of Asia. High tech manufacturing, financial and research services and electronics are few of the major industries of this country.

Malaysia is also emerging as an industrialized country. Klang valley is the heartland of Malaysia's commerce and industries.

Iran is the most developed west Asian country. Presence of oil deposits supports the growth of petrochemical industry and oil refineries in Iran. Most of the oil refineries are located at Abadan, Tehran and Kermanshah. Besides, the iron and steel industry, consumer goods industry, electronics industry etc. are also contributing majorly in the country's national output.

United Arab Emirates is another industrialized country of Asia; here economic growth is attributed to the presence of oil reserves in the country. Besides the oil refineries, construction industry along with textile industry contributes majorly to UAE's economy. Dubai, Sharjah are few of the important industrial zones of UAE.

Exercise C

1. Identify the nearest industrial region from your city and note the major production in those industrial centers.

Asia and India Industries

Post Second World War the Industrial development in Asia grew at a faster rate. Primarily Japan emerged as a manufacturing super power in Asia and in the world. However, in the recent past other countries such as Taiwan, Malaysia, South Korea, China and India have also shown tremendous growth. Even with tremendous growth in manufacturing industries, Asia's industrial output is still less in comparison to its proportion of the world population. In larger Asian countries heavy weight capital intensive manufacturing units contributes more towards the economy. In the less developed or new industrialized countries, labor intensive industries dominate the economy. Even medium technology industries are common in Asian economies. In many large Asian countries like India and China unequal regional development is a problem and is the reason behind Asia's lesser proportion of world's economy. Asia is rich with mineral resources, which is the base of many metallurgical industries. In fact, countries like China, Japan, Taiwan, South Korea, Turkey etc. are important steel producing and consumer countries. Other minerals like Aluminum, zinc, lead, copper and tin are also produced in countries like Russia, India, China, etc. Tin is majorly produced in Malaysia in Asia and Japan is a leading country in production of heavy capital goods, engineering goods and electronic equipment. Even China is a leading country in engineering goods.

Asia has rich deposits of crude oil and natural gas primarily in Gulf region, central Asia and parts of Siberia. Petrochemical industries are widely spread in many Asian countries like Malaysia, Indonesia, Japan, Iran, China, Indonesia etc. United Arab Emirates one of the most developed country in west Asia depends on oil and gas industry for its growth, which contributes to about 33% of the total GDP.

Asia's textile industries particularly cotton industry is wide spread across many countries. China is the leading exporter of cotton textile, followed by countries like Pakistan, India, Bangladesh, South Korea etc. All are equally prominent in the world market. Beside, Industries possessing agricultural products are widespread across Asian countries. The cottage or handicraft industries also support economy of many Asian countries.

Asia's service sector industries started growing from the mid of 20th century. In fact, in countries like Japan, China, Singapore, South Korea, the service industries are contributing more than half to the country's GDP. Particularly the banking, financial and tourism industries are contributing majorly in the service sector.

Table: 10.1 Contribution of Industrial and service sector in GDP of some of the Asian countries

Countries	Service sector contribution GDP % in 2014	Manufacturing industries contribution GDP % in 2014
China	48.1	42.7
India	52.6	30
Iran	52.4	38.2
Japan	72	26.9
Malaysia	51.2	40
Singapore	75	24.9
South Korea	59.6	38.1
Hong Kong	92.7	7.3
United Arab Emirates	44.3	55.1

Source: World Bank (modified by Author)

As you know, like many other Asian countries, industrial development in India expanded post its independence from the colonial rule. However, in the last 69 years its manufacturing sector has shown tremendous growth. All size of industries including micro, small, medium scale and large scale are widely spread across India today, which signals the growth of India's economy.

As per Government of India, Micro enterprises have a limit up to 25 lakh of investment in plant and machineries. Small scale industries have investment limit from 25 lakhs to five crore

and Medium scale industries have investment limit from 5 crore to 10 crore on machineries and plants. Large scale industries have much higher investment and man power.

In India both agro-based industry like cotton and Jute and mineral based industry like iron and steel support India's economy. The textile industry, iron and steel industry, automobile industry, engineering industry, IT and telecom industry etc. in India are large scale industries, which drive India's economy. The large scale industries hires larger number of people than the small scale industries, which hires lesser number of workers and have comparatively lower capital investment. Floor mill, breweries, cottage industries etc. are small scale industries.

Table 10.2 Sector wise contribution in India's GDP

Financial Year	Industry-Share to Total GDP	Mining and Quarrying - Share to Total GDP	Manufacturing - Share to Total GDP	Services - Share to Total GDP
2010-11	28.23	2.21	16.23	57.32
2011-12	27.51	2.06	15.70	58.39
2012-13	27.03	1.98	15.24	59.29

Source: National Information Center (data.gov.in)

Exercise B

2. On a political map of Asia mark four exporter countries of cotton textile in the world.

Major Industrial regions in India

India has many prominent industrial regions across the country. Some of them are discussed below.

1. Gurgaon, Meerut, Delhi industrial Region: This region developed faster post-Independence. There are two industrial belt in the vicinity of Delhi; one covers Mathura, Agra, Meerut and Saharanpur in UP and the other covers Ambala, Gurgaon and Faridabad in Haryana. This region gets its energy support from Bhakra-Nangal hydro power plant and Harduaganj and Faridabad thermal power plant. If Agra is famous for its leather industry and Glass industry, then Meerut is known for its sugar industry. Mathura has petro chemicals and oil refineries. Engineering and electronics industries are widespread in Faridabad. Besides, this region has many agro based industries.

2 Mumbai Pune Industrial region: The seeds of growth of this industrial belt were sown by the British, when they acquired the island of Mumbaiin 1774 to develop a port. Further the construction of the 34 km Mumbai- Thane railway track in 1853 and the opening of Suez Canal in 1869, which brought European countries closer to Mumbai led to industrial growth in this region. The growth of this region is mainly associated with the growth of cotton textile industry and chemical industry. The larger production of raw cotton due to the presence of black cotton

soil of Narmada-Tapi basin and humid coastal climate supported the growth of cotton textile industry in this region. Thus, this region is known as Cotton polis of India.

Today the region has extended over many adjoining areas such as Kurla, Jogeshwari, Andheri, Pimpri, Pune etc. More than the cotton textile industry, the other industries such as engineering goods industry, oil refineries, electrical industry, etc. have also grown in this industrial center.

3. **Vadodara, Ahmedabad industrial region of Gujarat**: This is another major industrial zone in India. This region today expands over many other cities of Gujarat including Jamnagar, Surat and Valsad. The decline of Mumbai's cotton textile industry and easy availability of raw materials and better transport facilities encouraged the growth of textile industry in Gujarat as well. The availability of oil in Gulf of Khambhat has also led to the growth of the petrochemical industry in this region. Besides, food processing, dairy product industries are also prominent in this industrial center.

4. Kolkata, Hugli Industrial zone: Cheap migrant labor from nearby states, presence of major minerals such as coal and iron ore in Chhotanagpur plateau, Tea plantation in Assam, thermal and hydro power plants, Haldia, Paradip ports andhuge water supply and greater connectivity through Ganga and its tributaries are some of the factors, which contributed to development of this region. This region has variety of industries including, jute industry, textile industry, iron and steel industry, engineering industry, locomotive industry, oil refineries etc.

5. **South India's Industrial regions**:

a. ***Madurai, Coimbatore and Bengaluru industrial zone*:**This region include important industrial centers such as Madurai, Tiruchirappalli, Bengaluru, Sivakasi, Mettur, Coimbatore and Mysore. There are many hydro power plant providing energy to this industrial belt such as Mettur, Papanasam and Pylkara projects. Many public enterprises iron and steel industry and IT industries are located in this industrial belt.

b. ***Vishakhapatnam - Guntur Industrial zone***: The presence of the Vishakhapatnam and Machilipatnam ports, coal fieldsat the Godavari basin, natural gas field in the Krisna – Godavari basin, availability of rich mineral resources near the ports and petroleum refinery at Vishakhapatnam support the growth of several industries in this region. Iron and steel, sugar, paper, textile, aluminum, light engineering, cement etc. are some of the major industries of this region.

6. **Chotanagpur plateau industrial region**: This industrial zone spread across Hazaribagh, Ranchi, Dhanbad, Jamshedpur, Chaibasa, Sindri, Daltonganj, Japla and Garwa. Coal and Iron deposit in Bihar – Orissa belt, easy availability of power from thermal and hydro power plants and availability of cheap labor from Orissa, Bihar supports the growth of several heavy

industries in this industrial region such as iron and steel, heavy electrical, heavy engineering etc. Besides, cement, paper, locomotives are other major industries of this region.

10.5 CONCLUSION

To conclude, it can be said that though industrial development in Asian countries primarily began post the Second World War. However, countries like Japan and China have shown tremendous growth in this sector. Japan today is one of the most industrialized countries of the world. India, China, Japan, South Korea, Hong Kong, etc. export varied manufactured products to rest of the world. No longer the Asian industry can be associated with only agricultural and pastoral activities, Asia's high – tech industries have changed its economy and employment structure. The only major challenge with Asia's industrial prospect is the uneven development across the continent. Such as countries in East Asia are more developed than central and south Asia. Even Southeast Asia has industrially strong countries like Singapore and Malaysia.

Asia with its vast size and population, different government systems, environment and culture and unequal distribution of natural resources, have managed to show huge industrial growth. However, a lot still needs to be done for industrial development of all other Asian countries. For instance, trade blocs and agreements within different Asian countries such as APTA, ASEAN, ACU, etc., should be encouraged more for uniform development across the continent.

10.6 SUMMARY

In this unit, you learnt in detail about industries and their types. All types of industries have been discussed, based on usage of raw materials, finished goods, size and scale, production type, and even on the basis of ownership details of the industry. Growth and distribution of Asian and Indian industries and major industrial regions of India and Asia have been discussed in this module. Six major industrial clusters of India have been discussed here. The industrial regions/ zones of Japan and China have also been explained. A table is given in the module, to show the contribution of industrial and service sector in the GDP of some of the major industrial countries of Asia. Even the need for economic agreements trade blocs in bridging economic gap and reducing disparity among different nations have been explained in the module.

10.7 GLOSSARY

Consumable Good: The goods which are regularly consumed and replaced.

Cooperative Sector: Voluntary association of people to meet their common economic, social or cultural needs.

Delta: Delta is a landform created by deposition of sediments from a flowing river at its mouth.

GDP: Gross Domestic Product represents the total value of goods and services produced in a country.

Industrial Cluster: Concentration of interrelated industries in a geographical area.

Locomotive: associated with the railways.

Metallurgical: is a science associated with transformation of metals for production of goods.

Pastoral Activities: Involves land grazing of by animals such as sheep's, goats, etc. Associated with countryside life.

10.8 ANSWER TO CHECK YOUR PROGRESS

Practice Question

Q1. Name different types of industries based on usage of raw material?

Q2. Define cooperative sector industries and give an example from India?

Q3. Give an example of public sector industry in Bangladesh.

Q4. What is the upper limit of investment on plants and machineries set by Government of India on Micro enterprises?

Q5. Which sector (industrial or service) contributed the most in Japan's GDP in 2014?

Q6. Which part of Asia, do we find rich deposits of crude oil?

Q7. Which region is known as the 'cotton polis of India'?

Q8. Which are common industries in Iran and why?

Q9. Which geographical region is considered heartland of Malaysia's commerce and Industries?

Answers to Practice Questions

Ans.1. The different types of industries on the basis of raw material used are:

Agro- Based Industries, which uses agricultural products as raw material for manufacturing finished products such as jute textile industry, cotton textile industry, vegetable oil industry etc.

Mineral Based Industries, which uses minerals as raw materials derived from nature such as iron, aluminum, cement industry etc.
Forest based industries, which uses forest products to manufacture other secondary products.

Pastoral based industries, which uses animal products as raw material for further productions.

Ans.2. Cooperative sector industries are run by group of people mainly primary producers. AMUL dairy in India is an example of cooperative sector.

Ans. 3. Bangladesh textile mills cooperation is an example of public sector industry in the country.

Ans. 4. The upper limit of investment on plants and machineries set by Government of India on Micro enterprises is Rupees 25 lakhs.

Ans. 5. Japan's service sector contributed maximum (about 72%) to the country's GDP in 2014.

Ans. 6. Asia has rich deposits of crude oil primarily in Gulf region, central Asia and parts of Siberia.

Ans.7. Mumbai – Pune Industrial region is known as the 'Cottonopolis of India'.

Ans. 8. Oil refineries and petrochemical industry are the major industries in Iran mainly due to the availability of huge oil deposits.

Ans. 9.Klang valley is considered as the heartland of Malaysia's commerce and industries.

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10.11 TERMINAL QUESTIONS

Q1. Name any two highly industrialized East Asian countries.

Q2. Distinguish between private sector ownership and public sector ownership.

Q3. List six industrial regions of India.

Q4. Which region of Japan contributes maximum industrial output?

Q5. Which sector contributes maximum in Hong Kong's GDP and name one of the important industrial center of Hong Kong?

Ans.1. Japan and South Korea are two highly industrialized East Asian countries.

Ans.2. Private Sector ownership refers to organizations run by individuals or family or firms and not controlled by government agencies or authorities. For instance, Reliance industry is a private sector firm.

Public Sector ownership refers to organizations or enterprises run by local, state or central government or by their authorized bodies. For example, Durgapur Steel plant in India.

Ans. 3. Following are the six major industrial regions of India:

1. Gurgaon, Meerut Delhi industrial Region
2. Mumbai Pune Industrial region:
3. Vadodara, Ahmadabad industrial regions of Gujarat
4. Kolkata, Hugli Industrial zone
5. South India's Industrial regions:

a. *Madurai, Coimbatore and Bengaluru industrial zone*:

b. *Vishakhapatnam - Guntur Industrial zone*:

6. Chhotanagpur plateau industrial region:

Ans4. 90% of Japan's industrial output comes from Northern Kyushu region.

Ans.5. Hong Kong's GDP gets maximum contribution from its tertiary activities including financial services, tourism industry, medical services etc. Kwan Tong is one of the major industrial regions of Hong Kong.

UNIT 11: TRADE

11.1OBJECTIVES

Trade and transport are closely related since ancient time. Asia has carried on trade with the rest of the world. It begins with caravans carrying silk, species and other exotic products. Therefore this chapter mainly focuses some meaningful aspects of trade.

- To focus on the trade in Asia.
- To explain types and pattern of trade in Asia.
- To describe national and international trade in Asia. To assess the silent features of trade.
- To examine the trade cycle and trading bloc's.

11.2 INTRODUCTION

Trade is simply the exchange of commodities and this can take place at many levels. commercial transaction involving the sale purchase of goods, trade is the activity of services between people or countries. In some primitive societies trade is still carried on with neighboring groups. The type of trade with which most people are familiar. However, is retail trade in which shopkeepers sell goods to individual customers for money. On large scale is the wholesale trade which is carried out within a country and by their goods to wholesalers who in turn sell them to shopkeepers. Therefore, two types of trade are-

1. Internal Trade-The extent of internal trade will depend on the variety of regions with in country.

2. International Trade-Is the exchange of commodities on a globe scale. No country can be completely self-sufficient, and trade between countries is therefore, essential to ensure a supply of a country's needs.

The increasing tempo of industrialization has mad international trade increasingly important. Industrial nations require raw materials for their factories and food for their workers. Much of this has to be imported from the mainly agricultural nations where there are surpluses to spare. Similarly, the agricultural countries need machinery to run their farms, and manufactured goods for their ones. These are supplied by the industrial nation. Some countries concentrate on attaining self-sufficiency, especially in food supplies, but this means that there is usually little surplus of export and therefore the country can afford few imports. Countries which have a large international trade, however, can import large quantities of goods and this means that a much wider range of foodstuffs, raw materials and manufactured goods is available then a single country could itself produce. Thus the volume of international trade is often taken as economic barometer or guide to a country's economic well-being. The trade of a country is usually measured by the total volume of value of all good exchanged. Sometimes, however, it is measured on a per capita basis, that is how much trade is carried on per head of the population.

11.3 TYPES AND PATTERNS OF TRADE IN ASIA

The pattern of Asian trade is the exchange of goods and services between counties. Usually developed countries export valuable manufactured goods such as electronics and cars and import cheaper primary products such as tea and coffee pattern in technical analysis, patterns are the distinctive formations created by the movement of security prices on a chart. A pattern is identified by a line connecting common price points over a period of time. The volume of trade, the direction of trade and the types of goods traded vary greatly between the various countries of the Asia. It is possible to classify the main commodities entering Asia trade as follows-

1-Foodstuffs- Including grains, beverages, fruits, meat, spices.

2- Raw Materials- Including fibers, rubber, timber, vegetable, oils, metals and other minerals.

3- Fuels-Mainly coal, petroleum and natural gas.

4-Manufactured Goods-Such as textiles, machines, chemicals and many more.

Table 11.1

Exporter	2016 exports (dollars)	Asian total	Since 2012
China	2.119 trillion	36.2%	+3.4%
Japan	644.9 billion	0.11%	-19.2%
Hong kong	516.6 billion	8.8%	+4.8%
South korea	495.5 billion	8.5%	-9.6%
Singapore	329.9 billion	5.6%	-19.2%
Taiwan	280.5 billion	4.8%	-6.8%
India	260.3 billion	4.4%	-10.1%
Thailand	213.6 billion	3.6%	-6.9%
Vietnam	211.4 billion	3.6%	+84.6%
Malaysia	189.4 billion	3.2%	-16.7%

Source-www.exportgenius.in

Major Trading Country in Asia

Japan is the most important trading nation in Asia and has an extensive export and import trade with countries thought the world. Its main exports are of manufactured goods, including steel, ships, textiles, electrical good and machinery, automobiles and chemicals. Manufactured goods are sent to developing Asian countries, to Europe and to North America. Imports include much oil from Middle Eastern countries, and raw materials from a wide variety of sources, including minerals from Australia and south East Asia, wool from Australia, and cotton, coal and timber from many sources. In the year of 2014- 2015, 55110crores dollar precious goods were imported.

China's foreign trade is most foodstuffs is greatly restricted by its large population, which consumes practically all its agricultural output wheat, usually from Canada or Australia in bad years. Before 1950, approximately 85%of trade was done by china to communists countries. In resent year, manufactured goods have been the main exports including some canned food, textiles, toys and cheap products of light industry. Its Japan, Honkong, Switzerland, Rumania, Great Britain, France, Germany, Italy, Pakistan, Mongolia, Malaysia , Europe and greater trading links can be expected in future with the more open policies currently being adopted in china.

South-East Asia-Is increasing importance as a trading zone, mainly because of the development of tropical row materials. These include tin, timber. Rubber, oil and petroleum from Malaysia tin, rubber, oil and coffee from Indonesia, coconuts, sugar, tobacco and iron are from the Philippines, rice, teak, rubber, tin and oil from Thailand and oil from Brunei.

Hong Kong's-Is major exports are of manufactured goods, however, including textiles and garments, toy's and electrical goods. Singapore, another small state, is also heavily dependent on trade and industry. In many other south-east Asian countries, especially Malaysia, light industries are greater importance. India and Pakistan have relatively little foreign trade because their minerals and crops are absorbed almost entirely by the large population. Some minerals and agricultural products such as tea, cotton, jute, woolen textile, wheat and coconuts are exported as well as some manufactured goods such as textiles and handy craft. Sri Lanka export tea, Coconuts and Coffee. The Middle Eastern country such as Kuwait, Iraq and Iran are extremely important in Asia and world trade because the region possesses more than half of the world's petroleum reserves. In many Middle Eastern countries such as Iran, Kuwait, Iraq countries oil represent between 85 and 95 percent.

Table11. 2 Top 5 Asian countries in terms of total import in 2016

COUNTRY	Import in %
China	10.2%
Japan	3.8%
Korea	2.7%
India	2.4
Vietnam	1%

Source-asianlinkbusiness.com.au

11.4 SALIENT FEATURES OF TRADE

A trade feature refers to fluctuations in economic activities especially in employment, output and economy, prices profits etc. "Business cycles are of fluctuations in the economic activities of organized communities." Foreign trade plays an important role in the economic development of any country. It is said; foreign trade is not simply a device for achieving productive efficiency but is an engine of economic growth. Many reasons certify this statement.

1-Nation can optimally use its resources.

2-Technical knowhow can be imported.

3-Surplus production can be exported.

4-Machinery and raw materials can be imported as and when needed.

5-Food grains and necessary help can be imported during natural calamities like earthquake and flood etc.

Features of Trade Cycle

The characteristics of salient features of trade cycle are-

1-Movement in economic activity-A trade cycle is a wave like movement in economic activity showing an upward trend and a downward trend in the economy.

2-Periodical- Trade cycles occur periodically but they do not show the same regularity.

3- Different Phases- Trade cycles have different phases such prosperity, recession, depression and recovery.

4- Different Types- There is minor and major trade cycles. Minor trade cycles operate for 3-4 years or more. Though trade cycles differ in timing, they have a common pattern of sequential phases.

5-Duration-The duration of trade cycles may vary from a minimum of12 years.

6-Dynamic-Business cycles cause changes in all sectors of the economy.

Fluctuation occur not only in production and income but also in other variables like employment, investment, consumption rate of interest price level etc.

7-Phases are Cumulative-Expansion and contractions in trade cycle are cumulative, in effect i. e increasing or decreasing progressively.

8- Uncertainty to Businessmen- There is uncertainty in the economy, especially any other type of income.

9- International Nature- Trade cycles are international in character, fore. G.greal depression of 1935.

Trading Blocs

Trading blocs are associations between groups of neighboring countries for the purpose of promotion the freeing trade. There are basically two kinds of association. Looser

trade association are concerned only with liberalizing trade by lowering or abolishing tariff barriers within the group and do not interfere with the external trading ties of the individual members. A trade bloc is a type of intergovernmental agreement, often part of a regional intergovernmental organization, where barriers to trade traffics and others are reduced or eliminated among the participating country.

The ASEAN free trade area (AFTA) is a trade bloc agreement by association of Southeast Asian nations supporting local manufacturing in all ASEAN countries. When the AFTA agreement was originally signed. ASEAN had six members namely-Brunei, Indonesia, Malaysia, Philippines, Singapore and Thailand. Vietnam joined in 1995, Laos and Myanmar in 1997 and Cambodia in 1999.AFTA now comprises the ten countries of ASEAN. All four latecomers were required to sign the AFTA agreement to join ASEAN but were given longer timeframes to meet AFTA's tariff reduction obligations.

The primary goals of AFTA are-

1. Increase ASEAN's competitive edge as a production base in the world market through the elimination within ASEAN of tariff and non-tariff barriers.

2. Attract more foreign direct investment to ASEAN

Traffics between these countries are being reduced and intra-regional trade in increasing but trade between ASEAN and rest of the world is growing faster.

World Trade Organization (W T O)

The world trade organization is an international body whose purpose is to promote free trade by persuading countries to abolish import tariffs and other barriers As such, it has become closely associated with globalization. Based in Geneva, the WTO was set Uno in 1995, replacing another international organization known as the General Agreement on Tariffs and Trade (GATT).WTO has a much broader scope then GATT regulated trade in merchandise goods, the WTO also covers trade in service, such as telecommunications and banking and other issues such as intellectual property rights.

11.5 CONCLUSION

Trade is very important to Asia about 70 percent of the world trade is carried on in the Asian countries. Trade is simply the exchange of commodities and this can take place at many levels. Trade is services like insurance, travel, tourism hotel banking, maritime, transportation, mobility of human resources etc. The trade of a country is usually measured by the total volume of all goods exchanged. It is possible to classify the main commodities entering Asia. Trade policies also aim at protecting the advanced countries through imposing quotes. However, a favorable

trade balances in not necessarily a sign of prosperity; many poorer countries and do so by restricting imports below the levels needed to sustain successful economies.

11.6 SUMMARY

Trade is the activity of buying and selling or exchanging, well and or services between people or countries. Therefore, two types of trade's are-1. Internal trade and 2. International trade. Japan, China, Hong Kong, Switzerland are major trading country in Asia. A trade feature refers to fluctuations in economic activities especially in employment, output and income, prices. Profits etc. foreign trade plays an important role in the economic development of Asian country. Some salient features of trade are nation can optimally use its resources. Technical knew how can be imported. Surplus production can be exported; Machinery and raw materials can be imported as and when needed. Food grains and necessary help can be imported during natural calamities like earthquake and flood etc. Some feature of trade or also very important for Asian trade such as, movement in economic activity, periodical trade cycles, different phases such as prosperity recession etc. and different types asus minor and major trade cycles, duration of trade cycles, dynamic like an employment, investment, consumption, cumulative trade cycles. Uncertainty and very important International nature of trade. However, a favorable trade balance is not necessarily a sign of prosperity; many poorer countries and do so by restricting imports below the levels needed to sustain successful economies.

11.7 GLOSSARY

1- Caravans – A group of people and animals that travel together.

2- Commodities- A product or material that can be bought and sold.

3- Primitive- Connected with a very early stage in the development of humans or animals.

4- Fluctuate- To change frequently from one thing to another.

5- Trade blocs- A type of agreements which are made up of a group of countries which join together to promote trade.

11.8 ANSWER TO CHECK YOUR PROGRESS

Q.1- How many types of trade?

Q.2-Mean trade zone in Asia?

Q.3-What are the trade blocs?

Q.4-Whatis called the trade policies?

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11.11 TERMINAL QUESTIONS

Q1. What are the essential differences between internal trade and international trade?

Q2. What are the salient features of trade in Asia?

Q3. What factors are the trade blocs?

Q4. Describe the pattern of major trade country in Asia.

Q5. Discuss the many trade policies in Asia.

UNIT 12 : TRANSPORTS, PORT & HARBOR

12.1 OBJECTIVES

Transportation and economic development are interlinked. In fact, both sustain each other. Empirical evidence of the so far development preceded their economic development. Therefore in this chapter meanly focus some meaningful aspects for Asian transports.

1. To review the existing transports system in Asia.

2. To focus the development and different pattern of transport like road transport, rail transport, air transport and water transport in harbors.

3. To study development pattern of ports and harbor

4. To estimate the future load and requirements of transport

5. The present study so far probed the existing transport facilities in Asia.

6. In this studying many more transport services in Asia.

12.2 INTRODUCTION

Transport and development are closely related. An efficient way of transport is absolutely essential for the rapid economic growth of any region. From the earliest times people have exchanged and traded goods from different regions to different parts of the world. First human portage was replaced by the use of pack and draught animals, and later the steam and internal combustion engines were applied to vehicles .As scientific and technological knowledge have progressed new modes of transport have been developed. This has resulted not only in a great speeding up of transport but has also greatly increased the range of communication networks, so that today almost every part of the world and not only Asia can be reached.

The development of mechanized transport has had great effects on the mobility of people as well as goods. It breaks down the barriers of religion and customs but bring together distant people physically, socially and culturally."The transport system is the sum of all technical instrument and organization designed to unable persons, commodities and new to master space." (Weidenfeld Kurt 1972.)

The effect of improved communications on migration during nineteenth century was enormous. Far more people migrated to new lands during that period than ever before. The development of transport has also been the basis for the development of a completely new industry.

A well developed system of transport and communication is vital to the establishment of political control, national unity and an efficient central administration, for those areas which are not easily reached may develop separatist tendencies if not efficiently administered.

12.3 DEVELOPMENT PATTERN OF TRANSPORT

A network of the different modes of transport is necessary for the exchange of raw materials and finished goods. Asia has developed a good transport network and great progress of economy. A dense network of roads, railways, navigable rivers, canals and airways is an index of industrial growth of any country in Asia

Road transport

Road and pathways have been stamped out by men since the earliest times. They are the most universal form of communication and also the most varied. The earliest roads were the paths and tracks worn out by the constant passage of men and animals. Some of these linked place fairly close together, while others crossed wide areas as major trade routes. e.g. the central Asian caravan routes. Some such ancient routes, e.g. across the Saharan are still used in much the same way by traders who depend on camel transport. The development of wheeled vehicles made wide roads and a better surface essential ,for earth roads became muddy I the winter and dusty in summer and were worn into deep ruts.

Roads are an important mode for transport for both passengers and freight transport. Freight transport by road is becoming increasingly important. In economically under developed countries road transport is an important infrastructure for development and rather a pre-requisite to rapid industrial and economic development. Historical evidence shows that the developing countries had spent more resources on transport development and transport innovation. In economic development of Japan, for example, investment in transport and petroleum were 59 percent.

There is 134 lakh km. of metaled road in the world of which 64 km is in Asia. In India road transportation has seen the most development. In 1968 India had7 lakh km. long roads and it increased to 33 lakh km in 1997,of which 5 lakh km was national highway. Major roads in India are in the southern part of India. Kolkata-Amritsar(G.T. Road),Kolkata-Chennai great Deccan, Delhi-Mumbai, Mumbai-Kolkata, Pathankot Srinagar etc. are the major roads of India.

After India the most development in roads is in Japan. Japan has approximately 1171894 km long network of roads which are connected to industrial areas.

After India and Japan, China has the most long network of roads which is approximately 15 lakh km. .Fourth largest network of roads is in Russia. The major roads in Russia are Siberian Soldiers roads. The biggest road is from Moscow to Vladivostok .And

Pakistan, Hindasia ,Korea, Turkey, Mayanmar, Iran too have made development in roads.

Table 12.1

COUNTRY	LENGTH OF ROAD(km)
India	33,20,000
China	17,65,000
Japan	11,71,647
Philippines	16,74,257
Iran	16,82,102
Tarki	3,82,102
South Korea	91,396
North Korea	31 742
Pakistan	2,57,881
Hindasia	374,881
Thailand	67,042
Myanmar	29,889

Source: The Statesman's Year Book,2016.

Rail Transport

The growth of the railways was brought about by two interrelated factors. Firstly, the steam engine was developed and applied not only to industry but also to transport, secondly the rapid rise of industry made it necessary to improve existing transport system. Apart from their importance as fright carriers, railways play a very important role in passenger transport. Railways are by far the most efficient form to transport for commuters who have to come into large cities each day because they do not contribute to traffic jams on the roads. Underground trains too are ideal for city transport because they take up little valuable space on the surface and can carry huge numbers of people from place to place to regular time table, unlike buses and cars which get caught in jam when a large number of people are trying to travel at once.

The importance of railway also depends to a large extent on the availability of other forms of passenger transport.

Railway pattern of Asia

In Asia after road transport comes rail transport. There's 30 lakhs km of railway tracks in the world of which 16 lakhs km lies in Asia. Railways are important both for freight and passenger transport for the following reasons:-

1. Road transport network are often sparse and road are poor quality

2. Though the population is large,few people can afford automobiles and they rely more heavily on railways

In China more attention is given to the railways which are in public ownership than to improving road for private vehicles.

In Asia the most development in rail transport took place in India. India has the densest network of railways. The railways are government owned. More people in India travel by train than any other means of transport. Railways in India and Pakistan, where there is also a good railway network, were first introduced by the British to ensure good communication for a administrative purposes and to provide outlets for the sugar, rubber and cotton exports. Main railways in India are Delhi to Howrah, Amritsar to Mumbai, and Delhi to Chennai etc.

After India the most development in railways is in Russia. Here the major railways are connected to areas of raw material to the areas of manufactured material. The major railway in Russia is Trans-Siberian railway which is connected in the east from Vladivostok to Leningrad in European Russia

In Japan the development in railways is mostly in the country's industrial belt. The first railway was not constructed until 1872,when a 29 km line linked Tokyo and Yokohama. Japanese railways are mainly electrified and are noted for their speed and efficiency. Major railway is from Tokyo to Osaka. The train running on this track is the fastest train in the world with a speed of 200km/hr

After Japan, China has a railway length of 70,100 km. China with about km of railways before the communist revolution had few major rail ways, since then the quest for high rate of national, economic and industrial development has led to the construction of many huge bridges to carry them over the main rivers. Many lines have converted from single to double tracks to cope with increased traffic in both freight and passengers. Manchuria railway is the longest in China with a length of 2370 km. The railway from Peaking to Canten goes from Pangchau and Bohan, this is an important railway line if China and has a length of 2310 km. Other railway lines are Titsin to Shanghai and Lenchan to Sikyang

Philiphines, Hinduasia, Pakistan, Iran. Korea. Taiwan, Turkey, Sri lanka, Iraq etc. too have seen development in rail transport

Water Transport

Since the earliest time, water transport has been used for carrying both passengers and goods by barge, boat, ship or sailboat over a sea, ocean, lake, canal, river etc. Water transport is the cheapest and the oldest mode of transport. It operates on natural track and hence does not require huge capital investment in the construction and maintenance of its track except in case of canals. It has the largest carrying capacity and is most suitable for carrying bulky goods over

long distances.Water transport probably developed before the use of animals and greatly aided hunters and fishermen in their activities because waterways formed an easy means of travel in places where dense forest on land hindered movement

In south east Asia rivers often play a vital role in the transport of local products where other means of communication such as railway or roads are poor or non-existent. Before the introduction of railways, inland navigation played an important role in the transport system of the Asian country. With the introduction of railways, inland water transport has lost its former importance. However, waterways provide the cheapest but slowest means of transport. The total length of navigable waterways is about 4 lakh km in Asia.

Table 12.2

COUNTRY	LENGTH OF WATERWAYS IN KM
China	160000
Thailand	11900
Bangladesh	8894
Iraq	3000
India	12683
Turkey	200

Source: The Statesman's Year Book,2016.

Ocean and river transport both are considered as a way of water transport

Asia has a straight coastline due to which water transport could not develop as much. There's also shortage of natural ports in Asia. Though the coastline of Pacific Ocean has cuts but the sea storms in the area makes it unsuitable for water transport

Major waterways in Asia:-

1. from Iraq to India, Sri lanka, Malaysia and finally connecting Australia

2. From Vietnam to China, Korea and finally connecting Japan is another major waterway

3. From Singapore to Philipphines and then to Japan

4. From Israel to Lebanon and then to Europe.

Major ports in Asia are Hefa, Tripoli, Adan, Basra, Abadan, Karachi, Mumbai, Columbo, Singopre, Jakarta, Manila, Hong Kong, Tokyo, Canten. Chennai, Osaka, Kolkata, Kangoon, Bangkok, Shanghai, Yakohama, Kwalalampur, Vladivo-staka etc.

Air Transport

Air ways is becoming more and more important. Many places in the interior which were not easy to reach are now connected by Airways. Air transport is relatively independent of

physical barriers such as mountain ranges. There has been a rapid development of air services in Asia and is constantly becoming more important but development has been very uneven in different part of Asia. The major factors affecting the present importance and future development of air transport are:-

1. Limited carrying capacity-Lack of space in aero planes restricts the amount of freight they can carry. High air freight rates will limit the role of air transport for many years to come.

2. Freedom of the air-The air is less free than the sea because though nation can only claim sovereignty over their territorial waters they can claim all the air space over their territory.

Airways connect the cities of Asia to each other and to the cities of the world. Many countries of Asia have their own airlines.

Development in Air transport happened most in Japan. In China development in air transport started in 1947.China have approximately 142 airports and airplanes from these airports also fly to Mangolia, Russia, Mayanmar, Korea and Vietnam. Peaking has an important airport of China which provides services for many international flights. Other important airport are shanghai, Canten Bohon, Nanking and Aanshan. Japan holds an important place in air transport. It is one of the most important industrial countries and has many airports. Tokyo is the most popular airport in Japan which is connected to many international airway routes. Other main airports in Japan are Osaka, Nagoya, Quito, Nagasaki, Hokedo etc. Japan has two major airlines Japan airline and Nion airline

Turkey, Israel also has seen development in their airways.

12.4 DEVELOPMENT PATTERN OF PORTS

Ports are major infrastructure components in the transport network that enable trade. Historically the core functions of ports have been transshipment and value addition that increasingly tended to agglomerate at these break of bulk locations(Thus understanding and deal in with barriers to trade related port functions are important for the maintenance of port and national competiveness).

Ports are bound by the need to reserve ships, and so access to navigable water has been historically the most important sit consideration. Before the industrial revolution ships were the most efficient means of transporting goods, and thus port sites were frequently chosen at the head of water navigation, the most upstream site.

Major Ports in Asia

Asia has about 62800 km coastline. Working ports in Asia handles 90% of seaborne trade. Asia is the largest continent on Earth, it covers 8.8% of the Earth's total surface area (or

30% its land area) and has the largest coastline. Asia is also the largest and most populous continent in the world. The Asian powerhouse economies are fuelling much of the dynamic growth on worldwide links, with 372 shipping routes extending to 367 ports in 102 countries on five continents.

Port is a location on the coast that can be used to load and unload cargo. Ports are commercial places along the coastline that are used for import and export of good and cargo from one country to another.

The major ports on the coast of Asia are Singapore, Kaohsiung, Tokyo, China, Oceania, Busan, South Korea, Shanghai, Kelang, Hong Kong, Laem, Chabang, Jawaharlal Nehru port are the major ports of Asia

1. Singapore port- Singapore is the biggest port in the world in terms of shipping tonnage since 1986.Singapore is also the world's top bunkering ports. The port of Singapore is also a thriving gob for shipbuilding, ship repairs and conversions. It is a global leader in the building of jack-up ridge, commanding some 80% of the world market share.

In recognition of these achievements Sigapore was voted the "Best seaport in Asia" at 2006 Asian freight and supply chain awards (AFSCA), making it the 18^{th} time the republic has been conferred the honors.

2. Kaohsiung Port- Taiwan port of Kaohsiung covers 2683 hectares with a natural harbor and two access channels to the sea of 11 and 16 meters draft depth. Located in southern Taiwan it is the country's leading port. The port has stimulated the region as an export-processing zone, producing aluminum, wood and paper, fertilizers, cement, metals, machinery and ships. Kaoshiung harbor is the fourth largest in the world and plays host of Taiwan's shipbuilding industry.

3. Tokyo Port- The port of Tokyo is nestland in a dense economic region serving an immediate population of 40 million people. Japan's prime hub occupies 1080 hectares of land and a designated water area covering 5453 berths, the port is equipped to handle the largest ocean going vessels and remarkably boosts 38 helipad spots. Seven berths at the oil container terminal each have a 50,000 dwt capacity.

4. Busan South Korea- The port of Busan consists of the north port, Gamchun Harbar, Tadaepo Harbour and the south eastern end of the Korean Peninsular, Busan bills itself as the gateway continent of Asia.

The port is currently capable of processing a million tons of cargo and has a quay wall extending 26.8 km enabling the simultaneous facilitation of 169 vessels. The Busan port authority has declared that importers and exporters will see an immediate reduction in the cost of logistics through the port.

5. Shanghai Port- It is highly likely that Shanghai port will soon officially lay claim to the title of world largest cargo port. Shanghai port was visited on average by 2173 container ships from more than 300 ports around the world each month from January to November per year. Already, seven of the world's top 26 container ports are in China and their growth rates are outstripping the rest.

6. Lembaga Pelabuhan Kelang Port- Port Kelang in Malaysia's primary ocean hub and is currently ranked 14th in the world in terms of container throughput handling 5543527 TEU's in per year. The facility also benefits from direct connection to a mainland railway which serves the capital Kuala Lampur

7. Hong Kong- Hong Kong still occupies one of the most strategic and prosperous port facilities in the world. A naturally sheltered deep seaport located in the KwaiChuny-Tsingyi basin, Hong Kong is capable of handling the largest vessels both in operation and those still on the drawing board. The existing terminals handle about 60% of total container traffic handled in Hong Kong.

8. Thailand Laem Chabang- Laem Chabang port located in the eastern part of Thailand covers total area of 2572 acres and is the main deep sea port of Thailand. It consists of several minor ports including seven container terminally, a dedicated Ro-Ro berth, and general cargo and passenger terminals. The facility also boasts a deep water shipyard facility.

9. Jawaharlal Nehru Port- Jawaharlal Nehru port also known as Nhava Sheva is a port in Maharashtra India, borders the Arabian Sea. The port is run by the Jawaharlal Nehru port trust, an organization entrusted with the operation of large shipping port in Navi Mumbai India and controlled by the central government of India. The port lies on the mainland opposite the city of Mumbai across Thane. It is connected to major highways and rail networks in India. The port handles 65% of India's container traffic.

10. Ho Chi Minh City- Ho Chi Mich city in Vietnam is the region's second fastest growing economy with an annual GDP growth rate of 7.1% in 2000.Hochi Minch city is the economic epicenter of Vietnam and is currently served by various ports and terminal facilities along the Saigon river, with over 700 km of canalsto deep water locations and the position in top ten ranking.

12.5 DEVELOPMENT PATTERN OF HARBOR

Harbor is a place on the coast where ships, boats and barges can seek shelter from a stormy weather. Harbors do not provide as many facilities as ports. A harbor can be a man made or natural feature connecting a piece of land with large water body that is mainly used to provide shelter to ship and vessels from bed promoted by power thesaurus .A harbor can be used on specific condition when water comes up to the shore whereas port can be used all the time.

Harbor Pattern In Asia

It is probably no surprise that the biggest harbors in the world are all located in China. Over the years Singapore was known as the world largest container port and Harbor.

Important harbor in Asia:

1.Sri lanka-

Major harbor in Sri lanka are Beruwala Harbor, Galle harbor, Olunil Harbor, Columbo harbor, Tricomalee harbor

2. Hong Kong-

Crooked harbor-It is a harbor at the northeast of New territories, Hongkong. The harbor is connected to double haven and the bigger sea of Miss Bag

Double Haven or(Yan Chau Tong)-It is a harbor enclosed by double island crescent island and crooked island with north-eastern new territories.

Hebe Haven-Also known as Pak Sha Wan. It is located in the south shore of Sai Kung Peninsula in Hong Kong. The harbor has one opening to port shelter in its south.The haven is an excellent natural harbor and is home to a number of yatch clubs, including the shelter clove yatch club.

Inner port shelter or Sai Kung Hoi-is a harbor off the shore of Sai Kung town. South of Sai Kung Peninsula, HongKong. Sharp Island is the major island in the harbor

Rocky Harbor or Leung Shuen Wan Hoi-It is a harbor at the south east of Sai Kung peninsula,Hong Kong.

Other harbor in Hong Kong are Taitan harbor, Tolo harbor and Victoria harbor etc.

3. China-

Haikon New Port-It is a sea port in Hainan, China. Formerly known as the inner harbor, this port is located on the southern side of the mouth of the Nanda river 7km east of Haikou Xiuying Port.

4. India-

Visakhapatnam is an outer harbor in India and is India's second largest in terms of volume of cargo handled. It is located on the east coast of India and is located midway between Chennai and Kolkata ports.

Important fishing harbor in India are Kakinad harbor, Machiliptnam, Nizampatnamand Royapuram harbor in Chennai.

5. Indonesia-

Kamal is a port on Madura island in Indonesia.It is a ferry port and connects with Surabaya,s harbor of Tanjung Perak.

Sibolga is a city and port located in the natural harbor of Sibolga bay on the west coast of north Sumatra province in Indonesia.

6. Japan-

The port of Vokohama is operated by the port and harbor Bureau of the city of Yokohama in Japan. It opens into Tokyo bay

7. Malaysia-

Blair's harbor is located between Pahang on the east coast of Peninsular Malaysia and the island of Tioman

8. Philippines

Pot of Uoilo is one of Philippines country's safest and most natural harbors.

12.6 CONCLUSION

Transport represents one of the most important human activities worldwide. It is an indispensable component of the economy and plays a major role in spatial link between regions and economic activities, between people and rest of the world. The transport network of a particular Asian country is unique. The transport system develops gradually and as the economy of Asia develops the system become denser and the roads, railways, airways, waterways become more important. Population is the most important factor affecting demand for both passenger and goods transport and hence get priority in the process of estimation of future demand for all types of transport services.

12.7 SUMMARY

Transport and development are closely related. An efficient way of transport is absolutely essential for the rapid economic growth of Asia. As scientific and technological knowledge have progressed new modes of transport have been developed.

A network of different modes of transport is necessary for the exchange of raw material and finished goods. Asia has developed a good transport network and made great progress of economy. A dense network of roads, railway, navigable rivers, canals and airway is an index of industrial growth of any country in Asia. Before the industrial revolution ship were the most efficient means of infrastructure components in the transport network that enable trade. The major ports in Asia are Singapore, Kaohsiung, and Shanghai etc. Harbors are also important part of transportation in Asia. However, harbor does not provide as many facilities as ports. So transportation and economic development are interlinked, in fact, both sustain each other.

12.8 GLOSSARY

1. Mechanized- To use machines instead of people to do work

2. Versatility- Ability to adapt or be adapted to many different functions or activities

4. Freight transport- is the physical process of transporting commodities and merchandise goods and cargo.

5. Carrying capacity- A number or quantity of people or things which can be conveyed by a vehicle or container

12.9 ANSWER TO CHECK YOUR PROGRESS

Q 1. What is the length of metaled road in Asia?

Q 2. Where does the G.T road start and end?

Q 3. Name the most important railway in Asia.

Q 4. What is the fastest mode of transport?

Q 5. Where does the Trans-Siberian railway start and end?

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12.12 TERMINAL QUESTIONS

Q 1. What are the causes of low development of roads in Asia?

Q 2. Explain about the major railways of Asia.

Q 3. Describe the major airways of Asia.

Q 4. Explain about the major port of Asia.

Q 5. Explain the difference between port and harbor.

BLOCK 5 - REGIONAL STUDY

UNIT 13 : IRAQ & IRAN

13.1 OBJECTIVES

The present unit has been attempted to make an in-depth and comprehensive study of agriculture, physiography, climate, and drainage, development of Iraq and Iran by evaluating following objectives:

1) Examining the regional geography of Iraq under different topics as physiography, climate, drainage, and agriculture.

2) Studying the regional geography of Iran under few important topics as physiography, climate, drainage, and agriculture.

13.2 INTRODUCTION

Lying at the south western corner of the huge Asian landmass is a large stretch of territory from Turkey to Afghanistan that occupies over two and a half million sq. miles in area and contains nearly 250 million people and over a dozen and a half sovereign states, two neutral zones, and bits and pieces of territory. This area, though arid and semi-arid, has enormous resources of minerals, especially petroleum and natural gas. Iraq and Iran are the countries lies in the region and having rich history, culture, physiography, climate, and drainage and agriculture system. The detail description about the region is given below under various headings**.**

13.3 REGIONAL GEOGRAPHY OF IRAQ (PHYSIOGRAPHY, CLIMATE, DRAINAGE, AGRICULTURE)

Sprawling over an area of 438,446 sq. km, Iraq has a population of 33.5 million according to 2010; with an average density of 52 persons per sq. km. Iraq is well known for its early Mesopotamian civilization. Baghdad is the capital of it and other important cities are Mosul, Basra, Irbil, Kirkuk and Karbala. Having a boundary with Saudi Arabia, Kuwait, Jordan, Syria, Turkey, Armenia and Iran, to its north lays Turkey; source of Iraq's both vital rivers. In the 7th century AD, it became part of the Arab world. Under Ottomans Turkish rule, from the 17th

century until World War I, it was then under British mandate until 1932. Iraq achieved independence as a monarchy, but a violent revolution brought the establishment of a socialist republic in 1958.**(**Fig.13.1),Map of Iraq showing political boundaries of Iraq. Lying at the south western corner of the huge Asian landmass is a large stretch of territory from Turkey to Afghanistan that occupies over two and a half million sq. miles in area and contains nearly 250 million people and over a dozen and a half sovereign states, two neutral zones, and bits and pieces of territory. This area, though arid and semi-arid, has enormous resources of minerals, especially petroleum and natural gas. Iraq and Iran are the countries lies in the region and having rich history, culture, physiography and climate, and drainage, agriculture system. The detail description about the region is given below under various headings**.**

Figure 13.1 Map of Iraq

Source: Author

Physiography

Iraq consist four distinct physical regions: 1. Lower Mesopotamia or the alluvial plains of the central and south-western part of the country; 2. Al Jazirah (the Island) or Upper Mesopotamia; 3.The western desert; 4. The mountainous region of the north and the northeast. Four broad altitudinal topographic regions can be distinguished in Iraq these are:

Mountain

This region is majestic covers, area of 92,000 km2, or about 21 parents, of the total area. The mountain region extends mainly in the northern and north-eastern parts of the country. The mountains consist mainly of parallel anticline ridges separated by elongated synclinal valleys. But they are united by narrow gorges, the outlets of the drainage of the interior basins. The mountains, for the greater part, are eroded and the detritus material has been deposited in the valleys and in the area in front of the mountains. The mountains are comprised of various folded limestone layers varying from simple folding in the south to complicated folding in 15 the north. Sindy, Zab and Rawandooz geosynclines separate these two parts. The average elevation of the former ranges from 1,700 to 2,000 meters, while it reaches an elevation of 2,300 to 3,000 meters in the latter. Faults, metamorphic rocks, and glacial landforms are not uncommon in this area. The highest mountain peak in the country is Hassarrost; it stands 3,607 meters above sea level. Water-falls, cascades, rapids and deep gorges are common geomorphic phenomena in the area. Northern mountains make up 21% of land area.

Undulating Lands

This area is comprised of a fairly hilly landscape, located south and west of the mountain region. It covers an area of about 42,000 km2, or nearly 9.6% of Iraq's total area. Although there are some similarities with the former region, general landscape differences stand sharp. The area is somewhat folded in the later phase of folding. It consists of low parallel hill ridges, wide shallow valleys and extensive plains, in which various streams have cut their valleys. In general, average altitude varies from 200 to 1,000 meters. Local relief ranges from a minimum of 200 to a maximum of 800 meters per square kilometer. Beds of gravel, conglomerate and sandstone make up the area. It can be divided, in terms of geomorphic landforms structure, surface rocks and degree of erosion al process, into a number of plains, plateaus, mountains and hill ridges. The mountains are relatively low. Sin Jar Mountain, west of Mosul, is an anticline range extending in a north-easterly direction. Its elevation varies from 900 to 1600 meters above sea level. The

southern edge of the mountain range is a highly dissected part. Strike valleys and minor scraps are common. Plateaus are small in number, and the best known are those of Mosul and Kirkuk. The surface of Mosul plateau is dissected by shallow valleys with hills rising to 400 meters above the surrounding valley bottoms. Plains are found within the area such as the plains of Sin jar and Arbil. The latter is a synclinal triangular basin filled with alluvium deposits. Its elevation varies from about 600 m at the eastern edge to 350 m at the western parts.

The Depositional Plain

The cultural and economic core of ancient and modern-day Iraq evolved in the southern Mesopotamian alluvial plains, along and between the lower courses of the Tigris and Euphrates. The plains drop from 80 m above sea level near Baghdad to sea level near Basra in the south. Southeast of the Baghdad area, the central inter fluve is mostly wasteland or marshes that become desiccated in the dry, hot summers. It is the plain of the twin rivers, the Tigris and the Euphrates, referred to in ancient times as Shinar and later on called Al-Sawed (i.e., black lands), because of its high agricultural productivity. The plain is located in central and southern Iraq with a number of distinct landscapes. The undulating lands are to the north, the western plateau to the west, Zagros Mountains to the east and the Persian Gulf to the south. The plains cover an area of 132,500 km2, or 30.2% of the total area of Iraq. It has a northwest-southeast orientation, trending in the same direction of the Tigris, Euphrates and Shatt al-Arab. The Mesopotamian plain is the cultural and economic core of ancient and modern-day Iraq. Nearly the whole plain is now covered by this silt material. Along the eastern borders, rivers tumbling down from the eastern mountains helped to form a number of alluvial fans. A series of adjacent fans coalesced to form an extensive piedmont alluvial plain.

The Western Plateau (Semi-desert)

This extension of the Syrian and Arabian deserts lies west of the Euphrates Valley and comprises the barren western third of Iraq. It is the realm of Iraq's few thousand remaining Bedouins and least populated and least developed part of the country. This is the largest physiographic region in the country. It occupies an area of 171,817 km2, or about 39.2% of Iraq's total area. The surface rises gradually from 120 m in the east to 700 m in the west. The topography is complex and includes rocky desert, sand dunes, ridges and depressions.

Climate

The climate of Iraq is mainly of the continental, subtropical semiarid type, with the north and north-eastern mountainous regions having a Mediterranean climate. Rainfall occurs during the winter months, from December to February in most parts of the country and November to April in the mountains, with average day temperature of 16°C dropping at night to 2°C with a possibility of frost. Summers are dry and hot to extremely hot, with a shade temperature of over 43°C during July and August, yet dropping at night to 26°C. Rainfall is highly erratic in time, quantity and locations, and ranges from less than 10cm in the south and southwest to about 100 cm/year in the north and northeast. Roughly 90% of the annual rainfall occurs between November and April, most of it in the winter months from December through March. The remaining six months, particularly the hottest ones of June, July, and August, are dry. Except in the north and northeast, mean annual rainfall ranges between 10 and 17cm. Data available from stations in the foothills and steppes south and southwest of the mountains indicate that mean annual rainfall ranges between 35 and 60 cm for that area. Annual rainfall in the mountains is more abundant and may reach 100 cm in some locations.

The summer months are marked by two kinds of wind phenomena. The southern and south-easterly Sharqi, a dry, dusty wind with occasional gusts of eighty kilometers an hour, occurs from April to early June and again from late September through November. This wind is often accompanied by violent dust storms that may raise to heights of several thousand meters so close airports for brief periods. From mid-June to mid-September the prevailing wind, called the Shamal, is from the north and northwest. It is a steady wind, absent only occasionally during this period.

The yearly average number of these east-moving cyclones amounts to 120. Most precipitation is associated with these weak cyclones. Occasionally, a well-developed cyclone may remain stagnant over the country for several days. This draws in large bodies of maritime air, associated with considerable amounts of rain in the lowlands, and heavy snowfall in the mountains. The climate of Iraq, in terms of temperature and rainfalls, may be classified into three main types.

Mediterranean Climate

This type is characterized by cool wet winters and hot dry summers. It is more restricted to the mountainous areas; therefore, snowfall is not uncommon and the amount of rainfall varies

from 40 cm at lower altitudes to 1,00 cm at higher altitudes. Average summer temperature does not exceed 35° C on the lower slopes, but it is much less on higher slopes.

Steppe Climate

This type is transitional one between the Mediterranean type in the north and the desert in the south. High temperature and small amounts of rain are the main limiting factors. Annual rainfall ranges from 200mm to 400mm. It comes during the cool season of the year when the evaporation rate is the lowest.

Hot Desert Climate

The climate of the lowlands of Iraq is a typical desert climate. This is an area of a high thermal energy. With clear sky during summer, air temperature rises to a maximum of 45-50° C. with a wide range 14 in daily temperature. Nights are rather cool. In winter times, warm and sunny weather prevails, and the temperature rarely drops below freezing point.

Now it is clear that the climate of Iraq is closely influenced by its latitudes and altitudes. In general, Iraq's climate is characterized by high summer temperatures and aridity.

Drainage

There is only one river basin in Iraq, the Shatt Al-Arab basin. The Shatt Al-Arab is the river formed by the confluence downstream of the Euphrates and the Tigris which flows into the Persian Gulf after a course of only 190 km. Before their confluence, the Euphrates flows for about 1,000 km and the Tigris for about 1,300 km, respectively, within the Iraqi territory. Nevertheless, due to the importance of the Euphrates and the Tigris, the country is generally divided into three river basins: 1. the Tigris, 2. the Euphrates, and 3. the Shatt Al-A

Surface Water Resources

Water resources in Iraq are controlled by the Twin Rivers, the Tigris and the Euphrates. Both are international rivers originating their source in Turkey. The Tigris river basin in Iraq has a total area of 253,000 km^2, or 54% of the total river basin area. 27 The average annual flow of the Euphrates as it enters Iraq is estimated at 30 km^3, with a fluctuating annual value ranging from 10 to 40 km^3. Unlike the Tigris, the Euphrates receives no tributaries within Iraq's borders. For the Tigris, average annual runoff as it enters Iraq is estimated at 21.2 km^3. All upstream and downstream tributaries of the Tigris are on its left bank; these are: the Greater Zab, which originates in Turkey and is partly regulated by the Bakhma dam. It generates 13.18 km^3 at its

confluence with the Tigris; 62% of the 25,810 km² of river basin is in Iraq; the Lesser Zab, which originates in Iran and is equipped with the Dokan dam (6.8 km³). The river basin of 21,475 km² (of which 74% is in Iraqi territory) generates about 7.17 km³ of water; Al-Adhaim (Great River), which drains about 13,000 km² entirely in Iraq. It generates about 0.79 km³ at its confluence with the Tigris. It is an intermittent stream subject to flash floods; Diyala, which originates in Iran and drains about 31,896 km², 75% of which is in Iraqi territory. It is equipped with the Darbandikhan dam and generates about 5.74 km³ at its confluence with the Tigris;Nahr Al-Tib, Dewarege and Shehabi rivers, with a combined draining of more than 8,000 km². They originate in Iran and bring together in the Tigris about 1 km³ of highly saline waters; Al-Karkha, its course is mainly in Iran and, from a drainage area of 46,000 km², brings about 6.3 km³ yearly into Iraq, namely into the Hawr Al Hawiza during the flood season, and into the Tigris river during the dry season. The Karun River, originating in Iran flows with its mean annual flow of 24.7 km³ into the Shatt Al-Arab. It brings a large amount of fresh water into the Shatt Al-Arab just before it reaches the Persian Gulf. The Euphrates and the Tigris are subject to large and possibly disastrous floods.

Agriculture

In Mesopotamia, the severe cold, especially in the north, is followed by a very short spring season, which in turn leads to an extremely long, hot summer. Consequently, grasses complete their life cycle within a period of 3-4 months. Most wild wheat can still be found in the north. Similarly, a large number of Azeglio's species, including Aetriuncialis, Aecrassa, and Aespiltoides, are widespread in most northern and central parts of Iraq. Wild barley is abundant throughout most of the country. Landraces of wheat and barley still occupy a few niches in the dry land farming sector, although their replacement by pure line, high-yielding varieties is on the rise. The northern part of Iraq is a rich centre of diversity for a number of stone fruit trees, both wild and domesticated. Evergreen fruit trees, including date palm, predominate in central and southern Iraq. A country-wide program was launched by the State Board for Agricultural Research and Faculties of Agriculture to collect, characterize, and evaluate genetic resources of a number of fruit species. These included pomegranate, pistachio, grape, olive, and apple. Field gene banks were established on a small scale in representative locations throughout the country. The date palm enjoys a favorable status in Iraq. In the early 1980s, an estimated 30 million date palm trees were growing in Iraq, but the number has declined dramatically since then. Major efforts have been initiated for the proper conservation and propagation of the more than 700

varieties of date palm in Iraq. Traditional and modern propagation methods, including tissue culture, have been utilized to maintain and, finally, to enhance the genetic diversity and promote the cultivation of this ancient tree. Iraq harbors a tremendous wealth of vegetables adapted to the various bioclimatic regions of the country. They include landraces of tomato, eggplant, okra, watermelon, melon, onion, cucumber, garlic, lettuce, cabbage and carrots. A nationwide project was initiated in 1986 to survey, collect and evaluate genetic resources of Iraqi vegetables, enhance their yield potential through pure line selection; and distribute improved lines to farmers. Landraces of vegetable crops were collected and conserved; the genetic diversity of most crops, especially the cross-pollinated ones, was improved; and high-yielding, more adapted, pure lines of vegetables derived from local landraces were distributed to farmers. Production of wheat in the three Northern Governorates (Iraqi Kurdistan) is reported to have increased as a result of the increase in the use of fertilizer and pesticides which were distributed under the oil-for-food program. Barley requires less water than wheat does, and it is more tolerant of salinity in the soil. For these reasons, Iraq started to substitute barley production for wheat production in the 1970s, particularly in southern regions troubled by soil salinity. Rice, grown in paddies, was Iraq's third most important crop as measured by cultivated area. Also, some medicinal plants, or their products, are being used externally to cure dermal diseases, insect or animal bites, and sometimes for the treatment of hair problems. Information about the medicinal and aromatic plants of Iraq is scattered in a range of different works; however, women farmers keeps tremendous indigenous knowledge of these plants and their uses.

The Current National Agricultural Research System (NARS) The Iraqi NARS is currently composed of three main types of institutions, these are: **1.** Institutions mainly specialized in agricultural research: The State Board for Agricultural Research (SBAR), and the Centre for Water and Soil Research (CWSR); these represent 32% of the Full Time Equivalent (FTE) in agricultural research; **2.** Colleges of Agriculture and Veterinary Medicine, under the Ministry of Higher education and Scientific Research, these represent 49% of FTE; and **3.** Other scientific and technical institutions for which agricultural research is a secondary mandate, such as the Agricultural and Biological Research Centre of the Iraqi Atomic Energy Commission, which represents 19% of FTE.

The State Board for Agricultural Research (SBAR) SBAR is the largest NARS institution. Its main mandate is agricultural research along with soil analysis, seed production, extension and

training. At present, SBAR consists of six main agricultural divisions: agronomy, horticulture and forestry, date palm and tissue culture, soils, animal resources and plant protection. Currently, Iraqi NARS is composed of researchers at the Ministries of Agriculture & Irrigation, Colleges of Agriculture & Veterinary Medicine, and The Iraqi Atomic Energy Commission.

The objectives of that strategy were to achieve: 1. Food self-sufficiency through the adoption of new and more productive technologies, 2. a long-term sustainable agricultural production system through sound management and development of available resources.

But agriculture sector in Iraq is facing the lack of contribution of NARS and SBAR in reference to : 1. Absence of an explicit mandate for national agricultural research, 2. Absence of research priorities related to national research needs, 3. Missing functions of planning, coordination, and evaluation of research at the university, 4. Existing physical facilities that are not used for research, 5. Existing potential of human resources that is not used for research, 6. Lack of funding for university research, 7. Missing incentives for university staff to do research, 8. Its relations with external institutions-for example, developed-country universities and international donors—which do not encourage or support development oriented research, and 9. Absence of linkages with users and potential clients of research. Thus, it is a responsibility of government to keep the agriculture agencies more healthy for the development of country.

13.4 REGIONAL GEOGRAPHY OF IRAN (PHYSIOGRAPHY, CLIMATE, DRAINAGE, AGRICULTURE)

Geographically, Iran is located in West Asia and borders the Caspian Sea, Persian Gulf, and Gulf of Oman. With an area of 1,648,195 square kilometers, Iran ranks eighteenth in size among the countries of the world. Iran shares its northern borders with three post-Soviet states: Armenia, Azerbaijan, and Turkmenistan. These borders extend for more than 2,000 km, including nearly 650 km. of water along the southern shore of the Caspian Sea. Iran's western borders are with Turkey in the north and Iraq in the south, terminating at Ar vand Rud. The Persian Gulf and Gulf of Oman littorals form the entire 1,770 km southern border. To the east lies Afghanistan on the north and Pakistan on the far south (fig. 13.2).Detail on

physiography, climate, drainage and agriculture are to retain knowledge of the area is given here for you.

Figure 13.2 Map of Iran

Source: Author

Physiography

The topography of Iran consists of rugged, mountainous rims surrounding high interior basins. Mountains, plateaus, hills and valleys, planes and inland water covered areas are the major geomorphic forms, which, in varying combinations, constitute the topography of Iran. Most of the country is above 460 meters with one sixth of it above 1, 976 meters. The largest part is the vast dry land of the interior plateaus which are virtually enclosed by high mountains, effectively cutting off sources of moisture. Outside the mountain ring are the coastal plains. In the north the 644 km narrow strip along the Caspian Sea, nowhere more than 112 km wide, falls abruptly from the 3,040 meters summits to below 27 meter plateau and the rugged mountains nearly three times as high towards the Persian Gulf and Gulf of Oman leaving a small, elongated coastal plain.

The main mountain chain is the Zagros Mountains, a series of parallel ridges interspersed with plains that bisect the country from northwest to southeast. Many peaks in the Zagros exceed 3,000 metres above sea level, and in the south-central region of the country there

are at least five peaks that are over 4,000 metres. As the Zagros continue into south eastern Iran, the average elevation of the peaks declines dramatically 1,500 metres. Rimming the Caspian Sea littoral is another chain of mountains, the narrow but high Alborz Mountains. Volcanic Mount Damavand, 5,610 metres, located in the centre of the Alborz, is not only the country's highest peak but also the highest mountain on the Eurasian landmass west of the Hindu Kush.

The centre of Iran consists of several closed basins that collectively are referred to as the Central Plateau. The average elevation of this plateau is about 900 meters, but several of the mountains that tower over the plateau exceed 3,000 meters. The eastern part of the plateau is covered by two salt deserts, the Dasht-e Kavir (Great Salt Desert) and the Dasht-e Lut. Except for some scattered oases, these deserts are uninhabited. Parts of north western Iran are part of the Armenian highlands, which adjoins it topographically with other parts of neighboring Turkey, Armenia, Azerbaijan, and Georgia.

The interior plateaus cover nearly half of the country and contain some of the world's most desolate areas. The relatively flat surface of the plateaus is broken locally by low hills and mountains that contain a series of basins of interior drainage of varying sizes. The largest of the basins are the plateau's most remarkable features, the DashteKavir (Kavir Desert) and the Dasht-e Lut (Lut Desert). The two are largely uninhabited.

Iran has only two expanses of lowlands: 1. The Khuzestan Plain in the south west and 2. The Caspian Sea coastal plain in the north. The former is a roughly triangular-shaped extension of the Mesopotamia plain and averages about 160 kilometers in width. It extends for about 120 kilometers. Much of the Khuzestan plain is covered with marshes. The Caspian plain is both longer and narrower. It extends for some 640 kilometers along the Caspian shore, but its widest point is less than 50 kilometers while at some places less than 2 kilometers separate the shore from the Alborz foothills.

Drainage

There are no major rivers in the country. Of the small rivers and streams, the only one that is navigable is the 830 kilometers long Karun, which shallow-draft boats can negotiate from Khorramshahr to Ahvaz, a distance of about 180 kilometers). Other major rivers include the Karkheh, spanning 700 kilometers and joining the Tigris; and the Zayandeh River, which is 300 kilometers long. Several other permanent rivers and streams also drain into the Persian Gulf, while a number of small rivers that originate in the north western Zagros or Alborz drain into the

Caspian Sea. The Um Almaarik River in the southwest region was expected to irrigate 20,000 ha upon completion. On the Central Plateau, numerous rivers-most of which have dry beds for the greater part of the year-form from snow melting in the mountains during the spring and flow through permanent channels, draining eventually into salt lakes that also tend to dry up during the summer months. There is a permanent salt lake, Lake Urmi (the traditional name, also cited as Lake Urmiyeh, to which it has reverted after being called Lake Rezaiyeh. In the northwest, its brine content is too high to support fish or most other forms of aquatic life. There are also several connected salt lakes along the Iran-Afghanistan border in the province of Baluchistan valtistan.

The drainage of the vast interior plateaus is largely of the inland type, consisting of a few streams that empty into the arid plateaus. Outside the interior plateaus, the drainage pattern is down the outward slopes of the mountains, terminating in the sea. Among the large rivers only the Karun is navigable. It originates in the Zagros Mountains and flows south to the Shatt-al-Arab and empties into the Persian Gulf. The largest inland body of fresh water is Lake Urmia in the north western part of the country; other lakes are mostly seasonal, and have a high content of salt.

Climate

Iran has a varied continental type of climate marked by extremes in both temperature and precipitation. In the northwest, winters are cold with heavy snowfall and subfreezing temperatures during December and January. Spring and fall are relatively mild, while summers are dry and hot. In the south, winters are mild and the summers are very hot, having average daily temperatures in July exceeding 38°C. On the Khuzestan Plain, summer heat is accompanied by high humid. Iran has a variable climate. In the northwest, winters are cold with heavy snowfall and subfreezing temperatures during December and January. Spring and fall are relatively mild, while summers are dry and hot. In the south, winters are mild and the summers are very hot, having average daily temperatures in July exceeding 38°C. On the Khuzestan Plain, summer heat is accompanied by high humid. In general, Iran has an arid climate in which most of the relatively scant annual precipitation falls from October through April. In most of the country, yearly precipitation averages 25 cm or less. The major exceptions are the higher mountain valleys of the Zagros and the Caspian coastal plain, where precipitation averages at least 50 cm annually. In the western part of the Caspian, rainfall exceeds 100 cm annually and is distributed relatively evenly

throughout the year. This contrasts with some basins of the Central Plateau that receive 10 cm or less of precipitation. Koppen classified the climate of Iran into following type:-

1. Caspian mild and wet climate,
2. Caspian mild climate,
3. Mediterranean with spring rains type climate,
4. Mediterranean climate,
5. Cold mountains climate,
6. Very cold mountains climate,
7. Cold semi-desert climate,
8. Hot semi-desert climate,
9. Dry desert climate,
10. Hot dry desert climate, and
11. Hot coastal dry climate.

Agriculture

Agriculture is one of the most important economic sectors in Iran. It contributes twenty per cent of national income (GDP) involving 23.4 per cent of total employment, 80 per cent of domestic food requirements and more than one-third of non-oil exports. It is also major occupation employing 70 per cent of total population in rural areas and is still continue as main source of livelihood of human being in spite of growing industrialization and urbanization. Agriculture is an outcome of the combination of both physical and socio-economic factors. The significance of agriculture is therefore indeed unique and wide ranging. Iran has always pursued food security by providing adequate and safe food for all, as a major priority. In this respect, the Third Five Year Development Plain has given priority on the improvement of food security through enhancing domestic production. Even then, the process of agricultural growth has not been properly channelized due to imbalance allocation of resources, unavailability of basic infrastructure and uneven and uncertain rainfall. Organic agriculture has a rapid development in Iran, with increasing interest from consumers and agricultural students. Being a centre of evolution of agriculture, organic agriculture represents an interesting alternative for a fruitful development of traditional farming methods**.** But still there are few challenges to apply as:

- Diversified crop, animal husbandry integrated program.
- Use of animal manure, wastes and by-products for soil improvement.

- Biological pest and disease control.
- Lankness of community cooperation, family labor and local market orientation.

Now Organic agriculture in Iran started within universities, and is taught in specific courses.

Iran: A land of high value organic products

The future for organic agriculture in Iran is very positive. The growth rate, experienced over the last few years, suggests a fast and considerable development of the sector. Iran may become a central area for producing high value organic products with a world-wide demand, such as Saffron, Pistachio, Pomegranate and Medical plants. Cultural studies have shown that Iranians always were interested in traditional products originating from the villages. Hence, organic products are favored because they are considered free from toxic chemicals, additives, artificial flavorings and colorings, preservatives, and are perceived as having a higher quality. Iran, the second largest country in the Middle East, is located in the southwest of Asia with an area of 1.65 million km sq. the importance of Iran as a centre for the evolution of agriculture (Fertile Crescent). Since people engaged in agriculture first settled here some 10,000 years ago, Iran is the origin of many domesticated plants and animals which are among the main sources of food for human beings all over the world. Traditional small scale farming was the main structure of farming communities for centuries. Here, the land management was based on indigenous farming systems, practices and knowledge associated with self-sufficiency and family associated communities. About 86 percent of farmers in Iran are smallholders who manage close to 40 percent of arable lands in Iran without access to agrochemicals, and traditional mixed farming systems remain prevalent. In small-scaled farming systems, ecological practices are still prevalent.

Opportunities for Organic Agriculture in Iran

Iran is the main origin of Saffron production in the world. As in many countries in the Mid-East, the domestic market for organic products in Iran is still relatively small. However, local demand for organic products has been growing parallel with consumer awareness as well as concerns related to a number of food safety issues. It is typical for developing countries that the domestic organic market starts in the capital city with small corners in the supermarkets. These shops are usually in residential areas that are inhibited by upper- and middle class citizens especially in northern part of (capital) Tehran.

The main problem for organic market growth is a consistent supply of products. Organic agriculture may enable Iranian smallholders to achieve household food security and gain better incomes while regenerating the land, enhancing biodiversity, and supplying quality food to local communities. At present, there is increased interest for organic products for export. The majority of the organic production in Iran is being exported. The main importing countries of Iranian organic products are Germany, France, The UK, The Netherlands and some countries in East Asia.

National support for developing Organic Agriculture

The Ministry of Agriculture recently established a 'Committee on Organic Agriculture' to make a policy and provide an action plan for the development of organic agriculture in Iran. An Agricultural Research, Education and Extension Organization has introduced a program to implement a new research department called "Farming Systems", where a research program for organic agriculture was included. Governmental subsidies on agrochemicals have been reduced dramatically since 2007, which may contribute to a positive development for organic agriculture.

Cultivated area in Iran

Parallel to the interest for organic agriculture within the universities, the market began to develop. Certified organic products in Iran have been available since 1999, when an orchard with roses for extracting essential oils in Kerman province was converted. In 2006, a company in the province of Fars was certified to export organic Pomegranate, Figs, Dates, and Medicinal herbs to the EU. Since then, the organic market has been growing rapidly. Recent statistics published by IFOAM & FIBL show that there are 43000 hectares under organic management, and about the same certified for wild collection. The only dense wild Pistachio forest in the world located in Northern East of Iran. Iran is the main origin of Saffron production in the world. As in many countries in Mid- East, the domestic market for organic products has been growing parallel with consumer awareness as well as concerns related to a number of food safety issues.

13.5 CONCLUSION

Thus we can say that the objective of the unit as Examining the regional geography of Iraq and Iran under different topics as physiography, climate, drainage, and agriculture is full fill

by above description very well.. Iraq lies between 29°15'N, and 38°15'N, 38°45 and 48°45'E, and is located entirely within the North Temperate Zone having total area of 438,320 km2. Mountains, plateaus, hills and valleys, planes and inland water covered areas are the major geomorphic forms. Which, is varying combinations, constitute the topography of Iraq. These geomorphic forms exert a strong influence upon the cultural and economic patterns of the country and, together with the climate. The country has only three river basins: the Tigris, the Euphrates, and the Shatt Al-Arab. Agriculture, in 2001, contributed 6.1% to the GDP. During recent decades, however, Iraq has shifted from net food exporter to food importer. This shift was prompted by several factors, including population increase, a rising standard of living, increased industrialization, migration of farm workers to urban centers, and loss of soil productivity in poorly drained irrigated areas of the south etc. On the other side the agrarian sector in Iraq witnessed a number of drastic measures during the last 40 years. These include: land reform, cooperative and collective state farming, central planning and, finally, private ownership etc. Hope that in future there will be good responses from agriculture.

Iran is bordered by the Gulf of Oman, the Persian Gulf, and the Caspian Sea. It hasarid or semiarid climates mostly characterized by low rainfall and high potential evapotranspiration and its location cause it to receive less than a third of the world average precipitation. The complex physical conditions of Iran including topography and landscape have created a diverse climate pattern, so that it led to the formation of different ecological zones with various species of plants and animals. Furthermore, the climate is influenced by Caspian Sea in north, coastal areas of south of the country, Mediterranean area and Red sea. There are no major rivers in the country. The only one that is navigable, Karun, other rivers includesthe Karkheh, Tigris, Zayandeh, Alborz, and Um Almaarik. Agriculture is one of the most important economic sectors in Iran. It contributes twenty per cent of national income (GDP) involving 23.4 per cent of total employment, 80 per cent of domestic food requirements. The main crops grown are wheat, barley, rice, fruits, dates, sugar beet, cotton, oilseeds, vegetables, almond, walnut, saffron, pistachio, apricot, fodder and legumes. Even then, the process of agricultural growth has not been properly channelized due to imbalance allocation of resources, unavailability of basic infrastructure and uneven and uncertain rainfall. So there is requirement of proper management and effort in the field. Organic agriculture is telling the story of progress in Iran.

Iraq was created in 1932, when the Brutish relinquished control over their former mandates in South west Asia. It has an area of 435,652 sq. km excluding the neutral zone jointly controlled by Saudi Arabia, and a population of 22.4 million. It was ruled as monarchy by the Hashemite family until an army-led revolution overthrew it in 1958, when it became a republic. Occupying the territory that was known as Mesopotamia of classical times, the region's extensive alluvial plains of the Tigris and Euphrates gave rise to the world's earliest civilizations. Iraq is one of the world's leading oil producers. In recent decades it has built one of the most powerful armed forces in the Arab world.

13.6 SUMMARY

Now you get the regional distribution of Iran and Iraq under various topics as physiography, climate, drainage and agriculture**.** Both the neighboring countries has same problem of low agriculture production, harsh climatic conditions, poor drainage system and not good support by the government. Iraq was created in 1932, when the Brutish relinquished control over their former mandates in South west Asia. It has an area of 435,652 sq. km excluding the neutral zone jointly controlled by Saudi Arabia, and a population of 22.4 million. It was ruled as monarchy by the Hashemite family until an army-led revolution overthrew it in 1958, when it became a republic. Iraq is one of the world's leading oil producers.

Topographically, Iraq is shaped like a basin, consisting of the Great Mesopotamian alluvial plain of the Tigris and Euphrates. This plain is surrounded by mountains in the north and the east, which can reach altitudes of 3,550 m above sea level, and by desert areas in the south and west, which account for over 40% of the land area. Mesopotamia, the ancient land of the "Twin Rivers" the Tigris and Euphrates, with its bountiful land, fresh waters, and varying climates, contributed tothe human civilization in many ways. Mountains, plateaus, hills and valleys, planes and inland water covered areas are the major geomorphic forms, which, in varying combinations, constitute the topography of Iraq. The climate varies from Mediterranean to continental & sub-tropical, semiarid type here.

The current situation is creating new, more intensive, and more diverse demands on farmers, agricultural producers and planners. Crops such as wheat, barley, sugar beet, cotton, vegetables, and fruits, dairy products, and agricultural industries (e.g., sugar, cotton, woolen

textiles, etc.) form the basis of a solid agricultural economy. Although the agricultural sector, during the last decade, has been given high priority to ensure food security through greater self-sufficiency, the country, and for the foreseeable future, will continue to depend on imported food. Due to poor management and inadequate planning and allocation of trained human resources; agricultural extension services and agricultural vocational education, in particular, are in need of major improvements.

Consists of a central plateau, and deserts region by high young folded mountains. Central Iran is a step- like plateau with a harsh climate, surrounded by deserts and mountains. According to climate; Iran has a varied continental type of climate marked by extremes in both temperature and precipitation. Summers are extremely hot along the Persian Gulf, where temperatures of 50^0 C, but fall rapidly at night. Winters are generally cold, except along the milder Caspian and Persian Gulf shores, with temperatures reaching below 0^0C on the plateau. In Tehran, the average January temperature is 2^0 C, and the average for July is 30^0 C. Precipitation ranges from more than 127 cm in the north western and very less in southward. Nation's only navigable river is the Karun, which rises in the central Zagros and joins the Shatt – al – Arab at Khorrramshahr. other rivers that flow round the year are the Atrak in the southeast, the Safid, which flows through the Elburz to the south shore of Caspian Sea, and the Araks in the north west. Qanats, or long underground water tunnels, are widely used to bring water from mountains into plateau. In Iran, only 30 per cent of the total population is directly or indirectly dependent on agriculture. Nearly 10 percent of the total area is under cultivation. The size of holding is, however, small and consequently, uneconomic. The main crops grown are wheat, barley, rice, fruits, dates, sugar beet, cotton, oilseeds, vegetables, almond, walnut, saffron, pistachio, apricot, fodder and legumes. Underground water irrigates the oases where several varieties of grains and fruit trees are cultivated.

13.7 GLOSSARY

Organic products- It is the product of a farming system which avoids the use of man-made fertilizers, pesticides; growth regulators and livestock feed additives.

Physiography-It is the subfield of geography that studies physical patterns and processes of the Earth, It aims to understand the forces that produce and change rocks, oceans, weather etc.

Drainage basin- The area drained by a river and all its tributaries. It is also called catchment area, drainage area.

Regional Geography-It is a branch of geography that studies the world's region. A region itself is defined as a part of the Earth's surface with one or many similar characteristics that make it unique from other areas."

Topographically-Graphic representation of the surface features of a place or region on a map, indicating their relative positions and elevations.

13.8 ANSWER TO CHECK YOUR PROGRESS

Q.1 what is the location of Iraq?

Q.2Write the name of the border country of Iraq.

Q.3what are the physiographic regions of Iraq?

Q.4what are the names of rivers flowing in Iraq?

Q.5 Write the name of major crops grows in Iraq.

Q.6Write the reason for the poor responses from agriculture sector?

Q.7 what are the neighboring countries of Iran?

Q.8 Write the short description about the climate of Iran?

Q. 9 write the name of rivers of Iran?

Q.10 what is the percentage of agriculture sector in GDP of Iran?

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13.11 Terminal Questions

Q.1 What is regional development?

Q.2 What do you understand by the term physiography?

UNIT 14 : PAKISTAN & SRI LANKA

14.1 OBJECTIVES

The present unit has been attempted to make an in-depth and comprehensive study of South Asia country Pakistan and Sri Lanka under various sub- headings as physiography, climate, and drainage, and agriculture, by evaluating following objectives:

1) Examining the regional geography of Pakistan under different topics as physiography, climate, drainage, and agriculture.

2) Studying the regional geography of Sri Lanka under few important topics as physiography, climate, drainage, and agriculture.

14.2 INTRODUCTION

South Asia includes the countries of Bangladesh, Bhutan, India, Maldives, Nepal, Pakistan and Sri Lanka. The region covers only 3 per cent of the world's area but population pressure is 22 per cent, and more than half of total population of these countries is engaged in subsistence farming. Thus the population growth rates in South Asian countries are the highest in the world. This is a region of immense physiographic variety of snow- capped peaks, deep and narrow valleys, vast deserts and broad river basins, high plateaus and vast sea shores. It has four clearly defined physiographic divisions:

1. The mountains,

2. The Great Plains

3. The plateau, and

4. The coastal plains and islands.

The climate of the south Asia is characterized by a rhythm of monsoon winds which change their direction completely after every six months. Develop drainage and extension of agriculture fields are the major characteristics of the region. The detail descriptions of two major countries as Pakistan and Sri Lanka are given below according to the objectives of the unit.

14.3 REGIONAL GEOGRAPHY OF PAKISTAN (PHYSIOGRAPHY, CLIMATE, DRAINAGE, AGRICULTURE)

On Aug. 14, 1947, Pakistan emerged as a national sovereign state. For the new state, the initial years proved to be a period essentially of consolidation and exploration. The constitution adopted in 1956. Pakistan is a populous and multi-ethnic country of South Asia. Having a predominately Indo-Iranian speaking population, Pakistan has historically and culturally been associated with its neighbors Iran, Afghanistan, and India. Since Pakistan and India achieved independence in 1947, Pakistan has struggled throughout its existence to attain political stability and sustained social development. Its capital is Islamabad, in the foothills of the Himalayas in the northern part of the country, and its largest city is Karachi, in the south on the coast of the Arabian Sea. Pakistan was brought into being at the time of the partition of British India, in response to the demands of Islamic nationalists: as articulated by the All India Muslim League under the leadership of Mohammed Ali Jinnah, India's Muslims would receive just representation only in their own country. From independence until 1971, Pakistan (both de facto and in law) consisted of two regions—West Pakistan, in the Indus River basin in the north-western portion of the Indian subcontinent, and East Pakistan, located more than 1,600 km to the east in the vast delta of the Ganges-Brahmaputra river system. In response to grave internal political problems that erupted in civil war in 1971, East Pakistan was proclaimed the independent country of Bangladesh. Pakistan is bounded by Iran to the west, Afghanistan to the northwest and north, China to the northeast, and India to the east and southeast. The coast of the Arabian Sea forms its southern border.

Pakistan encompasses a rich diversity of landscapes, starting in the northwest, from the soaring Pamir and the Karakoram Range through a maze of mountain ranges, a complex of valleys, and inhospitable plateaus, down to the remarkably even surface of the fertile Indus River plain, which drains southward into the Arabian Sea. It contains a section of the ancient Silk Road and the Khyber Pass, the famous passageway that has brought outside influences into the otherwise isolated subcontinent. Along the Indus River, the artery of the country, the ancient site of Mohenjo-Daro marks one of the cradles of civilization.

Figure 14.1 Map of Pakistan

Source Google

Physiography

Pakistan is situated at the western end of the great Indo-Gangetic Plain. Of the total area of the country, about three-fifths consist of rough mountainous terrain and plateaus, and the remaining two-fifths constitute a wide expanse of level plain. The land can be divided into five major regions: the Himalayan and Karakoram ranges and their sub ranges; the Hindu Kush and western mountains; the Baluchistan plateau; the sub mountain plateau (Pot war, Salt Range, trans-Indus plain, and Sialkot area); and the Indus River plain. Within each major division there are further subdivisions, including a number of desert areas.

The Himalayan and Karakoram ranges

The Himalayas, which have long been a physical and cultural divide between South and Central Asia, form the northern rampart of the subcontinent, and their western ranges occupy the entire northern end of Pakistan, extending about 320 km into the country. Spreading over Kashmir and northern Pakistan, the western Himalayan system splits into three distinct ranges, which are, from south to north, the Pir Panjal Range, the Zaskar Range, and the Ladakh Range. Farther north is the Karakoram Range, which is a separate system adjoining the Himalayas. This series of ranges varies in elevation from roughly 4,000 meters to higher than 6,000 meters above sea level. Four of the region's peaks exceed 8,000 meters, and many rise to heights of more than 4,500 meters. These include such towering peaks as Nanga Parbat 8,126 meters and K2, also called Godwin Austen 8,611 meters, in the Northern Areas. Beyond the Karakoram Range in the extreme north lies the Uygur Autonomous Region of Xinjiang, China; to the northwest, beyond the Hindu Kush, is the Pamir. Siachen Glacier, one of the world's longest mountain glaciers, feeds the Nubra River, a tributary of the Shyok.

The Hindu Kush and the western mountains

In far northern Pakistan the Hindu Kush branches off south-westward from the nodal organic uplift known as the Pamir Knot. The ridges of the Hindu Kush generally trend from northeast to southwest, while those of the Karakorum run in a southeast-northwest direction from the knot. The Hindu Kush is made up of two distinct ranges, a main crest line that is cut by transverse streams, and a watershed range to the west of the main range, in Afghanistan, that divides the Indus system of rivers from the Amu Darya (ancient Oxus River) drainage basin. From the Hindu Kush, several branches run southward through the areas of Chitral, Dir, and Swat, in Khyber Pakhtunkhwa. These branches have deep, narrow valleys along the Kunar, Panjkora, and Swat Rivers. In the extreme northern portion, the ranges are capped with perpetual snow and ice; high peaks include Tirich Mir, which rises to 7,690 meters. The valley sides are generally bare on account of their isolation from the precipitation-bearing influences. Toward the south the region is largely covered with forests of deodar (a type of cedar) and pine and also has extensive grass lands.he Safid Mountain Range, lying south of the Kābul River and forming a border with Afghanistan, trends roughly east to west and rises throughout to an elevation of about 4,300 meters. They are, from north to south, the Khyber, Kurram, Tochi, Gomal, and Bolan. South of the Gumal River, the Sulaiman Range runs in a roughly north-south direction.

The highest point of that range, Takht-e Sulaiman, has twin peaks, the higher of which reaches 5,633 meters. The Sulaiman Range tapers into the Marri and Bugti hills in the south. The Sulaiman and, farther south, the low Kirthar Range separates the Balochistan plateau from the Indus plain.

The Balochistan plateau

The vast tableland of Balochistan contains a great variety of physical features. In the northeast a basin centred on the towns of Zhob and Loralai forms a trellis-patterned lobe that is surrounded on all sides by mountain ranges. To the east and southeast is the Sulaiman Range, which joins the Central Brahui Range near Quetta, and to the north and northwest is the Toba Kakar Range (which farther west becomes the KhwajaAmran Range). The hilly terrain becomes less severe southwestward in the form of RasKoh Range. The small Quetta basin is surrounded on all sides by mountains. The whole area appears to form a node of high ranges. West of the Ras Koh Range, the general landform of north-western Balochistan is a series of low-lying plateaus divided by hills. In the north the Chagai Hills border a region of true desert, consisting of inland drainage and hamuns (playas).Southern Balochistan is a vast wilderness of mountain ranges, of which the Central Brahui Range is the backbone. The easternmost Kirthar Range is backed by the Pab Range in the west. Other important ranges of southern Balochistan are the Central Makran Range and the Makran Coast Range.

The sub mountain plateau

Lying south of the northern mountain rampart, the sub mountain plateau has four distinct divisions—the Trans-Indus plains, the Potwar Plateau, Potwar Plateau, the Salt Range, and the Sialkot region. The Trans-Indus plains, west of the Indus River, comprise the hill-girt plateaus of the Vale of Peshawar and of Kohat and Bannu, all of which are oases in the arid, scrub-covered landscape of Khyber Pakhtunkhwa. Of these, the Vale of Peshawar is the most fertile. Gravel or clay alluvial detritus covers much of the area and is formed from loose particles or fragments separated from masses of rock by erosion and other forces.

The Potwar Plateau

It covers an area of about 13,000 square km and lies at an elevation of some 350 to 575 meters. It is bounded on the east by the Jhelum River and on the west by the Indus River. On the north, the Kala Chitta Range and Margala Hills (at about 900 to 1,500 meters) form its boundary. Toward the south it gradually slopes into the Salt Range, which presents a steep face rising to about 600 meters even farther south. The middle of the Potwar Plateau is occupied by the structurally down warped basin of the Soan River. The general terrain of the basin consists of interlaced ravines, which are locally known as 'khaderas' and are set deep in the soft Shiwalik beds of which the whole area is composed. The surface layer of the area is formed of windblown loessic silt, deteriorating into sand and gravel toward the hill slopes.

The Salt Range is an extremely arid territory that marks the boundary between the sub mountain region and the Indus River plain to the south. The highest point of the Salt Range, Mount Sakesar, lies at 1,522 meters.

The Sialkot region is a narrow sub mountain area in the northeast. Unlike the Potwar Plateau, it is a rich agricultural region. Precipitation varies from 65 to 90 cm per year, and the water table is high, facilitating well (and tube-well) irrigation; the soil is heavy and highly fertile.

Climate

Aridity is the most pervasive aspect of Pakistan's climate, and its continental nature can be seen in the extremes of temperature. Pakistan is situated on the edge of a monsoonal (i.e., wet-dry) system. Precipitation throughout the country generally is erratic, and its volume is highly variable. The rainy monsoon winds, the exact margins of which vary from year to year, blow in intermittent bursts, and most moisture comes in the summer. Tropical storms from the Arabian Sea provide precipitation to the coastal areas but are also variable in character. The efficiency of the monsoonal precipitation is poor, because of its concentration from early July to mid-September, when high temperatures maximize loss through evaporation. In the north the mean annual precipitation at Peshawar is 33 cm, and at Rawalpindi it reaches 95 cm. In the plains, however, mean annual precipitation generally decreases from northeast to southwest, falling from about 50cm at Lahore to less than 13 cm in the Indus River corridor and 90 cm at Sukkur.

Under maritime influence, precipitation increases slightly to about 15 cm at Hyderabad and 20 cm at Karachi. The 50cm precipitation line, which runs northwest from near Lahore, marks off the Potwar Plateau and a part of the Indus plain in the northeast; these areas receive enough rainfall for dry farming (farming without irrigation). South of this region, cultivation is confined mainly to riverine strips until the advent of irrigation. Most of the Baluchistan plateau, especially in the west and south, is exceptionally dry.

Pakistan's continental type of climate is characterized by extreme variations of temperature, both seasonally and daily. High elevations modify the climate in the cold, snow-covered northern mountains; temperatures on the Baluchistan plateau are somewhat higher. Along the coastal strip, the climate is modified by sea breezes. In the rest of the country, temperatures reach great extremes in the summer; the mean temperature during June is 38 °C in the plains, where the highest temperatures can exceed 47 °C. Jacobabad, in Sind, has recorded the highest temperature in Pakistan, 53 °C. In the summer, hot winds called 'loos' blow across the plains during the day. Trees shed their leaves to avoid excessive moisture loss. The dry, hot weather is broken occasionally by dust storms and thunderstorms that temporarily lower the temperature. Evenings are cool; the diurnal variation in temperature may be as much as 11 to 17 °C. Winters are cold, with minimum mean temperatures of about 4 °C in January.

Drainage

Several important rivers flow from, or through, the mountains of Kashmir into Pakistan. From the PirPanjal Range flows the Jhelum River (which bisects the famous Vale of Kashmir); the Indus River descends between the Zaskar and Ladakh ranges; and the Shyok River rises in the Karakoram Range. South of the PirPanjal is the northwestern extension of the Shiwalik Range (there rising to about 200 to 300 meters), which extend over the southern part of the Hazara and Murree hills and include the hills surrounding Rawalpindi and neighboring Islamabad.

Agriculture

Overall, approximately one-fourth of Pakistan is arable land, although only small fractions of that are in permanent crops (about 1 per cent). Nonetheless, agriculture still provides

employment for the single largest proportion of the labour force and a livelihood for an even larger segment of the population. Land-reform programs implemented in 1959, 1972, and 1977 began to deal with the problems of large-scale, often absentee ownership of land and the excessive fragmentation of small holdings by introducing maximum and minimum area limits. The commercialization of agriculture has also resulted in fairly large-scale transfers of land, concentrating its ownership among middle-class farmers.

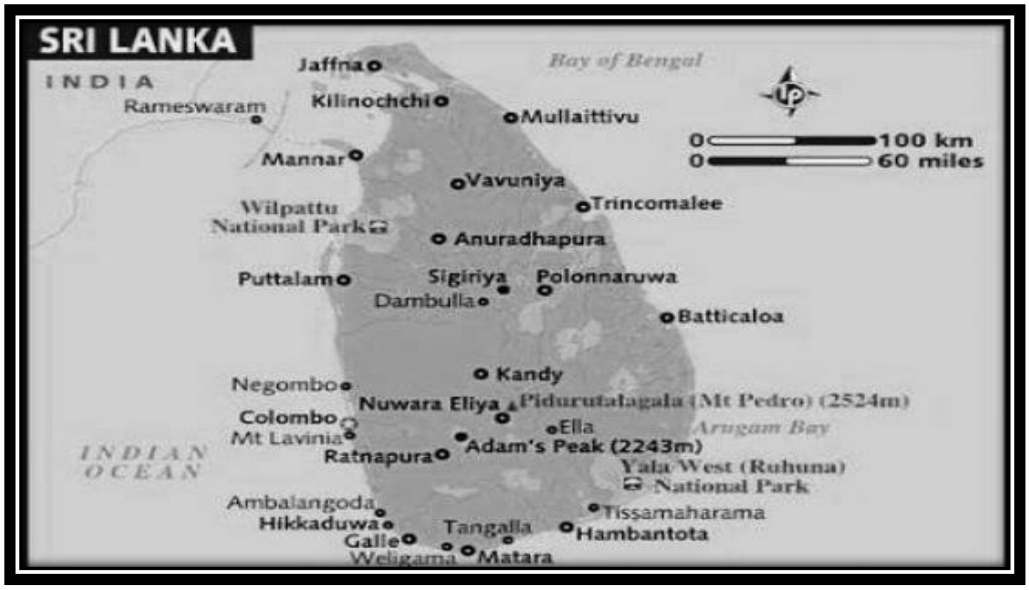
The attention given to the agricultural sector in development plans has brought about some radical changes in centuries-old farming techniques. The construction of tube wells for irrigation and salinity control, the use of chemical fertilizers and scientifically selected seeds, and the gradual introduction of farm machinery have all contributed to the notable increase in productivity. Self-sufficiency in wheat—the national staple—was achieved by about 1970. Cotton production also rose, which added to the domestic production of textiles and edible cottonseed oils. Rice is the second major food staple and one of the country's important export crops. Large domestic sugar subsidies have been primarily responsible for an increase in sugarcane production. Other crops include chickpeas, pearl millet (bajra), corn (maize), rapeseed, and mustard, as well as a variety of garden crops, including onions, peppers, and potatoes. Pakistan benefits greatly from having two growing seasons, rabi (spring harvest) and kharif (fall harvest).

The cultivation and transportation of illicit narcotics remains a large sector of the informal economy. Pakistan is one of the world's leading producers of opium poppy and also produces or transports cannabis from Afghanistan for local markets and for re-export abroad. The Ministry of Water and Power is responsible for the development of water projects including hydropower dams, main canals and inter-provincial works. The Ministry is supported by the Office of the Chief Engineering Advisor, the Chair of the Federal Flood Commission and the Chair of the Indus River System Authority (IRSA). The IRSA is responsible for the distribution of water among the provinces and assists provinces to share shortages according to the Apportionment Accord of 1991. The Water and Power Development Authority (WAPDA),created in 1958 as a semiautonomous body, is the functional arm of the Ministry of Water and Power and is responsible for the development of hydropower and water development projects in Pakistan.

14.4 REGIONAL GEOGRAPHY OF SRI LANKA (PHYSIOGRAPHY, CLIMATE, DRAINAGE, AGRICULTURE)

Sri Lanka, formerly Ceylon, island country lying in the Indian Ocean and separated from peninsular India by the Palk Strait. It is located between latitudes 5°55′ and 9°51′ N and longitudes 79°41′ and 81°53′ E and has a maximum length of 432 km and a maximum width of 224 km. Proximity to the Indian subcontinent has facilitated close cultural interaction between Sri Lanka and India from ancient times. Ancient Greek geographers called it Taprobane. Arabs referred to it as Sere dib. Later European mapmakers called it Ceylon, a name still used occasionally for trade purposes. It officially became Sri Lanka in 1972.In 1948, after nearly 150 years of British rule, Sri Lanka became an independent country, and it was admitted to the United Nations seven years later. The country is a member of the Commonwealth and the South Asian Association for Regional Cooperation. Colombo, which emerged as the main urban centre during British rule, remains the executive and judicial capital of Sri Lanka; Sri Jayewardenepura Kotte, a Colombo suburb, is the legislative capital. For administrative purposes, the country has been divided into nine provinces and subdivided into 25 districts.

Figure 14.2 Map of Srilanka



Source: Google

Sri Lanka is densely populated. The majority of its people are poor, live in rural areas, and depend on agriculture for their livelihood. A physical environment of wide-ranging diversity makes Sri Lanka one of the world's most scenic countries. As the home of several ethnic groups, each with its own cultural heritage, Sri Lanka also has a highly varied cultural landscape. Regional Geography of Sri Lanka under various sub-headings; physiography, climate, drainage and agriculture are fully described in the unit as:

Physiography

A roughly triangular mountainous area known as the Central Highlands occupies the south-central region of Sri Lanka and is the heart of the country. This highland mass is surrounded by a diverse plain, the general elevation of which ranges from sea level to about 300 meters. This plain accounts for about five-sixths of the country's total area. The Central Highlands have a highly dissected terrain consisting of a unique arrangement of plateaus, ridges, escarpments, intermountain basins, and valleys. Sri Lanka's highest mountains Pidurutalagala at 2,524 meters, Kirigalpotta and Adam's Peak (Sri Pada) are found in this area. The highlands, except on their western and south western flanks, are sharply defined by a series of escarpments, the most spectacular being the so-called World's End, a near-vertical precipice of about 4,000 feet. Geologically, the island of Sri Lanka is considered a southerly extension of peninsular India (the Deccan), with which it shares a continental shelf and some of its basic lithological and geomorphic characteristics. More than 90% of Sri Lanka's surface lies on Precambrian strata, some of it dating back 2 billion years. Sri Lanka does not experience earthquakes or major volcanic events because it rides on the centre of the plate.

Extensive faulting and erosion over time have produced a wide range of topographic features. Three zones are distinguishable by elevation: the Central Highlands, the plains, and the coastal belt.

Central Highlands:

The south-central part of Sri Lanka the rugged Central High landsis the heart of the country. The core of this area is a high plateau, running north-south for approximately 65 kilometers. This area includes Sri Lanka's highest mountains, Pidurutalagala at the height of

2,524 m. At the plateau's southern end, mountain ranges stretch 50 kilometers to the west toward Adam's Peak (2,243 meters) and 50 kilometers to the east toward Namunakula (2,036 m). Flanking the high central ridges are two lower plateaus. On the west is the Hatton Plateau, a deeply dissected series of ridges sloping downward toward the north. On the east, the Uva Basin consists of rolling hills covered with grasses, traversed by some deep valleys and gorges. To the north, separated from the main body of mountains and plateaus by broad valleys, lies the Knuckles Massif: steep escarpments, deep gorges, and peaks rising to more than 1,800 meters. South of Adam's Peak laid the parallel ridges of the Rakwana Hills, with several peaks over 1,400 meters. The land descends from the Central Highlands to a series of escarpments and ledges at 400 to 500 meters above sea level before sloping down toward the coastal plains.

The plains:

Most of the island's surface consists of plains between 30 and 200 meters above sea level. In the southwest, ridges and valleys rise gradually to merge with the Central Highlands, giving a dissected appearance to the plain. Extensive erosion in this area has worn down the ridges and deposited rich soil for agriculture downstream. In the southeast, a red, lateritic soil covers relatively level ground that is studded with bare, monolithic hills. The transition from the plain to the Central Highlands is abrupt in the southeast, and the mountains appear to rise up like a wall. In the east and the north, the plain is flat, dissected by long, narrow ridges of granite running from the Central Highlands.

The coastal belt:

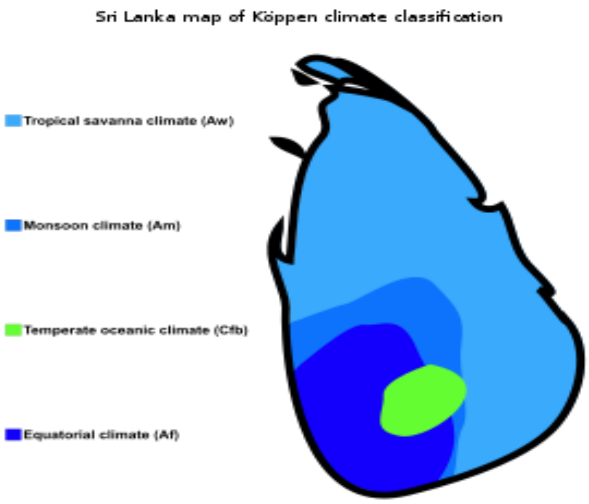
A coastal belt about thirty meters above sea level surrounds the island. Much of the coast consists of scenic sandy beaches indented by coastal lagoons. In the Jaffna Peninsula, limestone beds are exposed to the waves as low-lying cliffs in a few places. In the northeast and the southwest, where the coast cuts across the stratification of the crystalline rocks, rocky cliffs, bays, and offshore islands can be found; these conditions have created one of the world's best natural harbors at Trincomalee on the northeast coast, and a smaller rock harbor at Galle on the southwestern coast.

Climate

Sri Lanka's tropical location ensures perennially high temperatures, with monthly averages between 22 °C and 33 °C in the lowlands. In the Central Highlands, higher altitudes account for lower temperatures, with monthly averages between 7 °C and 21.6 °C.

Rainfall is the conspicuous factor in the seasonal and diurnal variations of the climate of Sri Lanka. Most parts of the country receive an average annual rainfall of more than 127 cm. However, regional differences in the amount of rain, its seasonality, and its variability and effectiveness have formed the basis of a distinction in Sri Lanka between a Wet Zone and a Dry Zone. In the former area, which covers the south-western quadrant of the island (including the highlands), the rainfall is heavy (annual averages range from 250 cmalong the coast to more than 380 cm in the highlands) and seasonally well distributed (although a greater part of the rain comes from the southwest monsoon from May to September). Rainfall deviates relatively little each year from the annual averages and is effective enough to maintain soil moisture and surface drainage throughout the year. Over the rest of the island, the Dry Zone annual totals of rain range from 75cm to 170 cm in the different areas (much of it being received during the northeast monsoon season from November to January). Droughts that persist for more than three months are common.

Figure 14.3 Climate of Srilanka



Source: Google map

Sri Lanka map of Koppen climate classification

Sri Lanka's climate can be described as tropical, and quite hot. Its position between 5 and 10 north latitude endows the country with year-round warm weather, moderated by ocean winds and considerable moisture. The average temperature ranges from a low of 16 °C in Nuwara Eliya in the Central Highlands (where frost may occur for several days in the winter) to a high of 32 °C in Trincomalee on the northeast coast (where temperatures may reach 38 °C). The average yearly temperature for the country as a whole ranges from 28 to 30 °C. Day and night temperatures may vary by 4 to 7 °C. January is the coolest month, especially in the highlands, where overnight temperatures may fall to 5 °C. May, the hottest period, precedes the summer monsoon rains.

The rainfall pattern is influenced by the monsoon winds of the Indian Ocean and Bay of Bengal and is marked by four seasons. The first is from mid-May to October, when winds originate in the southwest, bringing moisture from the Indian Ocean. When these winds encounter the slopes of the Central Highlands, they unload heavy rains on the mountain slopes and the southwestern sector of the island. Some of the windward slopes receive up to 2, 50 cm of rain per month, but the leeward slopes in the east and northeast receive little rain. The second season occurs in October and November, inter monsoonal months. During this season, periodic squalls occur and sometimes tropical cyclones bring overcast skies and rains to the southwest, northeast, and eastern parts of the island. During the third season, December to March, monsoon winds come from the northeast, bringing moisture from the Bay of Bengal. The northeastern slopes of the mountains may be inundated with up to 1, 25 cm of rain during these months. Another inter monsoonal period occurs from March until mid-May, with light, variable winds and evening thunder showers.An increase in average rainfall coupled with heavier rainfall events has resulted in recurrent flooding and related damages to infrastructure, utility supply and the urban economy.

Humidity is typically higher in the southwest and mountainous areas and depends on the seasonal patterns of rainfall. At Colombo, for example, daytime humidity stays above 70% all year, rising to over 90% percent during the monsoon season in June. Anuradhapura experiences a daytime low of 60% during the inter monsoonal month of March, but a high of 79% during the

November and December rains. In the highlands, Kandy's daytime humidity usually ranges between 70 and 79%.

Drainage

Sri Lanka's rivers rise in the Central Highlands and flow in a radial pattern toward the sea. Most of these rivers are short. There are 16 principal rivers longer than 100 kilometers in length, with twelve of them carrying about 75% of the mean river discharge in the entire country. The longest rivers are the Mahaweli Ganga (335 km) and the AruviAru (170 km). In the highlands, river courses are frequently broken by discontinuities in the terrain, and where they encounter escarpments, numerous waterfalls and rapids have eroded a passage. Once they reach the plain, the rivers slow down and the waters meander across flood plains and deltas. The upper reaches of the rivers are wild and usually un-navigable, and the lower reaches are prone to seasonal flooding. Human intervention has altered the flows of some rivers in order to create hydroelectric, irrigation, and transportation projects. In the north, east, and southeast, the rivers feed numerous artificial lakes or reservoirs (tanks) that store water during the dry season. During the 1970s and 1980s, large-scale projects dammed the Mahaweli Ganga and neighbouring streams to create large lakes along their courses. Several hundred kilometres of canals, most of which were built by the Dutch in the 18th century, link inland waterways in the south western part of Sri Lanka.

Thus it can be say that the surface drainage of Sri Lanka is made up of about 100 “rivers,” most of which are mere wet-season rivulets. Twelve major rivers account for about 75 percent of the mean annual river discharge of the country, with those that flow entirely through the Wet Zone (the highlands and the south-western part of the country; carrying about half the total discharge. With the exception of the 335 km long Mahaweli River, all major rivers flow radially from the Central Highlands to the sea. The Mahaweli, which originates on the western slopes of the highest areas of the highlands, follows a circuitous route in its upper reaches before it enters the plain to the east of the highlands and then flows toward the northeast coast. Because a part of its catchment is well within the Wet Zone, this river has a larger and less seasonally varied flow than the other. Dry Zonerivers and so is a major asset for irrigation in the drier parts of the country (the Dry Zone includes the northern part of the country and much of the east and southeast;).

Agriculture

Rice production is the most important economic activity of Sri Lanka's peasantry. Since independence there has been an impressive increase of paddy production. Tea, the preeminent crop of the plantation sector, grows in many parts of the Wet Zone. Crops that are concentrated at higher altitudes supply some of the best-quality black teas to the world market. The main rubber-growing area is the ridge-and-valley country of the Wet Zone interior. Coconut is grown mainly in the hinterland of the western seaboard. Plantations represent a segment of the economy that has failed to make significant advances since the time of independence. This is largely attributable to the persistently low rates of investment in this sector. Traditional farming techniques and life-styles revolve around two types of farming "wet" and "dry"- depending upon the availability of water. The life-sustaining rice fields begin where the houses end and stretch into the distance. Some irrigated fields may include other cash crops, such as sugarcane, or groves of coconut trees. Palmyra trees grow on the borders of fields or along roads and paths. Individual houses also may have vegetable gardens in their compounds. During the rainy seasons and thereafter, when the fields are covered by growing crops, the village environment is intensely verdant.

Rice cultivation:

Rice is the single most important crop occupying 34 percent (0.77 /million ha) of the total cultivated area in Sri Lanka. On average 560,000 ha are cultivated during Maha and 310,000 ha during Yala making the average annual extent sown with rice to about 870,000 ha. About 1.8 million farm families are engaged in paddy cultivation island-wide. Sri Lanka currently produces 2.7 million tonnes of rough rice annually and satisfies around 95 percent of the domestic requirement. Rice provides 45% total calorie and 40% total protein requirement of an average Sri Lankan.

Tea plantation:

Tea was planted in Sri Lanka as an experimental crop. Several research groups were sent to Assam to study and identify the necessary prerequisites for the new crop. In between this Tea industry was introduced to the country in 1867 by James Taylor, the British planter who arrived

in 1852, in Lool Kandura. It is one of the main sources of foreign exchange for Sri Lanka and accounts for 2% of GDP, generating roughly $700 million annually to the economy of Sri Lanka. It employs, directly or indirectly over 1 million people, and in 1995 directly employed 215,338 on tea plantations and estates. Sri Lanka is the world's fourth largest producer of tea. In 1995, it was the world's leading exporter of tea, (rather than producer) with 23% of the total world export.

Fruits and Vegetables

Around eighty different varieties of fruits and vegetables are grown in Sri Lanka's varied agro-climatic areas. The cool and salubrious climatic conditions in the hill country are ideal for temperate crops such as carrot, leek, cabbage, cauliflower, salad leaves, beet, bean, bell pepper and salad cucumber.The well demarcated low country and dry wet areas are suitable for a variety of tropical fruits and vegetables ranging from green chili, red onion, pumpkin, bitter gourd, melon, sweet and sour banana types, queen pineapple, papaya, mango, lemon and gherkins etc.

Sri Lanka produces more than 800,000 metric tons of fruits and vegetables annually and exports both fresh and processed varieties to many destinations in the world. 90 per cent of the fresh product is targeted to the Middle East and the Maldives Island and almost about 75 percent of the processed products go to the European market.

Agro Technology Parks

Agro Technology Park is one of the finest initiatives for agriculture extension, education and agro tourism implemented by the Department of Agriculture, Sri Lanka. The first A-Park was established in Kandy district. The park is bounded in three sides with the river Mahaweli in the historically important place of Gannoruwa in Kandy and, lies at an altitude of 473 m above sea level in a total area of 2 square kilometers.

Though there is good development of agriculture in Sri Lanka but some weak points are still on the path of progress in agriculture sector these are:

Develop men tissue According to the World Bank

Weaknesses in strategy and policy

Heavy public sector regulatory interventions in commodity and input/factor markets.

Weak delivery of services in rural areas Destructive impact of civil conflict and tsunami**.**

Thus we can say that this is need of time that Government and private sector work together for the development of the agriculture in Sri Lanka.

14.5 CONCLUSION

Now you find the knowledge about physiography, climate, drainage and agriculture of Pakistan and Sri Lanka. Both are the South Asian country; Pakistan with a total area of 796 100 sq. km whereas Sri Lanka comprises a total area of 65,000 sq. km. Pakistan is bordered by India in the east, China in the northeast, Afghanistan in the north and northwest, the Islamic Republic of Iran in the southwest and the Arabian Sea to the south. It is divided into four provinces, namely the Punjab, Sindh, Khyber Pakhtunkhwa and Baluchistan. Both the country has same type of geography as different types of landscapes varying from plains to deserts, forests, hills and plateaus and ranging from coastal areas of the Arabian Sea.

Pakistan is divided into four broad geographic areas: The Northern Highlands, The Pothwar Plateau, The Indus plain, and The Balochistan plateau. It lies in the subtropical arid zone and most of the country is subjected to a semi-arid climate. Based on physiographic factors and causes of diversity in climate, the country has been classified into four major climatic regions: 1. the marine tropical coastland; 2. the subtropical continental lowlands; 3. the subtropical continental highlands; and 4. the subtropical continental plateau**.** River flows here are basically glacier fed and rain fed. Indus, Sutlej, Beas, Ravi, Chenab and Jhelum are the major rivers of here. The total population economically active in agriculture was an estimated 24.0 million, which was 40 percent of the economically active population. About 29 percent of the population economically active in agriculture are women. In 2009, GDP was US$161 990 million of which agriculture accounted for 22 percent.

Sri Lanka's climate includes tropical monsoons: the northeast monsoon (December to March), and the southwest monsoon (June to October). Its terrain is mostly low, flat to rolling plain, with mountains in the south-central interior. There are 16 principal rivers longer than 100 kilometers in length, with twelve of them carrying about 75% of the mean river discharge in the

entire country. The longest rivers are the Mahaweli Ganga (335 km) and the AruviAru (170 km).Oilseed crops such as Groundnut, Sesame, Sunflower and Mustard are also cultivated in Sri Lanka. The primary form of agriculture in Sri Lanka is rice production. Tea is cultivated in the central highlands and is a major source of foreign exchange. Out of the total population in Sri Lanka, 31.8% engages in agricultural activities.

14.6 SUMMARY

Thus in foregoing discussion it is clear that Pakistan and Sri Lanka both are the south Asian countries and having same type of physiographic landforms, climate, and drainage pattern and agriculture production. Covering an area of 796,095 sq. km and a population of 178 million according to 2010, Pakistan is an Islamic Republic. It became independent on August 14, 1947. Islamabad is the capital city whereas the other major cities are Karachi and Lahore. A greater part of Pakistan is occupied by mountains, barren land and desert and only about 33 percent is productive plain area. In general, the climate of Pakistan is hot and dry, with cooler temperatures and greater rainfall in mountainous areas. Western and Eastern drainage system is developing by Indus, Sutlej, Beas, Ravi, Chenab, Jhelum and their numerous tributaries. A little above 25 percent of the total area is cultivated, and about 90 percent of the cultivated land is irrigated. The main crops grown in Pakistan are wheat, rice, cotton and sugarcane. Few government agencies as IRSA - Indus River System Authority, PARC - The Pakistan Agricultural Research Council etc. are doing good effort for the betterments in Pakistani agriculture.

The later part of the unit is Sri Lanka. It was formerly called Ceylon, is an island nation in the Indian Ocean, southeast of the Indian subcontinent, in a strategic location near major Indian Ocean sea lanes. The nation has a total area of 65,610 km², with 64,740 km² of land and 870 km² of water. Its coastline is 1,340 km long. The main island of Sri Lanka has an area of 65,268 km².It's the twenty-fifth largest island of the world by area. Dozens of offshore islands account for the remaining 342 km² area. The largest offshore island, Mannar Island, leads to Adam's Bridge. Sri Lanka's climate includes According to Koppen four type of climate as Tropical Savana climate- Aw, Monsoon climate- Am, Temperate oceanic climate -Ch, Equatorial climate - Af. Its terrain is mostly low, flat to rolling plain, with mountains in the south-central

interior. Out of the total population in Sri Lanka, 31.8% engages in agricultural activities. It shows that it is a well develop sector of Sri Lanka.

14.7 GLOSSARY

Regional Geography It is a branch of geography that studies the world's region. A region itself is defined as a part of the Earth's surface with one or many similar characteristics that make it unique from other areas."

IRSA- Indus River System Authority.

PARC- The Pakistan Agricultural Research Council.

WAPDA - The Water and Power Development Authority.

14.8 ANSWER TO CHECK YOUR PROGRESS

Q.1 What is the longitudinal and latitudinal extension of Pakistan?

Q.2 Write the name of the border country of Pakistan.

Q.3 what are the physiographic regions of Pakistan?

Q.4 what are the names of rivers flowing in Pakistan?

Q.5 Write the name of major crops grows in Pakistan.

Q.6 Write the reason for the poor responses from agriculture sector?

Q.7 what are the neighboring countries of Sri Lanka?

Q.8 Write the short description about the climate of Sri Lanka?

Q. 9 write the name of rivers of Sri Lanka?

Q.10 what is the percentage of agriculture sector in GDP of Sri Lanka?

14.9 REFERENCES

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14.10 SUGGESTED READINGS

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Geography of Sri Lanka

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14.11 TERMINAL QUESTIONS

Q.1 what is Agro Technology Park?

Q.2 what do you understand by the PARC?

Q.3 what does IRSA stands for?

Q.4 writes the full form of WAPDA.

UNIT 15 : INDONESIA & MYANMAR

15.1 OBJECTIVES

After reading this unit you should be able:

- To study the physiographical characteristics of Indonesia and Myanmar.
- To examine the temperature variance found in Indonesia and Myanmar.
- To Study about rainfall characteristics of Indonesia and Myanmar.
- To know the importance of monsoon for Indonesia and Myanmar.
- To study the agricultural characteristics of Indonesia and Myanmar.
- To study the different characteristics of Indonesia's Islands.
- To evaluation of the important food crops of Indonesia and Myanmar.
- To discuss the different characteristics agriculture of Indonesia and Myanmar.

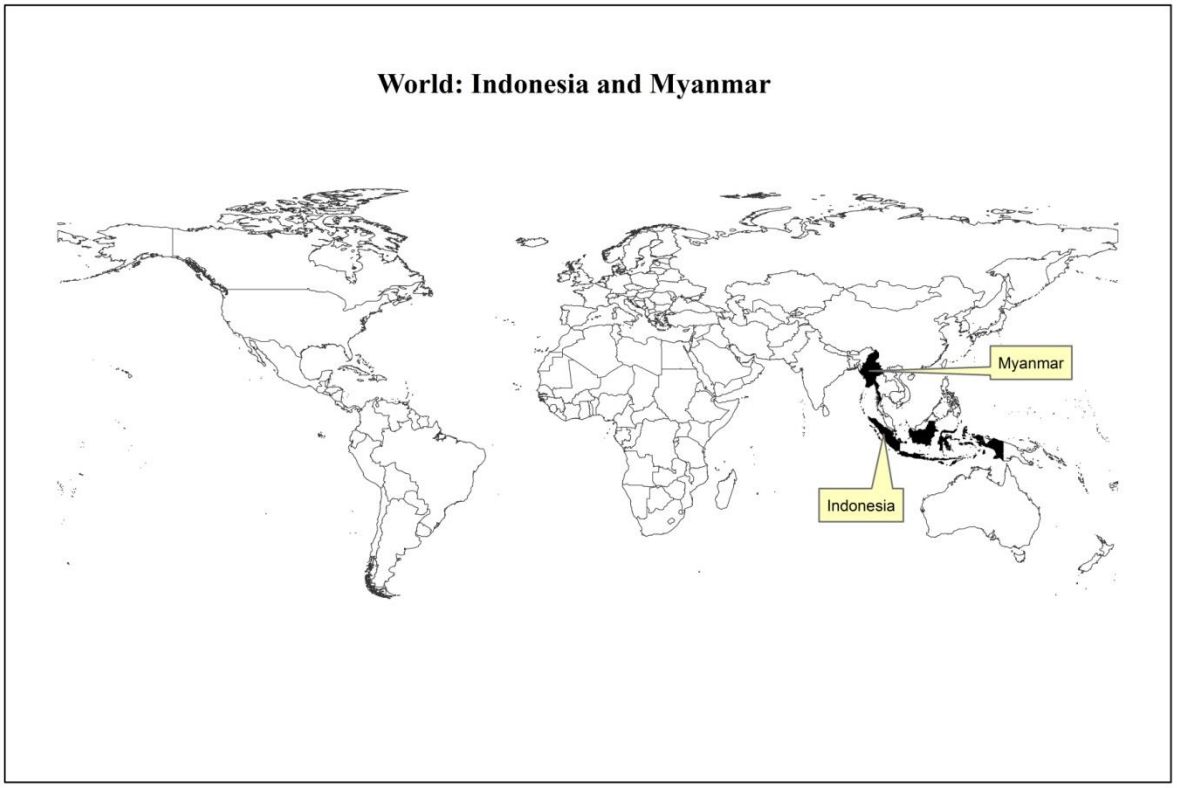
15.2 INTRODUCTION

Indonesia and Myanmar both are situated in the south-east Asia. Indonesia extends between 11°S and 6°N latitudes and 95°E and 141°E longitudes and is the largest archipelagic country of the world. The islands of Indonesia are stretching from the Indian Ocean to the pacific and include more than 13000 islands. Indonesia is also known as an archipelagic island nation in south-East Asia. It is developing country of south-East Asia. Indonesia is situated between Indian Ocean and Pacific Ocean. Total geographical area of the country is 1919.4 thousand sq. km. The country includes five major islands namely Sumatra, Java, Borneo, Sulawesi, and New Guinea: two major archipelagos (Nusa Tenggara and the Maluku Islands). The arable lands of the country are about 12.97 %, permanent crops 12.14 % and 74.88 % are others lands. It is high populated and rapid industrialized country. The present serious problems of the country are deforestation, air pollution, traffic, and garbage management etc.

Myanmar is also known as Burma is situated in south-East Asia. Myanmar shares boundaries with India in the west and China in the north-west. It also shares boundaries with Bangladesh, India, China, Laos and Thailand. It is divided into seven states and seven regions which are generally known as division. It is located near major Indian Ocean and a developing country of south - East Asia. Total geographical area of the country is 676.6 thousand sq. km. The area under arable land is about 16.56%, permanent crops 2.25% and others include 81.20 %.The serious problems of the Myanmar are deforestation, soil pollution, air pollution, inadequate sanitation, and garbage management etc. country as a low level of human

development. Its slow economic growth has contributed to the preservation of its natural resources.

Figure 15.1



Source: Google

Figure 15.2 Area of Myanmar and Indonesia (in 000 sq. km.)

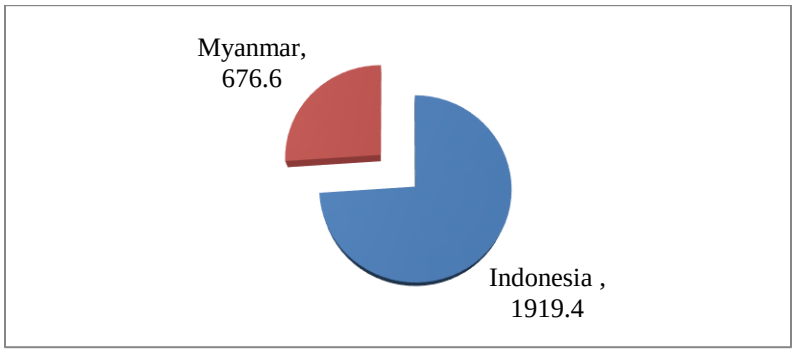


Figure 15.3 Indonesia: Land use

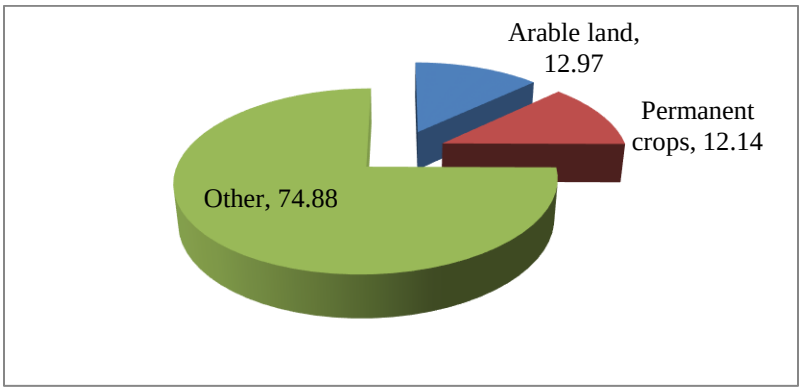
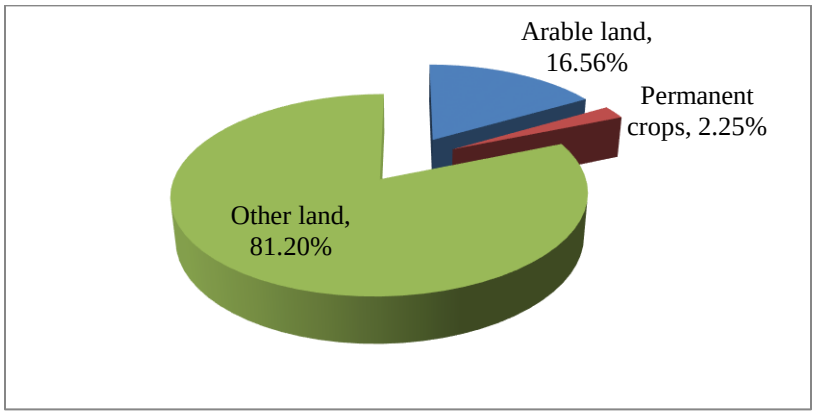


Figure 15.4 Myanmar: Land use



15.3 REGIONAL GEOGRAPHY OF INDONESIA

Physical physiography

Indonesia is a meeting point of several tectonic plates and its tectonic is very complex. The plate tectonic movements in the country formed major structures. Semangko fault or Great Sumatran fault is the most prominent fault found in the west of Indonesia. It is located on the pacific ring of fire. The country is highly unstable. Most of the Indonesian islands are mountainous. The highest mountains of Indonesia are situated in the Jayawijaya Mountains and the sudirman range in Papua. Puncak Jaya is the highest peak (4884 meters) which found in the Sudirman mountains.

Geographically the country is dominated by number of volcanoes. These volcanoes were created because of the subduction zones between the plates of Eurasia and the indo-Australia and also

the part of pacific ring of fire. A series of volcanoes stretches from Sumatra to the Banda Sea. Major volcanoes of the country are Krakatau (1883), Lake Toba and mount tambora (1815).

Fig.15.5 Indonesia Major Islands

Source: Google

Major five islands of Indonesia are:

Sumatra: it is the largest islands of Indonesia. It is situated west of Java and south of Malay Peninsula. Rugged tropical terrain, wildlife and smoldering volcanoes are the main characteristics of this island.

Java: it is located between Sumatra and Bali. Java is a volcano-dotted island**.**

Sulawesi: it is situated east of Borneo and includes many long peninsulas radiating from a mountainous center. It is also known for coral reef. Some important coral reefs of this island are Bunaken National Park, the Togian Islands and Wakatobi National Park.

Papua: Papua is situated far east of Indonesia province. It covers the half of New Guinea and several other islands:

Borneo: it is a massive rugged island of Indonesia. It includes the Malaysian states of Sabah and Sarawak, Indonesian Kalimantan and the tiny nation of Brunei.

Figure 15.6 Topography map of Indonesia

Source: Google

Climate

Indonesia has number of climates mostly tropical rainforest, followed by tropical monsoon and tropical savanna. Subtropical climate is found in high altitudes area. Laying along the equator the climate of Indonesia is almost entirely tropical. it has two seasons one is wet season (between November and march) and second is dry season which falls between April and October. Kilamantan and sumatra have only slight variance in rainfall and temperature between the seasons while nusatenggara, have more differences.

There is a very little change in the length of daylight hours from one season to the next. The difference between longest day and the shortest day is only 48 minutes. The rainfall is the main variable of Indonesia climate except air pressure or temperature. The relative humidity varies from 70% and 90%. The monsoon direction is from the south and east in June while from the northwest in December through March. The areas of west Sumatra, northwest Kalimantan, west Java, and western New Guinea receive plentiful rainfall. On the other hand the areas of Sulawesi and some nearest islands to Australia are drier.

Mountains above 3000 meters of Indonesia are cooler and dominated by sub-polar climate. Local topographical conditions impact the wind pattern of Indonesia to produce significant differences in rainfall. Most precipitation occurs in the western and northern part of the country. The areas of Western Sumatra, Java, Bali, the interiors of Kalimantan, Sulawesi, and Papua are receive more than 2,000 millimeters rainfall annually. While the islands nearest to Australia receive less than 1000 mm rainfall yearly. The temperature decreases about 1 degree C per 90 meters increase in elevation from sea level.

Climatic Regions

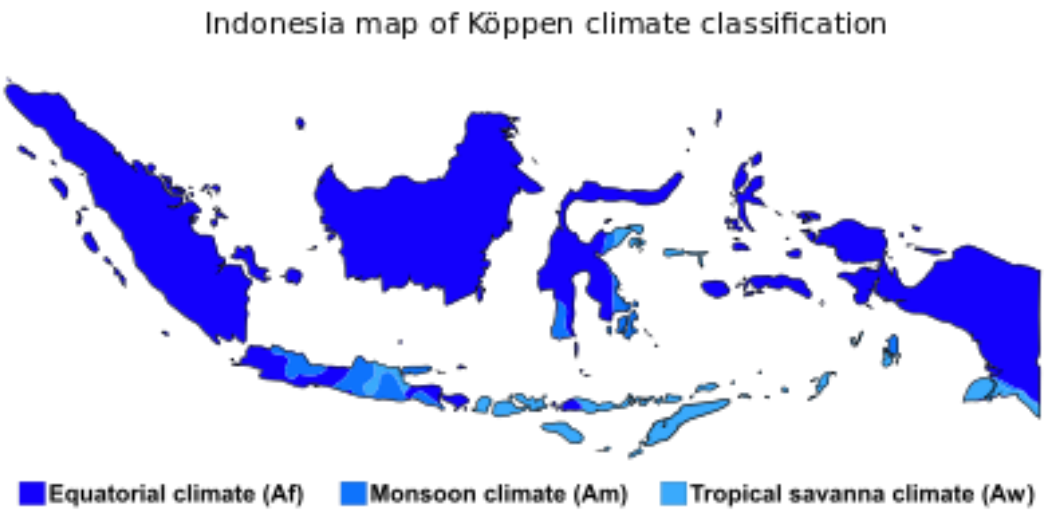
Climatic regions of Indonesia according to Koppen are:

I. Monsoon climate: it includes wet season, and dry season.

II. Equatorial climatic region

III. Tropical savanna climate

Figure 15.7



Source: https://en.wikipedia.org/wiki/File:Indonesia

Map of K%C3%B6ppen climate classification.svg

Drainage

Rivers are flowing in the every part of Indonesian islands. However rivers are short in length but very important for irrigation. Some important rivers are:

The Ayung river: it the longest river of Bali island. It flows 75 km from the northern mountain ranges of Bali and falls into the Badung Strait at Sanur near Denpasar. It is important for irrigation and local fishing.

The **Kapuas River:** It is one of the longest rivers of world's islands. it is also the longest river of Indonesia with the length of 1143 kms.

PawanRiver: PawanRiver is flows in the west Kalimantan with the length of 197 kms.

Manuk River: It flows in the west Java. It flows from south to the north. The river flows within Java Island.

Solo River: Solo River is the longest river in the Indonesian island of Java and about 600 km in length.

Aceh River: it has catchment area of 1775 sq. kms. It flows on the island of Sumatra.

Agriculture

Agriculture playsa most important role in Indonesia economic. Agriculture sector provides employment to thousands of Indonesia people. It contributed to 14.43 % of national GDP in 2013. Presently 30 % of land area of Indonesia is under cultivation. Main crops of Indonesia are such as palm oil, rubber, rice, tomato, sorghum, oilseed and soybeans. Mainly this sector comprises two types:

Large plantations either owned by state or private companies
Smallholder production modes, mostly traditional agricultural households

Rice: Rice is the first most prevalent grain crop, grown in most parts of the Indonesia. Indonesia is ranking third in producing of rice in the world after China and India. It is the staple food of all classes in Indonesian diet.

Figure 15.8 Rice field in Indonesia

Source: Google

Horticulture: Horticulture is one of the important sectors of Indonesia economy. This includes fruits and vegetables. The major product are salak, banana, mango, jackfruit, and mangos teen etc. some fruit such as apple, strawberry, honeydew, grapes and dragon fruits are grown in cooler region of the country. Malang in East Java is known for the production of apple and dragn fruit and areas around in West Java are known as strawberry, honeydew and mushroom production center of Indonesia.

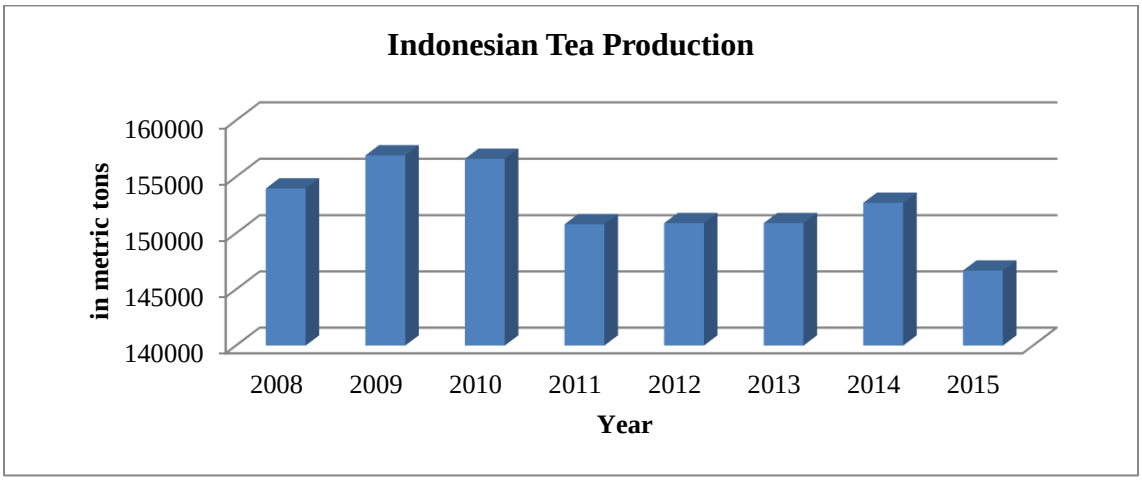
Palm Oil: Indonesia is the biggest producer of palm oil in the world. It covers the areas of about 6 million hectares. It is the essential ingredients to produces cooking oil, cosmetics products as well as other food. Sumatra and Borneo is the biggest producer of palm oil production account about 96 % of Indonesia total palm oil production.

Bar Graph: 15.8

Rubber: Rubber is the also grown in most parts of the Indonesia. Indonesia is ranking second in producing of Rubber in the world after Thailand. The production level of Rubber is about 1080 kg/hac which are lower than of Thailand (1800 kg/hac). The Rubber trees grown in high temperature (26-32 degree C) with a wet climate. The main areas of Rubber production are South Sumatra, North Sumatra, Riau, Jambi, and West Kalimantan.

Bar graph: 15.9

Tea: Indonesia stands on sixth for the production of tea of the world. Indonesia is dominated by lack tea production. Types of tea found in Indonesia are black tea, green tea, and, jasmine tea etc. the main areas are hilly belts of west Java, Middle Java and North Sumatra.



Bar graph: 15.10

Table 15.1 : Indonesian Palm Oil, Rubber & Tea Production

Year	Palm Oil Production (million tons)	Rubber Production (in mln tons)	Tea production (in metric tons)
2008	19.2	2.75	153971
2009	19.4	2.44	156900
2010	21.8	2.73	156600
2011	23.5	3.09	150800
2012	26.5	3.04	150900
2013	30	3.2	150900
2014	31.5	3.18	152700
2015	32.5	3.11	146682

Source: http://www.indonesia-investments.com/business/commodities/tea/item240.

Other crops: other crops grown in Indonesia are coffee, coconut, tomato, sorghum, oilseed, tobacco and soybeans.

15.4 REGIONAL GEOGRAPHY OF MYANMAR

Physiography

The physiography of Myanmar may classify as give below:

a) Lowlands with the Sittaung Valley and Chindwin Valley.

b)The small mountain ranges of ZeebyuTaungdan, Min-wunTaungdan, Hman-kin Taungdan.

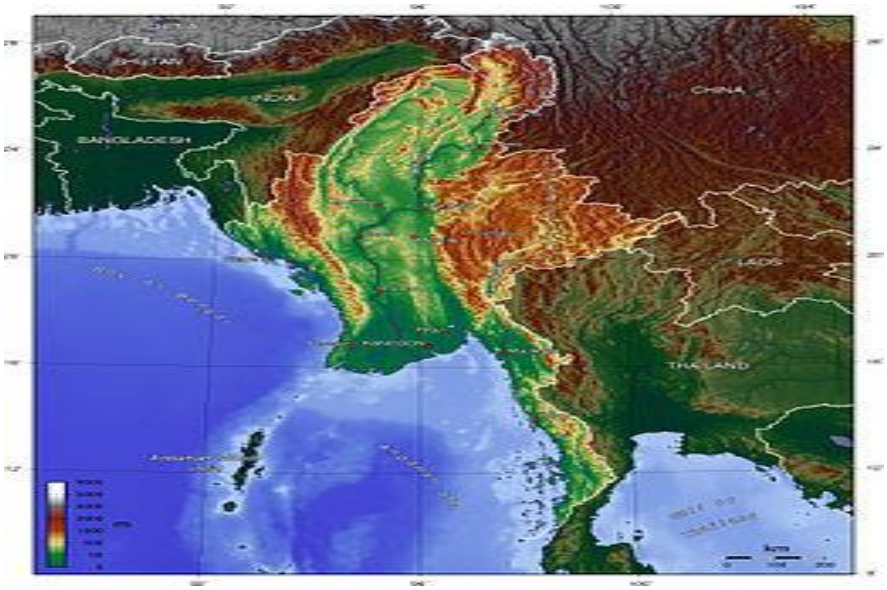
c) GangawTaungdan as well as the BagoYoma (Pegu Range): a low mountain chain located between the Irrawaddy and the Sittaug River in the middle part of Myanmar.

HakakaboRazi: It is the highest elevation point of the country located at the northern end of country.It is a part of ranges which run from the foothills of the Himalaya.

Arakan Mountains: It is situated in the west part of the country. This rang includes the Naga Hills, the Chin Hills, and the Patkai range which includes the Lushai Hills. Itruns from Manipur into western Myanmar southwards through Rakhine state.

Shan Hills: these hills are situated in the eastern part of the country. It is also the highest point of eastern hills (2563 m).

Fig.15.11 Topographical Map of Myanmar



Source: Google

Some peaks of Myanmar

· Hkakabo Razi 5,881 m	· Langhtam Razi, 3,221 m
· Gamlang Razi 5,870 m	· Nin-gun Bum, 3,162 m
· Saramati 3,826 m	· Mol Len, 3,088 m
· Hkaru Bum, 3,677 m	· Abawm Bum, 3,082 m
· Bumhpa Bum, 3,411 m	· Sahton Bum, 3,069 m
· Hkangri Bum, 3,388 m	· Nat Ma Taung (Mount Victoria), 3,053 m
· Hkawk Bam, 2,822 m	· Sangpang Bum, 2,692 m
· Wapawnaung Bum, 2,769 m	· Longadang Bum, 2,680 m
· Kanikana Bum, 2,742 m	· Tamihkat Razi, 2,678 m
· Kennedy Peak (Burma), 2,703 m	· Loi Leng, 2,673 m
· Sapa Bum, 2,702 m	· Mong Ling Shan, 2,641 m

Climate

Climatic condition in Myanmar varies from lowlands to highlands. The major climatic conditions found in Myanmar are:

Tropical monsoon in the lowlands below 2000 meters

South-west monsoon June to September

Rainy, hot, cloudy and humid summers

December to April northeast monsoon

Subtropical climate at around 2500

Less cloudy, scant rainfall mild temperature, lower humidity during winter

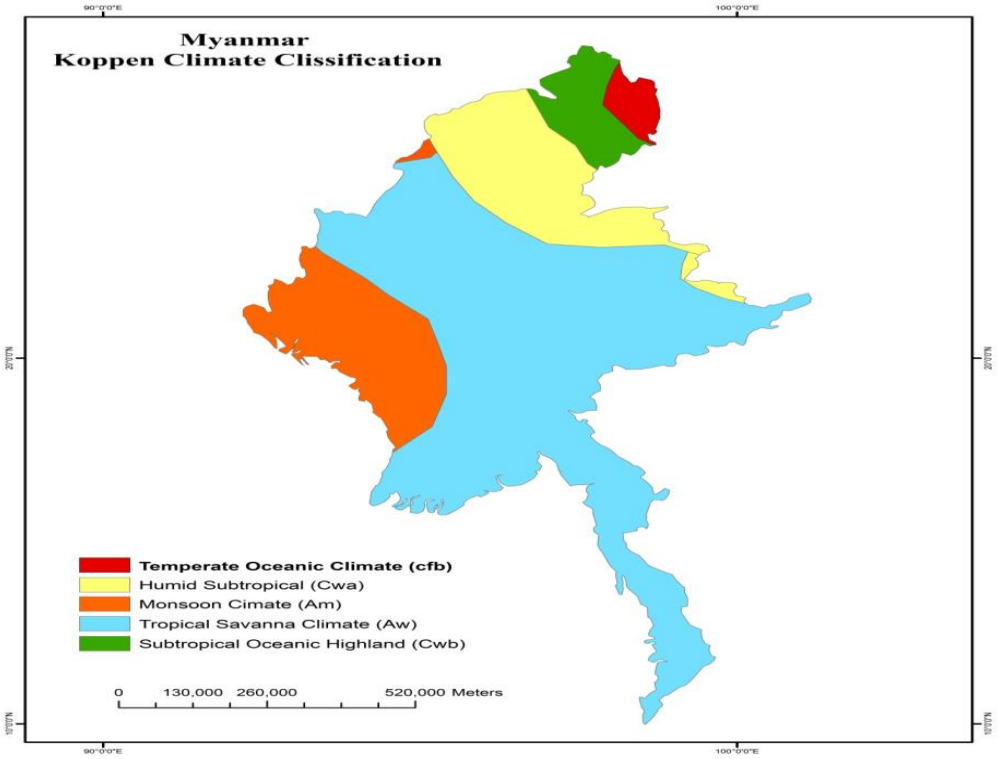
At elevation 3000 meters temperate

At elevation 3500 meters cool alpine

Above the alpine zone cold, harsh tundra and Arctic climate

Bad weather and heavy snowfall at the higher elevation

Figure 15.12: Myanmar Koppen Classification



Source: Google

Drainage

Irrawaddy River: The Irrawaddy River flows from north to south through Myanmar. It the longest river of Myanmar. Irrawaddy originate from the confluence of the N'mai and Mali rivers, it flows relatively straight North-South before emptying through the Irrawaddy Delta into the Andaman Sea.

Mekong River: it is **k**nown as the trans-boundary river in Southeast Asia. It is the seventh largest river in Asia and the worlds 12th longest river. The length of Mekong River is about 4350 km.

The Salween: **the le**ngth of Salween is about 2815 km. it originates from the plateau of Tibetan and fall into the Andaman Sea in Southeast Asia.

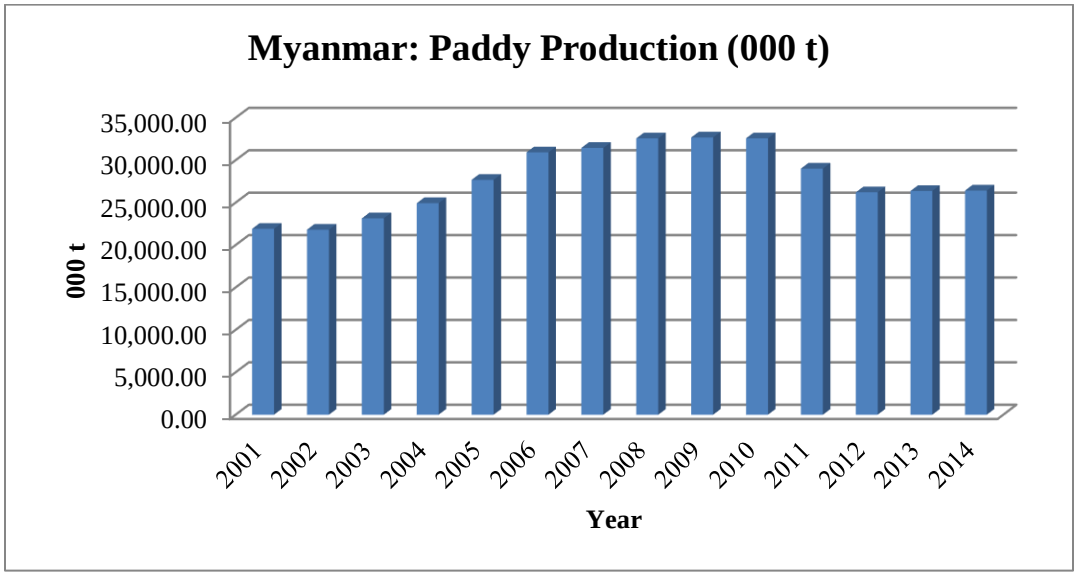
Kraburi River: It makes the boundary between Thailand and Myanmar at the Kra Isthmus of the Malay Peninsula. It originates in the Tenasserim hills and flows in the Andaman Sea.

In the south-ester part of the country the Ye Heinze, Dawei, Great Tenasserim and the Lenya rivers are relatively short and flow into the Andaman Sea.

Agriculture

Agriculture sector plays a vital role in Myanmar's economic. It provides employment to 65 % of labour force. It contributed to 60 % of national GDP. Myanmar is one of the largest producers of rice in the world. Main crops of Myanmar are rice, tomato, sorghum, oilseed, groundnuts, sugarcane, lumber and soybeans.

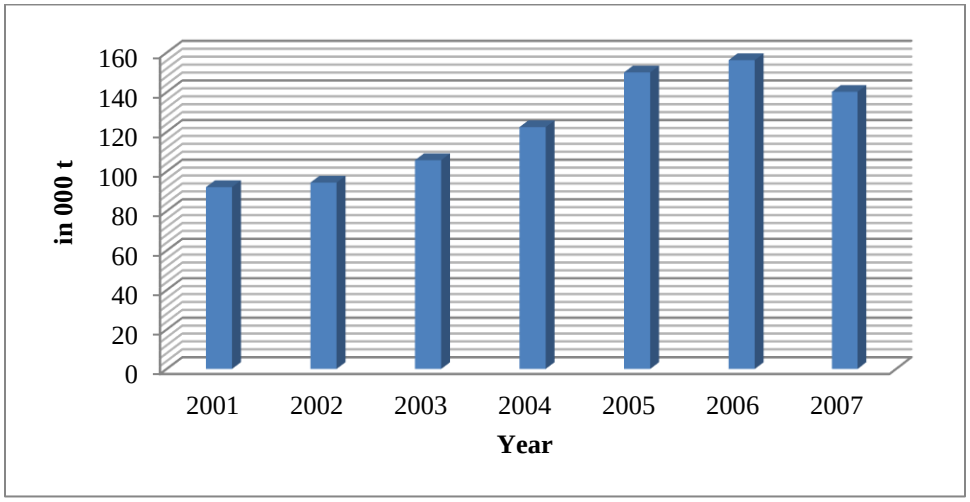
Rice: Myanmar is ranking sixth in producing of rice in the world and rice is the first most prevalent grain crop, grown in most parts of the country. The production of rice increased from around 18 million t of milled rice in 1995 to over 22 million t in 2010.Presently Myanmar is import in ground 0.02 million t annually. The production of rice grew at 3 percent per year during 2005 – 2010.Southern part of the country is highly rice producing. The main characteristics of rice cultivation are irrigated lowland, rain fed lowland, deep-water, and upland.



Bar graph: 15.13

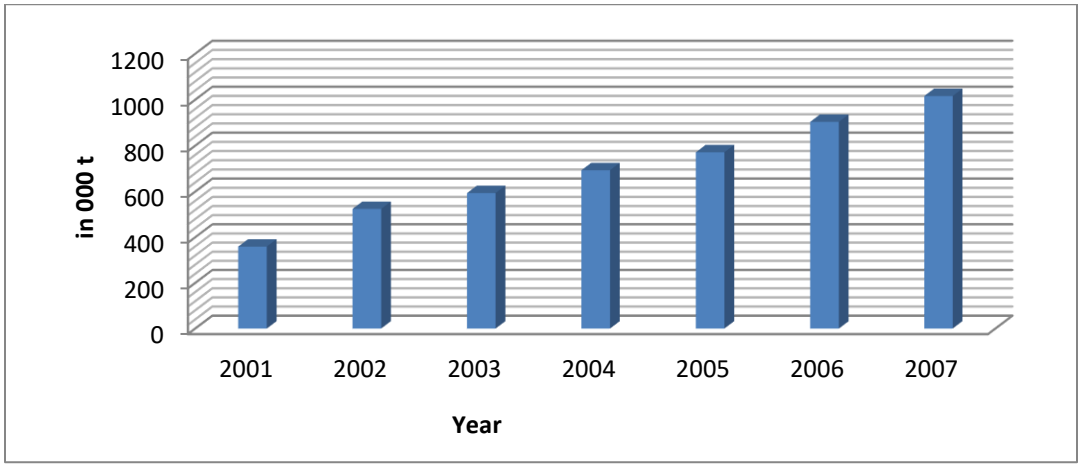
Wheat: The main areas of wheat cultivation are northwest, (Sagaing Division), central (Mandalay), and eastern (Shan State) of the country. It is grown at a subsistence level. The production of wheat is about 1.8 metric tons per hectare and all wheat production is consumed domestically.

Bar graph: 15.14 Myanmar Production of Wheat



Source: http://www.myanmar.cm/myanmardata2007/s0505.htm

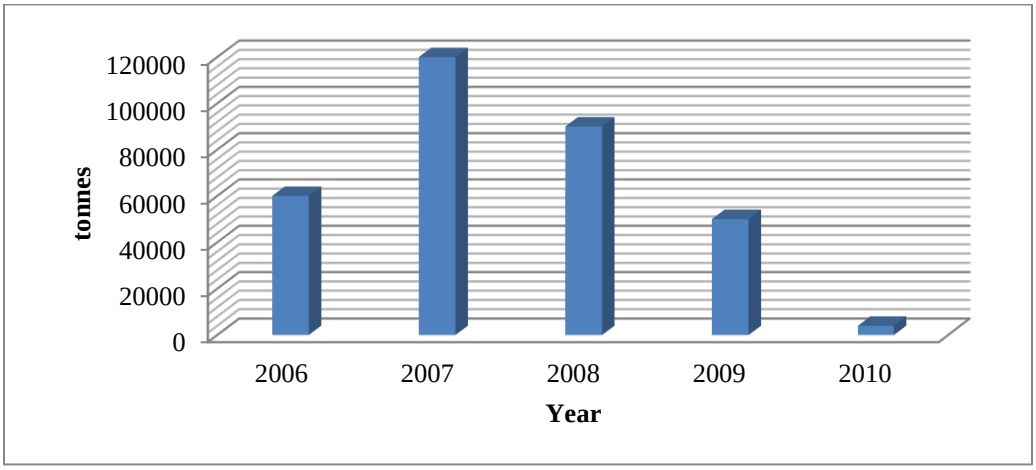
Maize: Maize is also the most important crop grown in Myanmar. The main areas of maize production are Northern Shan State, Mandalay Region and A yeyawaddy Region. The country exports 300 to 400 000 MT of maize annually. Generally it is harvested during August-September and in full swing during October -November.



Bar graph: 15.15 Myanmar Production of Maize

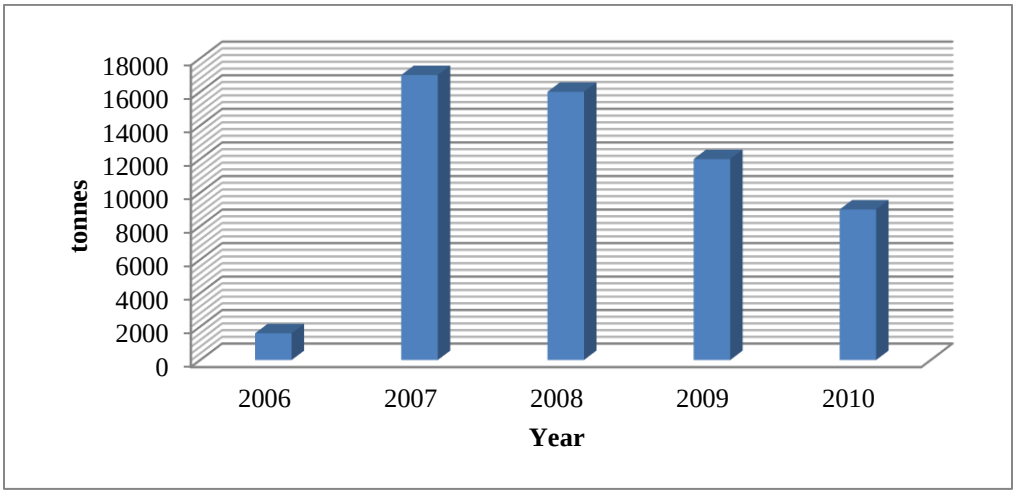
Chickpeas: this crop is generally cultivated in Rabi season. Desi and Kabuli are the two types of chickpeas grow in Myanmar. It is harvested during February to April and full swing in winter. Producing regions of the country are Sagaing, Pago (West), Magway, Mandalay and Ayeyarwaddy. Myanmar export most of it production.

Bar graph: 15.16 Myanmar export of Chickpeas



Source: http://www.mpbsma.org/products/beans/chick-peas

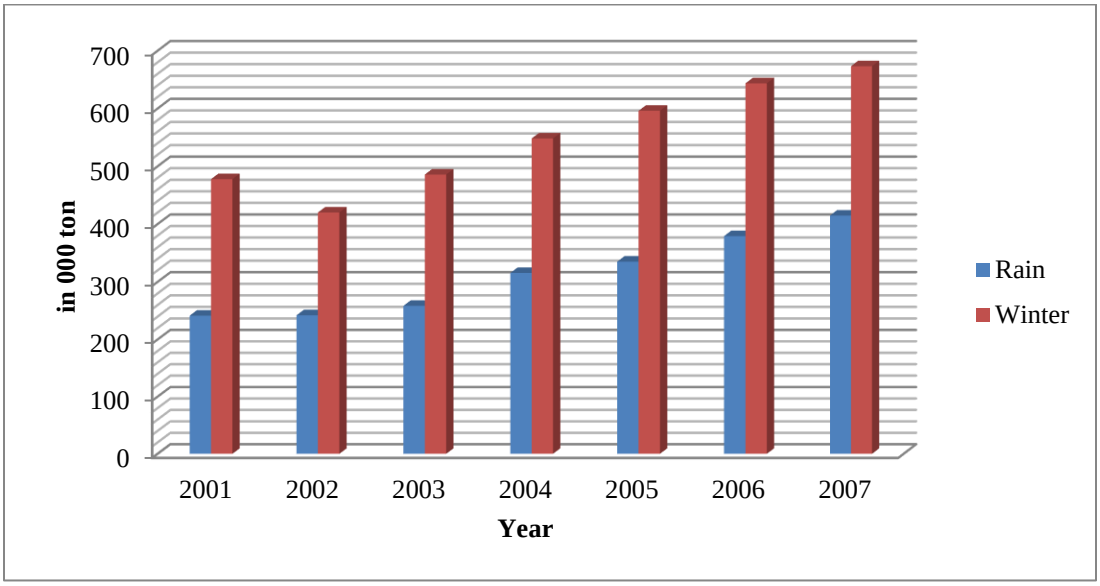
Butter bean: It is generally grown in winter season. It is harvested during February to April and full swing in winter. Producing regions of the country are Sagaing, Pago (East-West), Megue, Mandalay, Mon, Shan (North) and Irriwady. Myanmar export most of it production. Myanmar export around 75 percent of its total production to China, Japan, Korea, Singapore and UAE.



Bar graph: 15.17 Myanmar exports of Butter beans

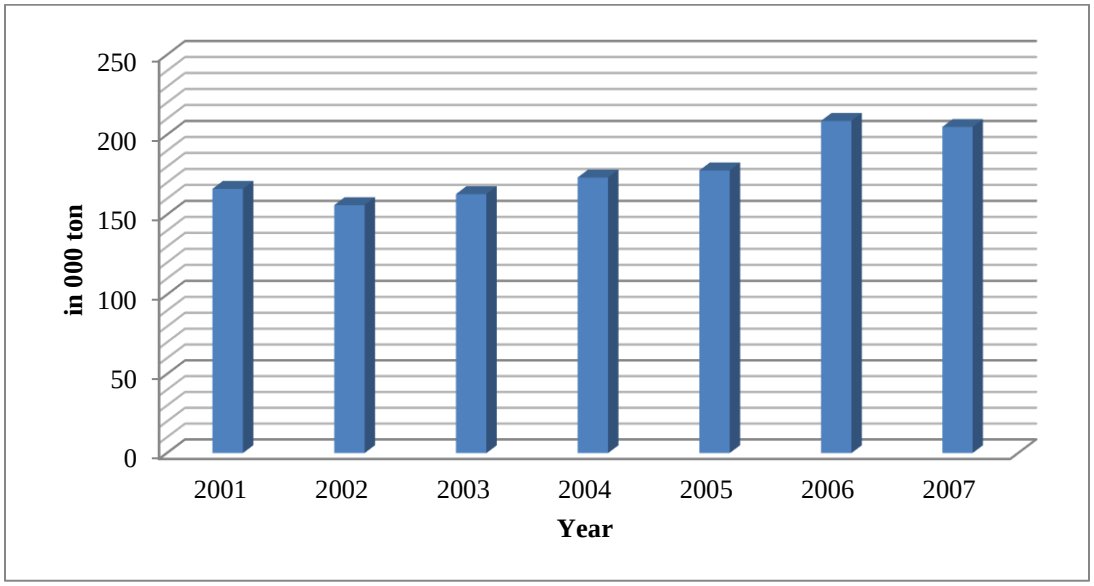
Groundnut: It is grown in two seasons one is winter season and second is Rainy season.

Bar graph: 15.18 Myanmar Production of Groundnut



Source: http://www.mpbsma.org/products/beans/chick-peas

Bar graph 15.18: Myanmar Production of Millet



Source: http://www.mpbsma.org/products/beans/chick-peas

Others: others crops of the country are tomato, sorghum, oilseed, sugarcane, lumber, Penauk, (Krishna mung), Chillie, Gram, Peyin (Rice bean) and soybeans etc.

15.5 CONCLUSION

Indonesia or an archipelagic island nation is a developing country of south - East Asia. The arable lands of the country are about 12.97 %, permanent crops 12.14 % and 74.88 % are others lands. It is a meeting point of several tectonic plates. Geographically the country is dominated by number of volcanoes. Indonesia has number of climates mostly tropical rainforest, followed by tropical monsoon and tropical savanna. Subtropical climate is found in high altitudes area. Laying along the equator the climate of Indonesia is almost entirely tropical. it has two seasons one is wet season (between November and march) and second is dry season which falls between April and October. Rivers are flowing in the every part of Indonesian islands. However rivers are short in length but very important for irrigation. Agriculture sector provides employment to thousands of Indonesia people. It contributed to 14.43 % of national GDP in 2013.

Myanmar or Burma is situated in south-East Asia. The area under arable land is about 16.56 %, permanent crops 2.25 % and others include 81.20 %. Deforestation, soil pollution, air pollution, inadequate sanitation, and garbage management etc are the serious problems of the Myanmar. Its condition varies from lowlands to highlands. The major climatic conditions found in Myanmar are: Tropical monsoon in the lowlands below 2000 meters, South-west monsoon June to September, Rainy, hot, cloudy and humid summers and December to April northeast monsoon. Irrawaddy is the longest river of Myanmar. Agriculture sector plays a vital role in Myanmar's economic and provides employment to 65 % of labour force. It contributed to 60 % of national GDP. Myanmar is one of the largest producers of rice in the world. Main crops of Myanmar are rice, tomato, sorghum, oilseed, groundnuts, sugarcane, lumber and soybeans.

15.6 SUMMARY

The main objectives of the study are to study the physiographical characteristics of Indonesia and Myanmar, to examine the temperature variance found in Indonesia and Myanmar, study about rainfall characteristics of Indonesia and Myanmar ad to know the importance of monsoon for Indonesia and Myanmar etc. The islands of Indonesia are stretching from the Indian Ocean to the pacific and include more than 13000 islands. Indonesia is also known as an archipelagic island nation in south-East Asia. Myanmar is also known as Burma is situated in south-East Asia. Myanmar shares boundaries with India in the west and China in the north-west. It also shares boundaries with Bangladesh, India, China, Laos and Thailand. It is divided into seven states and seven regions which are generally known as division. It is located near major Indian Ocean and a developing country of south - East Asia. Indonesia is a meeting point of several tectonic plates and its tectonic is very complex. The plate tectonic movements in the country formed major structures. Semangko fault or Great Sumatran fault is the most prominent fault found in the west of Indonesia. It is located on the pacific ring of fire. The country is highly unstable. Most of the Indonesian islands are mountainous. There is a very little change in the length of daylight hours

from one season to the next. The difference between longest day and the shortest day is only 48 minutes. The rainfall is the main variable of Indonesia climate except air pressure or temperature. The relative humidity varies from 70 % and 90 %. Main crops of Indonesia are such as palm oil, rubber, rice, tomato, sorghum, oilseed and soybeans. Mainly this sector comprises two types:

The physiography of Myanmar may classify as lowlands with the Sittaung Valley and Chindwin Valley, the small mountain ranges of ZeebyuTaungdan, Min-wun Taungdan, Hman-kin Taugdan and Gangaw Taungdan as well as the BagoYoma (Pegu Range): a low mountain chain located between the Irrawaddy and the Sittaug River in the middle part of Myanmar. The major climatic conditions found in Myanmar are: Tropical monsoon in the lowlands below 2000 meters, South-west monsoon June to September, Rainy, hot, cloudy and humid summers, December to April northeast monsoon, Subtropical climate at around 2500 and Less cloudy, scant rainfall mild temperature, lower humidity during winter. Agriculture sector plays a vital role in Myanmar's economic. It provides employment to 65 % of labour force. It contributed to 60 % of national GDP. Myanmar is one of the largest producers of rice in the world. Main crops of Myanmar are rice, tomato, sorghum, oilseed, groundnuts, sugarcane, lumber and soybeans.

15.7 GLOSSARY

Domestication: it is to convert the wild plants and animals to domestic uses mainly for the generations of breeding.

FAO: Food and Agricultural Organization of the United Nations, established in 1945.

Fringe: A transitional zone between two boundaries.

Green Revolution: the introduction of High Yield Varieties (HYV), fertilizers and pesticides which led to the high production of crops in a short time.

MT: Metric Tonne which is used for measuring the weight**.**

Native: origin or growing naturally in a particular region

Neolithic period: it is the cultural period of the stone age in 10,000 BC which is characterized by the development of agriculture and the making of polished stone implements.

Land use: the process of modification and management of natural environment into a manmade environment.

Land holding: it is an area of land that is owns or rent by someone.

Livestock rearing: it a domestication of animals mainly in an agricultural setting such as goats.

Region: it refers to the homogeneity particularly climate in an area.

Tropical: Region found in an area with high temperature and very heavy rainfall.

15.8 ANSWER TO CHECK YOUR PROGRESS

Q. 1 Describes physiography of Myanmar?

Q.2 What type of climate found in Indonesia and Myanmar?

Q.3 What is the difference between the climate of Indonesia and Myanmar?

Q.4 How climatic conditions impact the agriculture of Myanmar?

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15.10 SUGGESTED READINGS

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15.11 TERMINAL QUESTIONS

Q 1. What is the importance of monsoon for Myanmar?

Q.2 Describe the climatic zones of Myanmar?

Q.3 Describe the climatic zones of Indonesia?

Q.4 what are the different characteristics of Indonesia and Myanmar?

Q. 5Classify the physiography of Indonesia.

Q. 6 what are the rainfall characteristics of Myanmar?

Q.7 Define what is Climate found in Myanmar?

Q. 8 what are the factor responsible for short rivers of Indonesia?

Q. 9describe the important food crops of Indonesia.

Q. 10 Discus the different characteristics agriculture of Indonesia and Myanmar.

Q. 11 Write short notes

(i) A rchipelagicis land

(ii) Subtropical climate

(iii) Mekong River

(iv) Rainy season in Indonesia

(v) Shan Hills

UNIT – 16 CHINA & JAPAN

16.1 OBJECTIVES

After reading this unit you should be able to:

- Study the physiographical characteristics of China and Japan.
- Examine the temperature variance found in China and Japan.
- Study about rainfall characteristics of China and Japan.
- Know the importance of monsoon for China and Japan.
- Study the agricultural characteristics of China and Japan.
- Study the different characteristics of Japan's Islands.
- Factor responsible for short rivers of Japan.
- Evaluation of the important food crops of China and Japan.
- Discuss the different characteristics agriculture of China and Japan.

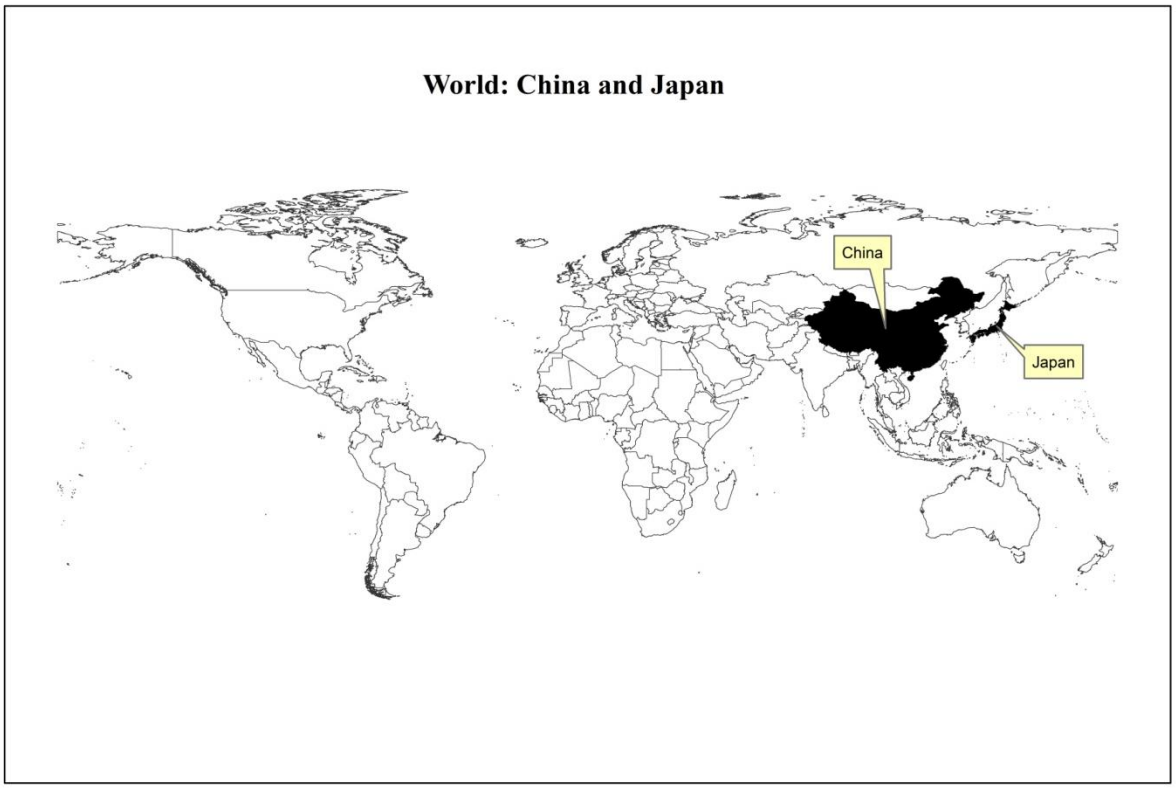
16.2 INTRODUCTION

China and Japan both are the Asian country. Both are the most industrialized country of the world. The china, officially known as the People's Republic of China lies between 21 degree n and 53 degree 5' n latitudes and 74 degree E and 135 degree E longitudes. The total geographical area of China is 95.98 lakh sq. km. China is the third largest country of the world after Russia and Canada. It has about 14000 km long coast line. Administratively China is divided into 22 provinces. It has great physical diversity. The main concentration of population has been found in the central plain of China. According to census the total population of China is over 1.381 billion, the largest of any country in the world.

Japan is situated in the North Pacific Ocean and known is an island nation in East Asia. It is a most industrialized country of Asia. Japan is lies between 25 degree n to 45 degree n latitudes and 125 degree E to 145 degree E longitudes. Japan is also known as the land of rising sun and it looks an arc. Total geographical area of the country is 377.8 thousand sq. km. the country includes for major islands namely from north to south Hokkaido, Honshu, Shikoku and Kyushu

and these islands also called Home Island. Honshu is the largest island. Soya strait separate it from Russia and Korea is separated from Japan y Korea straits.

Figure 16.1 World Maps of China and Japan



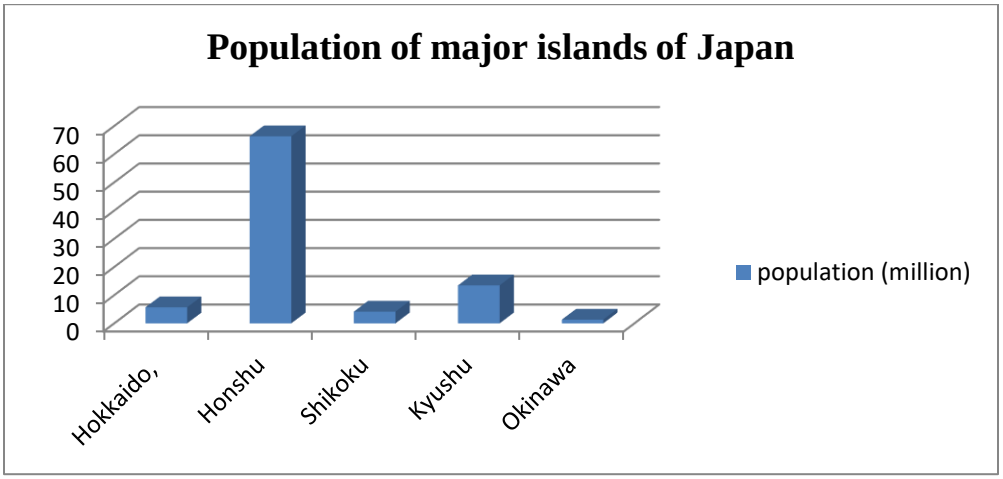
Source: Google

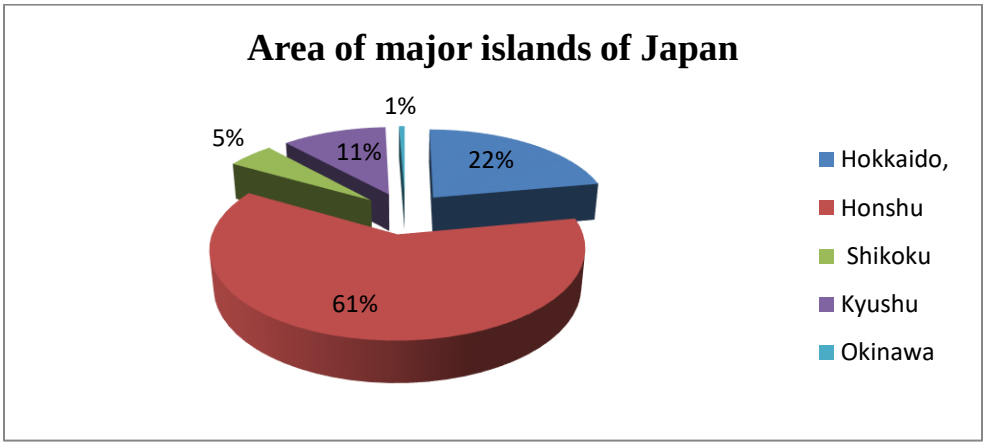
Table 16.1 area and population of major islands of Japan

Island	Area (000' km sq.)	% of Japans total area	population (million)	% of the country
Hokkaido,	83.45	22	5.68	6.25
Honshu	231.12	61	66.32	72.94
Shikoku	18.8	5	4.15	4.56
Kyushu	42.16	11.1	13.45	14.79
Okinawa	2.27	0.6	1.32	1.45

Source: Maurya, S.D. (2015)

Bar graph:16.2 Population of major islands of Japan





16.3 REGIONAL GEOGRAPHY OF CHINA

Physical physiography

There are three major physiographic divisions in China the plains, plateaus and mountains. These major physiographic division further subs divided into following parts as given below:

1. The Mountain Ranges

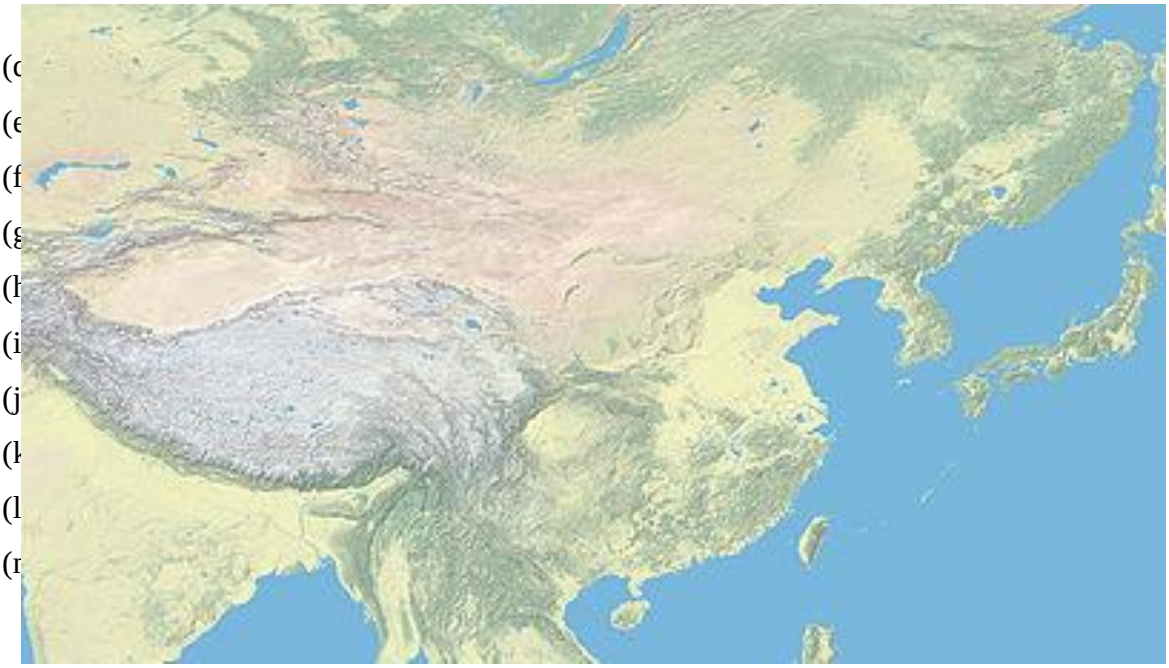
There are various mountain ranges are found in the western part of China. These ranges areextends from the Pamir knot towards south-east, east and north-east. Some of them are the Himalayas, the Kunlun, and the Tienshan etc.

(a) **The Tienshan Mountain**: these ranges located north-eastward from Pamir knot and further run as Peishan. In the north these ranges extend in west-east direction. These ranges are also including Altai, Syan and Khingan mountains.

(b) **The Kunlun mountain range**: This mountain range is situated in the north of Himalayas. It is spread eastward from the Pamir knot and passes into Tsinglingshan Mountain in the east.

(c) **The Himalayas range**: This range lies in the south China. It extends to the south-east from the

Figure: 16.3 Topographic map of China



Source: https://en.wikipedia.org/wiki/File:China_topography_full_res.jpg

Pamir knot: This rang is the highest range of the world. Himalaya range makes the boundary between India and China. Himalaya rages is also the source of many rivers which flow in the China.

2. **The Plateaus**

Plateaus are found in the western part of the country and are like basins between the mountain ranges. Tibetan plateau, the Tarimbasin, the Dzungarianbasin and Gobi plateau is the important plateau found in China.

A. The Tibetan plateau or roof of the world: this plateauis located between Kunlun Mountains in the north and the Himalayas in the south and elevation is more than 4000 meters. The Tibetan plateau is also known as the roof of the world.

B. The Tarim basin: It is lies between the Tiesshan Mountains in the north and Kunlun Mountains in the south.

C. Thetsaidambasin: The tsaidam basin is situatedsouth of the astinTagh and Nanshan Mountainsand lies north of the Tienshan Mountain.

D. TheDzungarianbasin: It is lies between the Altai Mountains in the north and the tienshan mountains in the south.

E. The Gobi plateau: It is lies to the north-east of Tarimbasin and dzungatianbasin. It is surrounded by the Khingan Mountain in the south.

3. The Alluvial Plains

The Alluvial Plains are found in the eastern part of china ad located to the east of plateaus and mountains country. The Alluvial Plains of China are the Hwang Ho Plain, the Yangtze kiang plain, and Sungari plain.

A. The Hwang Ho Plain: it is spread over 75000 sq km. in northern part. This plain is also known as the yellow plain. This is a very vast plain.

B. The Yangtze kiang plain: The Yangtze kiang plain is larger than Hwang Ho plain. Thisplain is located to the south of the Hwang Ho plain. The slope of the plain is eastward. This plain is very fertile in nature.

C. Sikiang plain: it is extend in the south-eastern part of the country. It spread to the south of the Yangtze kian plain. In size it is smaller than the Yangtze plain and Hwang Ho plain. The soil of this plain is also fertile.

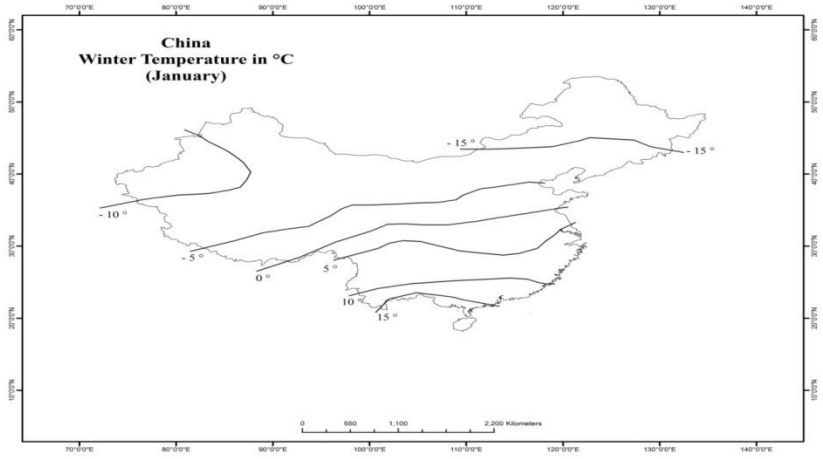
D. Sungari plain: Sungari plain is found in the central Manchuria and lying in north-south direction.

4. Climate

China has extremely diverse climatic conditions because of its geographical location. China is ranging from tropical in the south to subarctic in the far north while most of the China falls in the temperate region so climatic conditions are extreme. The climate of china is dominated by monsoon winds.

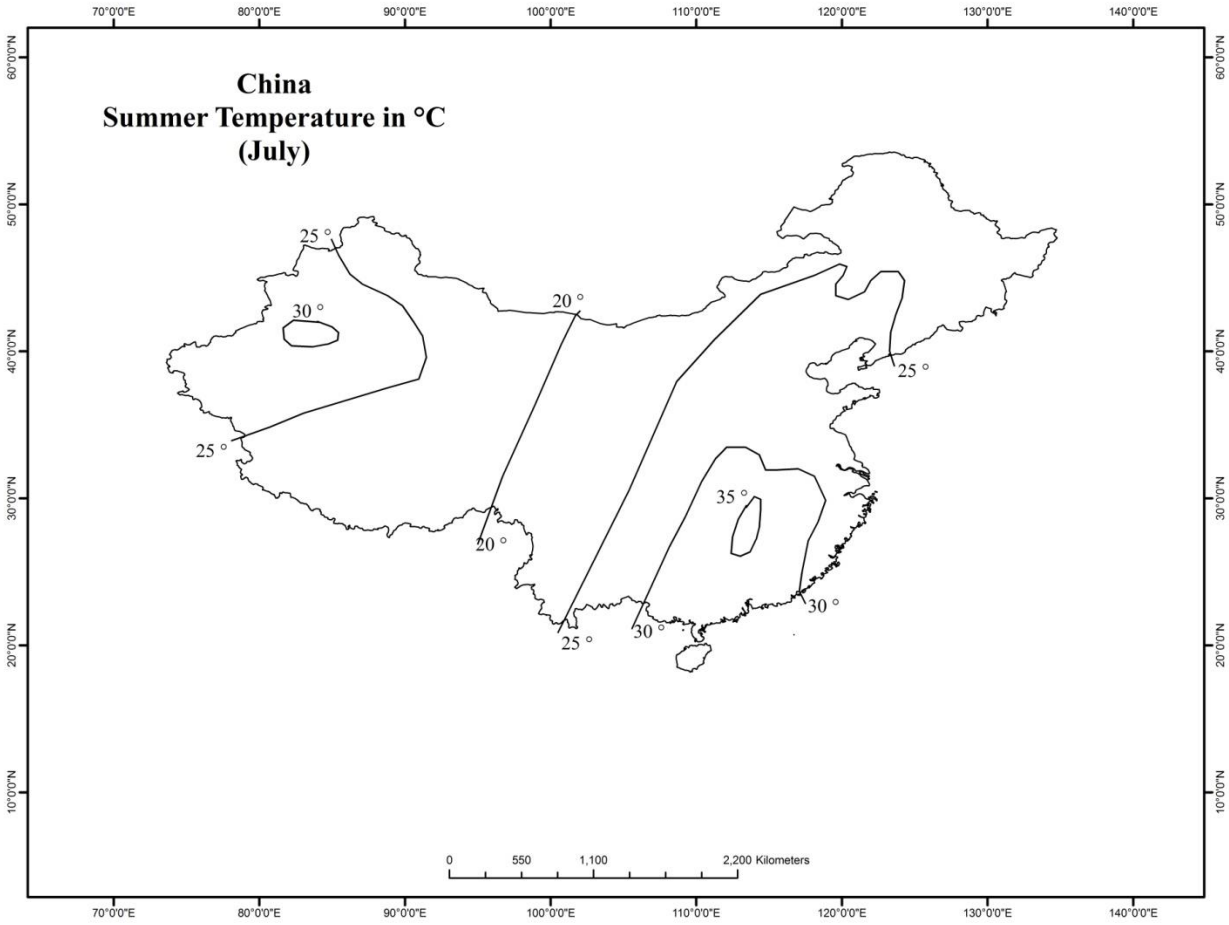
Temperature: the temperature decreased from south to north. January is the coldest month in China. In winter the average temperature are below freezing point through the north and west China and increase gradually southward. Temperature differences in summer are less considerable while in winter differences are more considerable. In China Summers are hot and July is the hottest month of summer season and the average temperature are above 20 degree which decreased towards the west.

Figure 16.4



Source: Google

Figure:16.5



Source: Google

Rainfall: Much of the country gets rain from East Asian monsoon during summer on the other hand the Siberian anticyclone dominates during winter which caused dry conditions. The summer monsoon occurs in the last of June or first week of July. The average annual rainfall ranges from place to place. It decreases markedly from south-east to north-west. In the south-eastern China heavy rainfall is caused due to tropical cyclone or typhoons. On the other hand on the Plateau of Tibet the rainfall decreases from south-east to north-west. Thus there are many variations in rainfall. For example there is a less than 20 mm in northwestern Qinghai on the other hand the Turpan depression of Xinjing to easily exceeding 2000mm in Guangdong, Guangxi and Hainan.The plateau of Tibetan and the north gets more sunshine comparatively south part of the China.

Climatic Regions

Climatic regions of China are:

I. Monsoon region: monsoon season includes winter season, summer season and rainy season.

II. Manchurian climatic region: the characteristics of this region are long summer humid continental climate, summer temperature remains high and winter is cold.

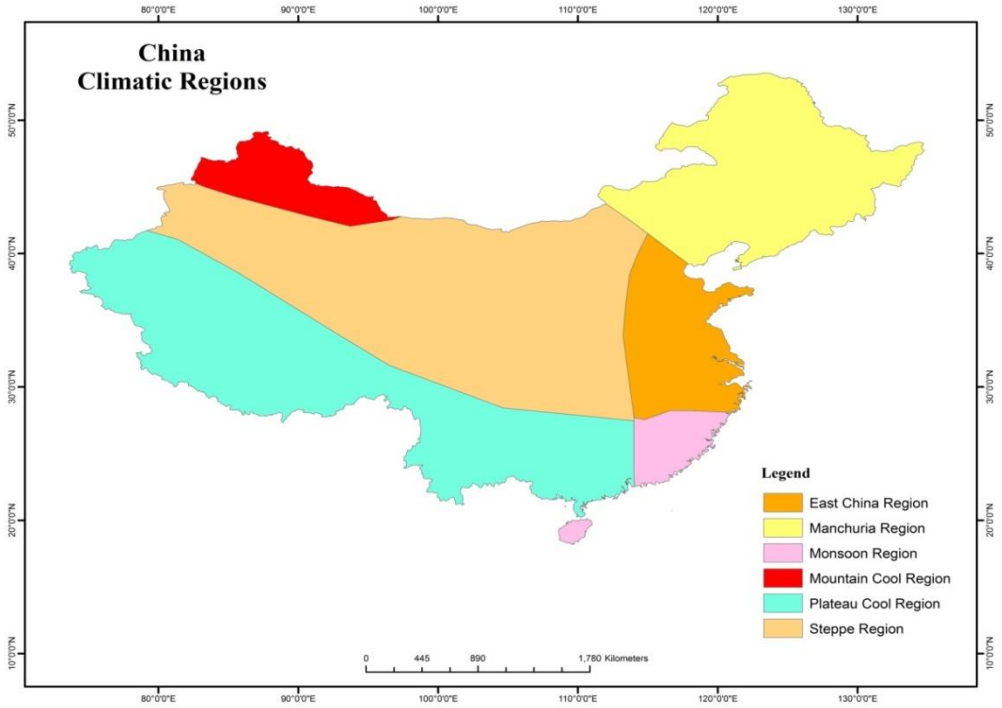
III. East China climatic region: This region is known as humid su-tropical region.

IV. Plateau cool climatic region with short summer, long and cold winter.

V. Steppe climatic region: the characteristics of this region are dry continent. It extends over north-west china.

VI. Mountain cool climatic region which is also known as the Altai type climatic region. Temperature decreases with altitude.

Figure: 16.6



Source: Google

Drainage

China has about 50000 rivers with the total length of 420,000 kilometers. The most of the rivers of China flow west to east and fall into the Pacific Ocean. The major drainage systems of China are:

I. Pacific ocean system
II. Indian ocean system and
III. Inland drainage system

Yangtze or Chang Jiang with the length of 5560kms and having a catchment area of 1.8 million square kmsoriginate from Tibet flows through central China and falls in the East China Sea. Yangtze is the third longest river of the world and first longest of the China.

Huang Ho which is also known as Yellow River is the second longest river of the country having a catchment area of 752,000 square kms. The length of the river is about 4900 kms. It originates from Tibet and falls into the Bo Hai Gulf. This river is also known as the sorrow of China

The Black Dragon River or Heilong River flows in northern China with 3,101 kms. In Russia this river is known as Amur.

Zhujiang or Pearl Riveris the longest river in south china. The length of the river is about 2,214 kilometer. This river forms the Pearl River delta near Guangzhou, Zhuhai, Macua and Hong Kong. In the northeast Liaohe, Haihe in the north, Qiantang in the east and Lancang in the southwest are the other major rivers of China.

On the other had the rivers of western Chinese plateau regions have inland drainage. Inland drainage covers about 40 percent drainage area of the China which includes uplands basins in the north and northeast.

Agriculture

Agriculture is a primary economic activity. China has about11 percent of arable land worldwide. It is a very most important industry in China which provides employment to more than 300 million farmers in China. China rank first in the many agricultural products such as rice, wheat,

potatoes, tomato, sorghum, peanuts, tea, millet, barley, cotton, oilseed and soybeans while it produces food for 20 percent of the world's population. More than 60 percent of China population is depends on agriculture.

Major crops

The major crops in china are rice, wheat, potatoes, tomato, sorghum, peanuts, tea, millet, barley, cotton, oilseed and raw silk.

Rice: Rice is the first most prevalent grain crop, grown in most parts of the country. China is ranking first in producing of rice in the world. It produces about 25 percent of the world's total. The annual production of rice is about 200 million tones. the major areas of rice cultivation in China are:

Szechwan basin and red basin,

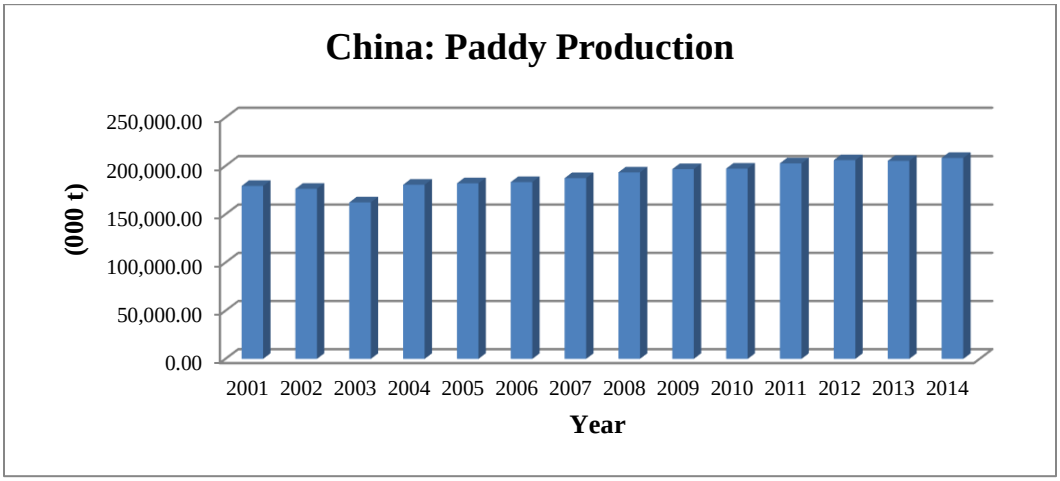
the lower valley and delta of the Hwang ho river,

The lower valley and delta of the Sikiang River.

Yunnan and Kweichow plateaus and the lower valley and

Delta of the Yangtze River.

Figure: 16.7



Wheat: wheat is the second most prevalent grain crop, grown in most parts of the China. China is leading producer of rice in the world. It produces about 15 percent of the world's total. The annual production of rice is about 115 million tones. the main areas of wheat cultivation are:

Manchuria plain

North-west region which extends upto Mongolia the valley of the Hwang ho river,

The lower valley and delta of the Sikiang river,

The valley of the Yangtze river and

Loess region of China where winter wheat grown.

Maize: Maize is also the most important growing crop in China. China produces about 18 percent of the world's total output and ranks second in the world. The annual production of rice is about 118 million tones. The main areas of maize cultivation are: southern Manchuria to the northern plains and hills of south and south-western plateaus.

Raw silk: China is the first largest leading producer of raw silk in the world. China produces about 60 percent of the world's total output. The annual production of raw silk is about 300 thousand metric tonnes. the main areas are: lower and middle Yangtze valley Sikiang valley and min valley and shantung peninsula

Tea: China stands on first for the production of tea with about 25 percent production of the world. The annual production of tea is about 1500 thousand metric tones. Types of tea found in China are green tea, brick tea, jasmine tea, Along tea etc. the main areas are hilly belts of Yangtze basin.

Figure 16.8: China's Tea field

Source: Google

Cotton: China stands on first rank for the production of cotton in the world accounting for about 20 percent of the world's total output. the major areas of cotton crops in China are:

1. The lower Yangtze valley,

2. The upper parts of the Hawang Ho delta and

3. Thewei Ho valley lying in the further west.

Figure 16.9: Cotton boll, staple fiber in Guangxi, China

Source: Google

Other crops: other crops of China are tomato, fruits, vegetables, sorghum, peanuts, millet, barley, oilseed, sugarcane and tobacco etc.

Agricultural Regions of China

As per science academy of China in 1969 there has been 4 primary agricultural regions. These are:

[1] Northern Dry Farming And Livestock Region
[2] Southern Humid Farming And Commercial Forestry Region
[3] North-Western Dry And Irrigated Farming And Livestock Region
[4] Qinghai-Tibet High Lands Farming And Livestock Region

16.4 REGIONAL GEOGRAPHY OF JAPAN

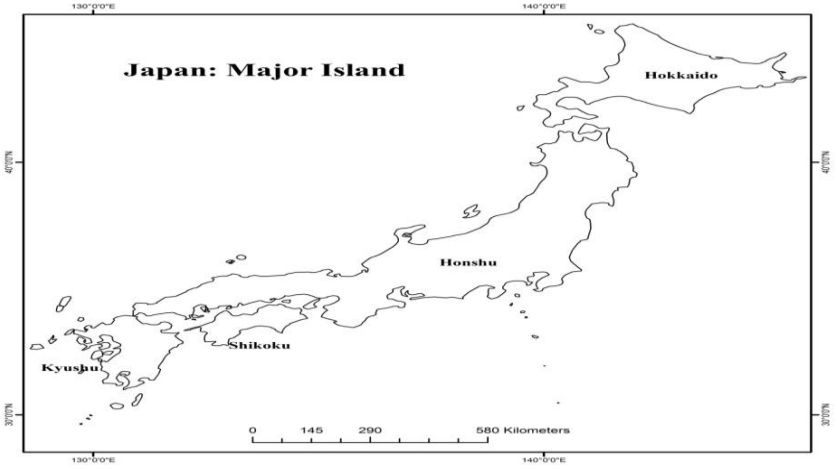
Physiography

Islands of Japan are covered by mountains, forest and are a part of circum-pacific ring. Islands are also crisscrossed by short, swift rivers. Earthquakes are frequent in Japan which is result from a fault that circles the Pacific Ocean. Highest mountain of Japan is Mount Fuji with an elevation of 3776 m. The islands of the country are the summits of mountain ridges uplifted near the outer edge of the continental shelf. This fault is also a zone of volcanic activity. The physiography of Japan may be into two major divisions:

B. Mountainous region: topography of Japan is mountainous. Most of the land is under hills, plateaus and mountains. The topography of Japan follows the fault that circles the Pacific Ocean. The range of principal mountains follows the fault lines of complex geology. Two or more arcs of mountains intersect and form knots of rugged mountains. One knot is found in the central Hokkaido and the in central Honshu. The arcs of south-western mountains lie over the southern Honshu, Shikoku, and Kyushu. The south – western region is demarcated into inner and outer zone. Both the inner zone has number of complex fault block and the anotheris occupied by the mountain of Akaishi, Shikoku and Kyushu.

B. Low lands and coastal plains: Japan consists only 16 % of low land out of total area.

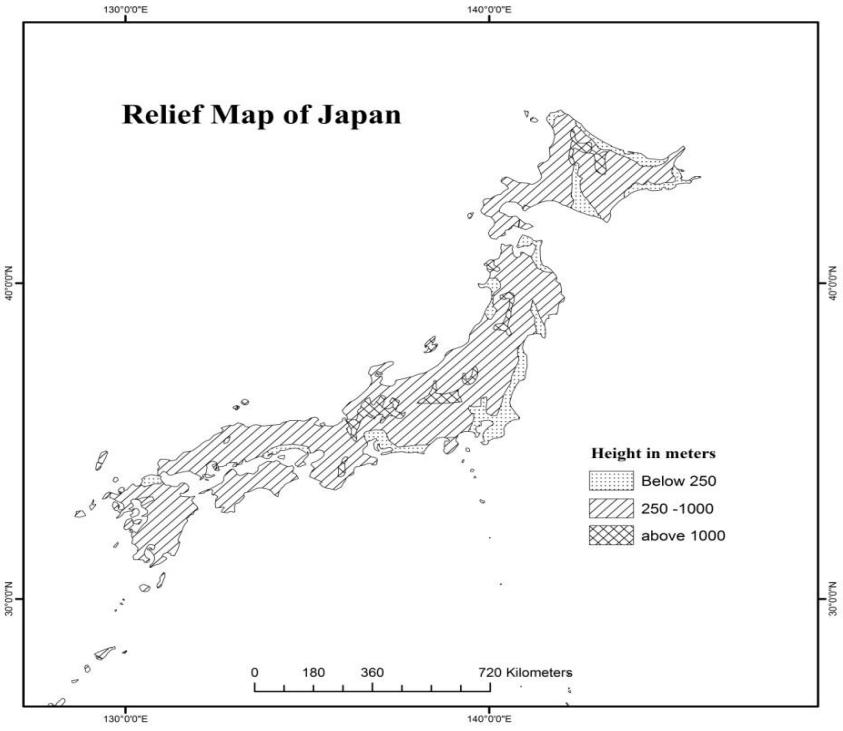
Figure 16.10 Japan



Source: Google

Their plains areas are small in size and discontinues in form. Plains are mostly found at the coastal regions. Kwanto plain of Honshu is the largest where Tokyo and many other cities are situated. Ishikari plain in Hokkaido is formed by the meeting of ranges of Karafuto and Chishima. Tokachi plain is the most important plain among the three plains located in north-eastern part of Hokkaido. Honshu western part is a discontinues coastal plain lying along the Sea of Japan where Nigata a large plain is located. In the east of Honshu in Nobi plain located at the near of Ise Bay. The two plainsK wanto and Nobi form the widest lowlands of Japan. The important plain of Japan is Kinki located on the west-central part of Honshu.

Figure 16.11



Source: Google

Climate

Japan has a variety of climate because of its seasonal winds, wide range of latitude and different types of ocean currents. The warm Kuroshio Current and cold Oyashio current are the two major currents that affect the Japan. It is a rainy country with high humidity. Sub- tropical climate

found in the south, temperate in middle and cold in the north part. Temperature and rainfall condition of the country are given below:

A. Temperature

The temperature increases from north to south. The period of sprig is large in the south and shorter in the north. The average January temperature at Kagoshim is 7 degree C while at Ashikawa it is 9 degree C. in summer the average temperature at Kogoshina is found 27 degree C on the other hand at Ashikawa it is 21 degree C. Thus temperature is differ from south to north because of its geographical location. The hottest temperature was measured in Japan, 41.0 °C occurred in Shimanto, Kochi on August 12, 2013.

B. Rainfall

Rainfall of japans is affected y monsoon. Maximum precipitation is occurs in summer except of the Sea of Japan cost. Precipitation in Japan is more than 25 mm of rainfall equivalent in all months of the year while in the wettest coastal areas it is above 100 mm per month throughout the year. Main rainy months of the Japan are June and July. Plum Rains occur in the month of May it is also called pre monsoon rainfall. Kii peninsula gets highest rainfall accounting for about 400 cm while Eastern coast of Japan receives lowest rainfall. Siberians high develops over the Eurasian land mass in winter the Aleutian Low develops over the northern Pacific Ocean which caused the flow of cold air southeastward across Japan that brings freezing temperatures and heavy snowfalls to the central mountain ranges facing the Sea of Japan. Mid June to mid-July is generally the rainy season in Honshu, Shikoku and Kyushu.

Climatic Regions

The islands of Japan namely Honshu, Shikoku and Kyushu are belonging to the temperate zone. Generally Japan's geographical features divide Japan into four major climatic zones:

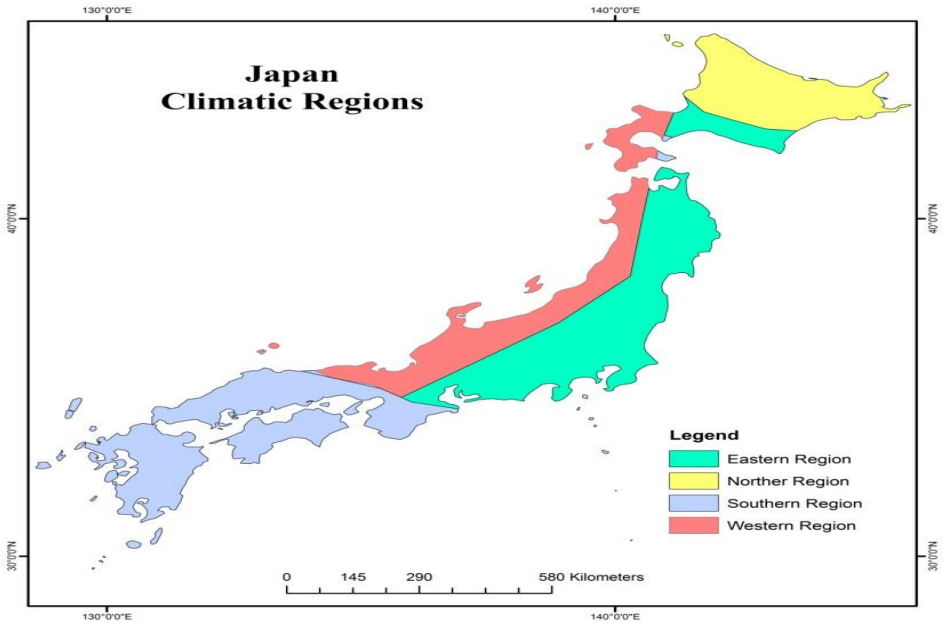
i. Northern region: northern part of Hokkaido comes in the region. Climate of this region is cold. Temperature is generally low which increase slightly towards south of the Hokkaido. Precipitation is low. It is belonging to the humid continental climate with long cold winters and cool summers.

ii. Eastern climate: Southern part of Hokkaido and eastern part of Honshu comes in the climatic region. Characteristics of this region are short, cool and drier winter and long summer. Rainfall is between 100 cm to 150 cm.

iii. Western region: This climatic region includes western part of Honshu and south-western part of Hokkaido. In this region northwest seasonal wind in winter gives heavy snowfall. Summer season is short with little rainfall and light hot. 100 cm is the average annual rainfall of the region.

iv. Southernregion: the average temperatures of southern region climate are 7 degree C and 27degree C of winter and summer seasons. Typhoons are generally occurring in this region with heavy rainfall. This region includes southern part of Honshu and islands of Shikoku and Kyushu. Characteristics of this region are mild and dry winter and long and hot summer.

Fig.16.12



Source: Google

Rivers of Japan

Rivers of Japan are short in length and considerably steep gradients because of its topographical characteristics. Only 10 rivers of Japan have more than 200 km. length. Shimano is the longest river of Japan which flows from nagano to niigata. The length of the river is 2367 km. Ishikari and Teshio are the main rivers of Hokkaido. Kitakami, Tone, Shinnano, Kiso and Tenryu are the main rivers of Honshu while Chikugo is the main river of Kyushu island. Tone has the largest watershed. There is a lack of fresh water and shortage of fresh water is a serious problem. Rivers coming from volcanic areas contain acidic water which is useless for irrigation and drinking purpose.

Agriculture

Topography of Japan is characterized by the hilly region. So most of the land is not suitable for agriculture and only about 20 percent of Japan's land is suitable for cultivation. Land holdings are very small (average 1 hec). Only about 6 percent population is engaged in agriculture. The primary occupation in Japan is manufacturing sector while agriculture is considered as secondary occupation. The main food crop is rice while commercial crops include growing of mulberry bushes for silk warm and tea cultivation. Main crops of Japan are wheat, oil seeds, tea, rice, beans peas, barley etc.

Major crops

The major crops in china are rice, wheat, potatoes, tomato, sorghum, peanuts, tea, millet, barley, cotton, oilseed and raw silk.

Rice: Rice is the first most prevalent grain crop of the Japan. Japan is ranking first in producing of rice per hectare per kilograms (6200 K.G. per hec) in the world. It produces about 1.7 percent of the world's total. The annual production of rice is about 10.6 million tones. The major areas of rice cultivation in Japan are:

1. Southern Hokkaido in north to Kyushu,

2. Okinawa island in the south,

Wheat: In Japan only 6 percent of the cultivated area is under wheat production. The production of wheat is very little. A yield of wheat per hectare is about 4000 kilograms. The annual production of rice is about 8 lakh metric tonnes. The main areas of wheat cultivation are:

1. Hokkaido and northern region Honshu

2. Southern Honshu and Kyushu

Raw silk: Japan producer a very little amount of raw silk in the world. The annual production of raw silk is about 200 metric tonnes. It is obtains form cocoons formed by the silk worm. The main areas are:

1. Honshu and

2. Kyushu

Tea: China produced about 3 percent of tea to the world production. The annual average yield of tea is about 2000 kg per hectares. Types of tea found in China are green tea, brick tea, jasmine tea etc. the main areas are pacific sides of southern Honshu, Shikoku and Kyushu.

Potato: It is one of the most important crops. The area under this crop is about 8 percent. The annual production of potato is about 30 lakh metric tones. It is cultivated in the area of hill terraces and alluvial plains of Hokkaido, Honshu and Kyushu.

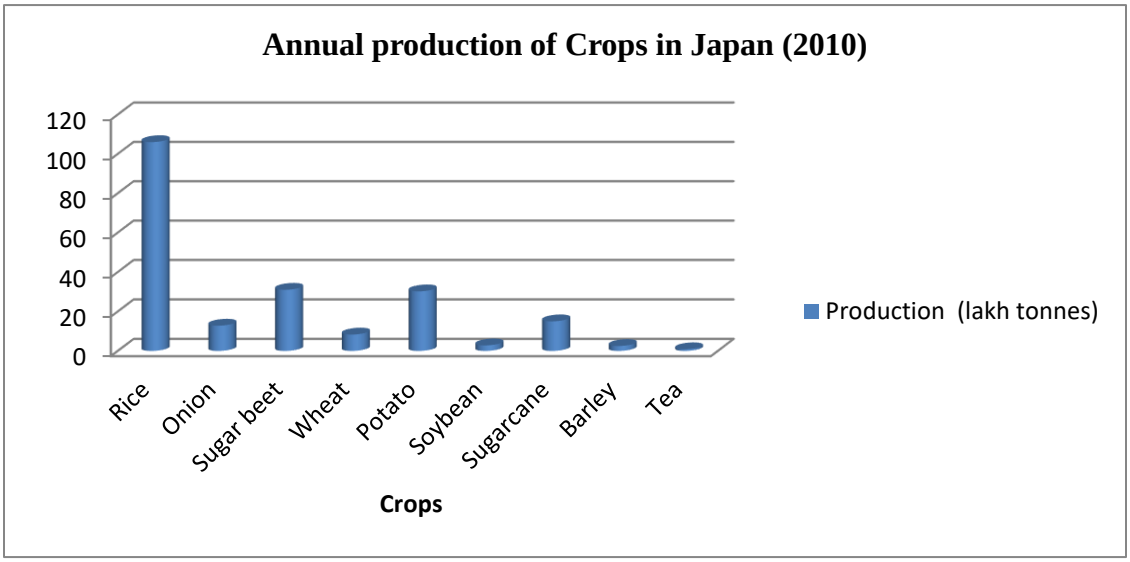
Other crops: other crops of Japan are tomato, fruits, vegetables, sorghum, peanuts, millet, barley, oilseed, sugarcane and tobacco etc.

Table 16.2:**Annual production of Crops in Japan (2010)**

Crops	Production (lakh tonnes)
Rice	106.0
Onion	12.8
Sugar beet	31.0
Wheat	8.3
Potato	30.2
Soybean	2.8
Sugarcane	15.0
Barley	2.5
Tea	0.85

Source: Maurya, S.D. (2015)

Figure: 16.13



16.5 CONCLUSION

China and Japan both are the most industrialized country of the world. Three major physiographic divisions of China are the plains, plateaus and mountains. These ranges are extends from the Pamir knot towards south-east, east and north-east such as the Himalayas, the Kunlun, the Tienshan etc. Tibetan plateau, the Tarim basin, the Dzungarian basin and Gobi plateau are the important plateau found in China and the Alluvial Plains of China are the Hwang Ho Plain, the Yangtze kiang plain, and Sungari plain. China has extremely diverse climatic conditions and climate of china is dominated by monsoon winds. China rank first in the many agricultural products such as rice, wheat, potatoes, tomato, sorghum, peanuts, tea, millet, barley, cotton, oilseed and soybeans while it produces food for 20 percent of the world's population.

Japan is dominated by mountains and about 84 % of its land is occupied by hill, mountains and plateaus. Islands are also crisscrossed by short, swift rivers. The islands of the country are the summits of mountain ridges uplifted near the outer edge of the continental shelf. The physiography of Japan may be into two major divisions' Mountainous region and Low lands and coastal plains. Japan has a variety of climate because of its seasonal winds, wide range of latitude

and different types of ocean currents. Sub- tropical climate found in the south, temperate in middle and cold in the north part. The islands of Japan namely Honshu, Shikoku and Kyushu are belonging to the temperate zone. Most of the land is not suitable for agriculture and only about 20 percent of Japan's land is suitable for cultivation. Land holdings are very small. The main food crop is rice. Other main crops of Japan are wheat, oil seeds, tea, rice, beans peas, barley etc.

16.6 SUMMARY

China and Japan both are the most industrialized country of the world. There are three major physiographic divisions in China the plains, plateaus and mountains. There are various mountain ranges are found in the western part of China. These ranges are extends from the Pamir knot towards south-east, east and north-east. Some of them are the Himalayas, the Kunlun, theTienshan etc. Plateaus are found in the western part of the country and are like basins between the mountain ranges. Tibetan plateau, the Tarim basin, the Dzungarian basin and Gobi plateau are the important plateau found in China. The Alluvial Plains are found in the eastern part of china and located to the east of plateaus and mountains country. The Alluvial Plains of China are the Hwang Ho Plain, the Yangtze kiang plain, and Sungari plain. China has extremely diverse climatic conditions because of its geographical location. China is ranging from tropical in the south to subarctic in the far north while most of the China falls in the temperate region so climatic conditions are extreme. The climate of china is dominated by monsoon winds. Agriculture is a primary economic activity. China has about11 percent of arable land worldwide. It is a very most important industry in China which provides employment to more than 300 million farmers in China. China rank first in the many agricultural products such as rice, wheat, potatoes, tomato, sorghum, peanuts, tea, millet, barley, cotton, oilseed and soybeans while it produces food for 20 percent of the world's population.

Islands of Japan are covered by mountains, forest and are a part of circum-pacific ring. Islands are also crisscrossed by short, swift rivers. Earthquakes are frequent in Japan which is result from a fault that circles the Pacific Ocean. Highest mountain of Japan is Mount Fuji with an elevation of 3776 m. The islands of the country are the summits of mountain ridges uplifted near the outer edge of the continental shelf. This fault is also a zone of volcanic activity. The physiography of Japan may be into two major divisions' Mountainous region and Low lands and

coastal plains. Japan has a variety of climate because of its seasonal winds, wide range of latitude and different types of ocean currents. The warm Kuroshio Current and cold Oyashio current are the two major currents that affect the Japan. It is a rainy country with high humidity. Sub-tropical climate found in the south, temperate in middle and cold in the north part. The islands of Japan namely Honshu, Shikoku and Kyushu are belonging to the temperate zone. Rivers of Japan are short in length and considerably steep gradients because of its topographical characteristics. Only 10 rivers of Japan have more than 200 km. length. Shimano is the longest river of Japan which flows from nagano to niigata. Topography of Japan is characterized by the hilly region. So most of the land is not suitable for agriculture and only about 20 percent of Japan's land is suitable for cultivation. Land holdings are very small (average 1 hec). Only about 6 percent population is engaged in agriculture. The primary occupation in Japan is manufacturing sector while agriculture is considered as secondary occupation. The main food crop is rice while commercial crops include growing of mulberry bushes for silk warm and tea cultivation. Main crops of Japan are wheat, oil seeds, tea, rice, beans peas, barley etc.

16.7 GLOSSARY

Domestication: it is to convert the wild plants and animals to domestic uses mainly for the generations of breeding.

FAO: Food and Agricultural Organization of the United Nations, established in 1945.

Fringe: A transitional zone between two boundaries.

Green Revolution: the introduction of High Yield Varieties (HYV), fertilizers and pesticides which led to the high production of crops in a short time.

MT: Metric Tonne which is used for measuring the weight**.**

Native: origin or growing naturally in a particular region

Neolithic period: it is the cultural period of the stone age in 10,000 BC which is characterized by the development of agriculture and the making of polished stone implements.

Land use: the process of modification and management of natural environment into a manmade environment.

Land holding: it is an area of land that is owns or rent by someone.

Livestock rearing: it a domestication of animals mainly in an agricultural setting such as goats.

Region: it refers to the homogeneity particularly climate in an area.

Tropical: Region found in an area with high temperature and very heavy rainfall.

16.8 ANSWER TO CHECK YOUR PROGRESS

Q. 1 what do you understand by physiographic divisions?

Q.2 what type of climate found in China and Japan?

Q.3 what is the difference between the climate of China and Japan?

Q.4 How climatic conditions impact the agriculture of Japan?

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16.10 SUGGESTED READINGS

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16.11 TERMINAL QUESTIONS

Q.1 What is the importance of monsoon for China?

Q.2 Describe the climatic zones of China?

Q.3 Describe the climatic zones of Japan?

Q.4 What are the different characteristics of Japan's Islands?

Q.5 Classify the physiography of Japan.

Q. 6 What are the rainfall characteristics of China?

Q.7 Define what is Climate?

Q. 8 What are the factor responsible for short rivers of Japan?

Q. 9Describe the important food crops of China and Japan.

Q. 10Discus the different characteristics agriculture of China and Japan.

Q. 11Write short notes

(i) China's Inland drainage system

(ii) Huang Ho River

(iii) Plum Rains

(iv) Rainy season in Honshu, Shikoku and Kyushu

(v) Shimano

LAB WORK

BLOCK 1 - SURVEYING

UNIT 1 - PRINCIPALS OF SURVEYING

1.1 OBJECTIVES

After reading this unit, you will be able to:

- Know about fundamentals of Surveying
- Explain about the types of surveying

1.2 INTRODUCTION

Survey is an art in which the horizontal distances, angle and heights measured on the surface with the help of survey instruments. After this it is showed as a map as per conventional method. Thus, the survey consists of three functions. (i) Field work, in which with the help of survey equipment horizontal distances between the fixed points in the area are written in the field book by measuring angle, directions and height. (ii) Mapping, in which measurement are written in field book, according to the rules of map art, the given area map is made and (iii) Computation, in which the necessary calculation work is done to determine positions, area and volume.

From the above description, it is clear that the survey is a mixture of science and art. The surveyor is required to survey the principles of survey, the technical knowledge of the design of the equipment and their right use. Surveyors must also have full knowledge of the general rules of map art. A good surveyor should have high observation capability. A good surveyor should have the ability to make quick decisions. In the previous unit we read about the regression and correlation. In this unit we will tell you the principals of the survey and also we will explain the types of survey.

1.3 FUNDAMENTALS OF SURVEYING

Different methods of survey are based on two basic rules. (i) Working from the whole to the numerator and (ii) use of more than one independent process in determining the position of new centers. According to the first rule, in the surveys, a sequence of controlling points is first established with high precision. For horizontal control, these points are decided by triangulation or absolute traverse. To perform this task by triangulation, divide the given area into large triangles and conduct surveys with maximum accuracy of these triangles. After this, these triangles are divided into sub departments. The purpose of this work system is to prevent accumulation of error and to control minor errors. According to the second law, the conditions of the new centers are determined by the pre- decided centers on the basis of linear measurement, angle measurement or both types of measurement in the survey. For example, in chain surveys, the main lines and the measurement of the center are examined and it is checked by the check or tie line.

Two types of measurement are used in plane surveys. (i) Linear measurement and (ii) Angular measurement. Linear measurement can be again divided into two departments. (i) Horizontal distance, (ii) Vertical distance. Similarly, angular measurement has two different

subdivision. (i) Vertical angle and (ii) Horizontal angle. It should be remembered that in the survey, always H.E. is measured between the points given on the ground.

1.4 TYPES OF SURVEYING

The survey can be classified according to various different bases as follows:

1- Primary classification of survey
   (i) Geodetic Surveying
   (ii) Plane Surveying

2- According to the method of surveying
   (i) Triangulation Surveying
   (ii) Traverse Surveying

3- Classification according to the survey instrument/equipment used
   (i) Chain and Tape Surveying
   (ii) Plane table surveying
   (iii) Compass surveying
   (iv) Sextant surveying
   (v) Theodolite surveying
   (vi) Dumpy level
   (vii) Indian pattern clinometers
   (viii) Air surveying

4- Classification according to the object of the survey
   (i) Topographical survey
   (ii) Archaeological surveying
   (iii) Geological surveying
   (iv) Military survey
   (v) Cadastral survey
   (vi) City survey
   (vii) Engineering survey
   (viii) Other surveys

5- Classification according to the nature of the survey area
   (i) Land survey
   (ii) Marine or navigation survey
   (iii) Astronomical survey

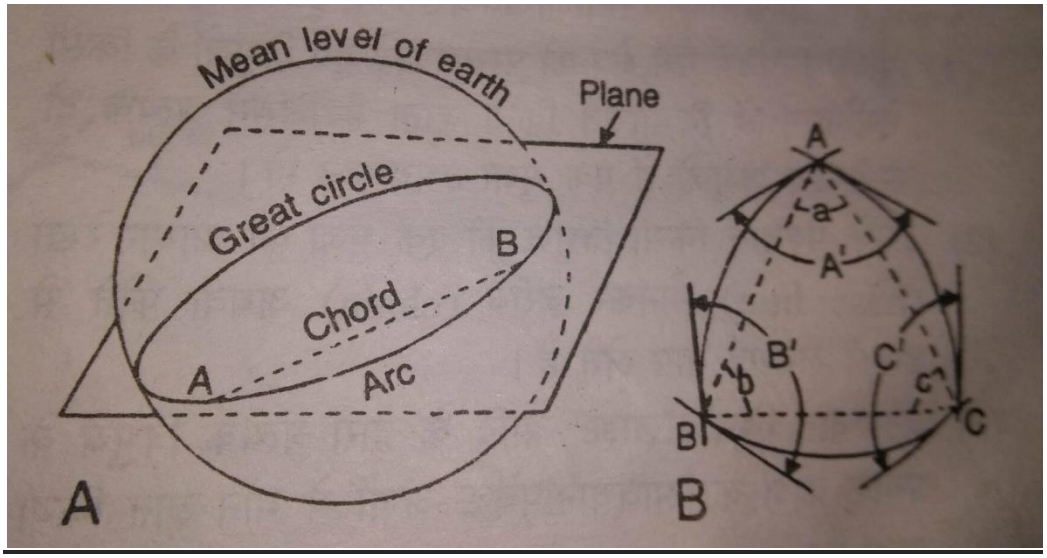
1- Geodetic survey

In the view of spherodical shape of the earth, the survey carried out is called trigonometrical survey. Trigonometrical survey is done to find the precise conditions on the earth given to the points given in a large area. The methods of the equipment used in this survey are very refined. These types of surveys are only done by the Government. For example- Survey of India in India, US Geological survey in the United States and US Cost & Geodic survey department conducted trigonometrical surveys.

If the shape of the earth is assumed like a full sphere, it is obvious that the line joining any two points, A and B, will be curved on the surface. In the similar fashion if any three points are joined with one another, the resulting figure will be a spherical triangle. In figure 1.1 B, ABC is a spherical triangle and A' B' C' are the spherical angles. If the curvature of the earth is not brought into consideration meaning, the earth's surface is considered as a plane then the lines joining these points will be the simple lines and the resultant triangle will be the plane triangle ABC, the angles a,b,c, of the triangle will be the plane angles. Hence in Geodic survey the use of spherical tignomeatry is made.

2- Plane surveying

Fig. 1.1



Source: J P Sharma Practical Geography

In the plane survey the surface of the earth is considered as flat that is no consideration is made on the impact of the curved shape of the earth while doing surveys. Students of Geography conduct surveys from different instruments through this method. To conduct this type of survey, it is necessary to have knowledge of both line arithmetic and tignometry. Although flat surveys

are not as accurate as Geological survey but this method is appropriate for survey of relatively small areas, because there is no effect of curvature of the earth on distances distilled in a small area. This is the reason that the use of flat surveys in the construction of the boundaries of the cities and villages and construction of roads, railways and canals etc.

3- Triangulation surveying

In the triangulation survey, an area is divided into triangle. Find the value of one side of the triangle and all the angles. With the help of trigonometry on the basis of these values, the length of the remaining arms is fixed and from this, the process of making maps is called triangulation survey.
This survey is done in the following steps:

(i) The first given area is divided into one of the corresponding triangles in an order, in which two adjacent triangles have one side in common.
(ii) After this, one side of a triangle, regarding the base as a baseline, measures its length by using Chain & Tape.
(iii) After this, the degree of the values of each angle of each triangle is determined by theodolite.
(iv) By placing the above values in the following trigonometric formula, the length of the remaining two sides of the triangle with the first baseline is fixed.

$$\frac{\sin A}{a} = \frac{\sin B}{b} = \frac{\sin C}{c}$$

In the above formula has an angle of A, B and C triangle and a b c are respectively sides facing these angles. When the length of the three sides of the baseline triangle is known, the sides of the proximal triangles can be determined by using the above formula.
From the above description it is clear that in the triangulation survey, every distance of the field is not measured by the chain and it is done according to the baseline.

4- Traverse surveying

The sequence of simple lines connecting the sequence of pre determined points in a survey path is called traverse. The point at which the traverse line changes its direction is called a traverse point. Thus in the traverse survey, all the lines that make up the traverse line are measured. The angle between two simple lines is found out at each traverse point. To measure distances on the surface, the chain and tape method is used. Angular measurements are found out by prismatic compass or theodolite. This method is often used in flat areas because there is lack of surface obstacles; it is easy to measure distances. There are two types of traverse. (1) Close traverse, (2) Open traverse. The surveyor is the close traverse comes back to the same point as the traverse

point start. For example, survey of any field or ground. In the open traverse the surveyor continues to grow continuously and does not reach the starting point. For example survey of any road or canal.

1.5 CONCLUSION

Survey is very important for making a map of an area. It can be easily made to map of an area with the help of scale. This is a very important study. It is a record of surface. Basic need for survey is preparing for construction, ensuring accurate boundaries, understanding topography etc.

1.6 SUMMARY

Information about different types of surveys was given in this unit. What is geodetic, plane, triangulation and traverse survey? What are the uses of these surveys? What are the principals of the surveys? Which rules are based on the surveys? What are the measurements used in the survey? Like the linear measurement, angular measurement, horizontal distances, vertical distances, horizontal angle, vertical angle.

1.7 GLOSSARY

- **Survey** - The measuring and recording of the details of an area of land
- **Geodetic** - Relating to geodesy
- **Triangulation** - The tracing and measurement of a series or network of triangles in order to determine the distances and relative positions of points spread over an area.
- **Astronomical** - Relating to astronomy
- **Topographical** - Representation of the physical features of an area
- **Cadastral** - Showing the extent, value of land
- **Engineering** - The study of using scientific principles to design and build structures

1.8 ANSWER TO CHECK YOUR PROGRESS

2. What is Geodetic survey?
3. What is Plane survey?
4. What is Triangulation survey?
5. What is Traverse survey?

1.9 REFERENCES

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1.11 TERMINAL QUESTIONS

Q 1. Explain the difference between the types of Survey according to the different bases.
Q 2. Explain the differences of Geodetic Survey and plane survey.
Q 3. Explain the methods of Triangulation Survey and Traverse survey.

UNIT 2 - PLANE TABLE SURVEYING

2.1 OBJECTIVES

After reading this unit, you will be able to:

- Know about Plane Table Surveying
- Explain about the different methods of plane table survey
- Know about positioning techniques

2.2 INTRODUCTION

Plane Table Survey is an accurate easy to use graphical method. From the survey to the map, the entire work done in the field, while in other surveys the measurement work is done in the ground and mapping is done in the laboratory. This is the most suitable and popular survey technique for flat parts but in hilly terrains and extreme rugged states the survey is difficult. Errors are very less due to the completion of the entire survey done in the area.

2.3 PLANE TABLE SURVEYING

The invention of the plane table was in 1570. Today, it is considered the most popular tool to make plan by surveying the ground. The biggest feature of the plane table is that all the work is completed in the field, like surveying and mapping on paper. There are many benefits to the plan completion in the area.

- No need to make field book. As a result, the survey work becomes easy.
- If any details of the area in making the plan have been left then he gets instant knowledge.
- The survey work is completed quickly.

INSTRUMENT REQUIRED FOR PLANE TABLE SURVEYING

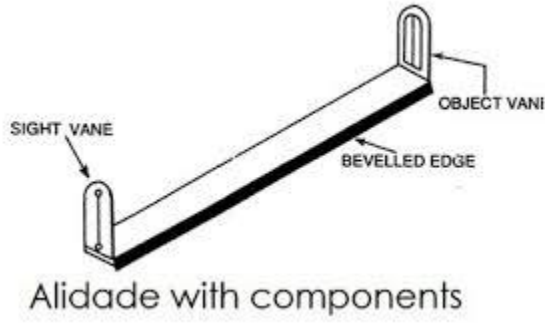
The following tools are required in the Plane Table Survey:

Plane Table and Tripod Stand - Plane table is the main tool of the survey, which has two parts- (i) Drawing board and (ii) Tripod stand. Drawing board is made of pine wood. These are of different sizes like 40x30 cm, 70x60 cm, 45x45 cm and 60x60 cm etc. For strengthening, on the lower surface of the drawing board the teak wood is wooded. In the middle of the board, there is aluminum round plate on the bottom, which is called pivot plate.

Drawing board is tightly used on a 1.5-meter-long tripod stand. If the ground is rough then that drawing board can leveled from the tripod stand. Tripod stand legs are made of teak wood. In the top of it is attached to a plate of aluminum by fly- nuts, which is called Tribrach plate. Drawing board and tripod stand joints to each other with clamping screw.

Source Google

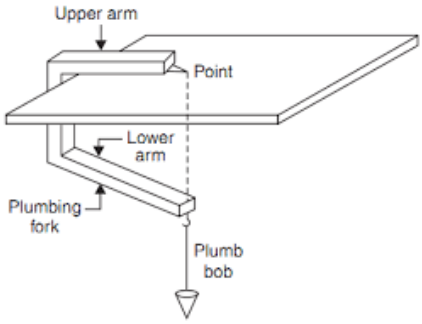
Alidade - The alidade is a ruler with a sight line attached and is used on the plane table for intersect the object, drawing rays, direction lines, etc. It consists of a metal (brass or gunmetal) or boxwood straightedge or ruler of about 45 cm long. The alidade may be plain fitted with sight vanes at both the ends and it can be fitted with a telescope. One of the sight vanes is provided with a narrow rectangular slit. Whereas other is equip with a central vertical hair or wire.



Alidade with components

Source Google

Plumbing Fork and Plumb Bob - Plumbing fork is a U-shaped metal frame with an upper horizontal arm and a lower inclined arm. The upper arm is provided with a pointer at the end while the lower arm is provided with a hook to suspend plumb bob.

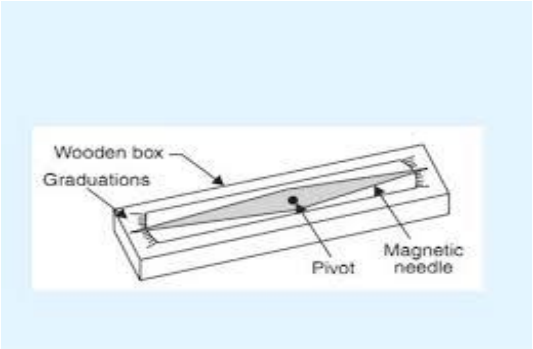


Source Google

Spirit level - If the spirit level which may be very sensitive is not fitted to the alidade, the table can be leveled by placing the spirit level in two positions at right angles to each other and setting the plane table such that the bubble is central in both positions.

Source Google

Trough compass - Trough Compass with two bubble tubes at right angles to each other mounted on a square brass plate is used for indicating the direction of the magnetic meridian on the paper.



Source Google

Survey Operation - After checking all the equipment of the survey, it is taken to the place of the survey.

1-Reconnaissance Sketch Map

Before starting a survey of an area, make an estimated image of the area and target points should be marked on that estimated image. Where the place is not clearly visible, the ranging rod should be buried. To mark all the details, by selecting the station, the field should be selected so that the entire area can be made on paper.

2-Setting up the plane table

The following procedure is adopted for establishing a plane table.

After reconnaissance sketch map drawing sheet is attached with the help of a board pin on the table. Drawing sheet is very important on which the map has to be made. Plane table is fixed in the first survey station at the height of the chest. At first station two actions are done to fix the plane table (i) leveling, (ii) centering. At the next station, do three works to establish the plane table. Leveling, centering & orientation.

(a) Leveling the plane table

Use spirit level to level the drawing board. The air bubble always escapes to the height in the spirit level. To adjust the plane table, spirit level is placed in middle and each corner of the drawing board. If the drawing board is not flat, then it's leveled by shaking one leg of the tripod stand. After adjusting the plane table should be tight.

(b) Centering of the plane table

Finding the position of the drawing board in the vertical direction of the survey station is called centering. The table should be centered by using plumbing fork. By using which we can arrange the plotted point exactly over the ground point.

After the work is done at first station, pick up the plane table and put it at another survey station. The position of which is already marked on drawing paper. In this process, drawing board can get a difference in vertical condition.

(c) Orientation

Draw lines on the drawing board, fable lines corresponding to the ground keeping parallel is called orientation. It is very important to make an orientation before drawing rays at all survey stations otherwise any details mentioned in the plane will be in a different situation than its actual position. There are two main methods of making orientation.

(i) Orientation by trough compass

It is very easy to orientation the plane table with the help of trough compass. At the survey station where the planning of the plane table is oriented, loose the drawing board and centering & leveling with that station. After this, in the drawing paper with the north- south line drawn on the first survey station, keeping the trough compass, the drawing board revolves around the magnetic north direction indicated by the needle. When the needle of the trough compass is located in the middle, then the drawing board is tighten to the tripod stand. With this method, to orient the plane table, the previously drawn north south line on the drawing paper is set according to the direction. After the orientation, the centering and leveling of the plane table is re- examined.

If an iron pitcher is located near a survey station, then the magnetic needle cannot tell the correct north direction. Therefore, this method cannot always be accurately oriented.

(ii) **Orientation by back sighting**

In this method, plane table is oriented by placing both ends of previously laid- baseline on the drawing paper in the direction of survey stations located on the ground. For example, suppose A and B are two surveying stations on the ground, in which the A B baseline appears on the drawing paper from a b line. (fig.2.1) Now, for the purpose of orienting the table on the B station, buried ranging rod at the A station and loose the drawing board on the tripod stand and adjust the centering and leveling of plane table at B station. Once the correct centering is done, B and b points will be in a vertical line. Now keep the alidade with b a line. Now rotate the drawing board so that the wire of object vane is straightened at A station where ranging rod is buried. After getting straightened, tighten the drawing board. While rotating the drawing board, the alidade should remain constant on the b a line. When rotating the drawing board, if there is a difference in its leveling or centering, then it should be removed and should re- look at the pre station A and check the precision of the orientation.

The method of orientation of the plane table by the back sighting is considered to be more reliable and authentic. Therefore, when using the orientation, often use this method.

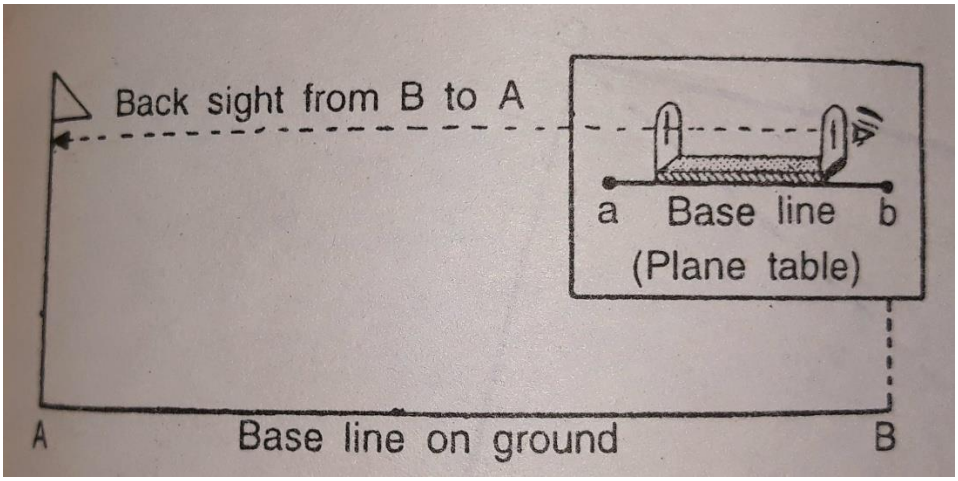


Fig. 2.1Source Practical book J.P.Sharma

COMPLETING THE PLAN

After making all the necessary details and boundary line of the area, its scale should be marked below the plan. Writing the name of the relevant area on each plan and the name of the survey method below it is necessary.

PRECAUTIONS USING THE PLANE TABLE SURVEY

- Drawing board should be tightly kept in the time of surveying. If it is slightly disturbed then becomes difficult for its working.
- Alidade side should be straight and make the rays straight and fine.
- The scale should be like this, in which the map will not be too big or too small.

- Scale should be kept according to the details on the map.
- Magnetic north must be made on the diagram. Metallic items should not be nearest at the time of work. The clock tide on your hand also influences it.
- Plane table should be properly set up, because the accuracy of the survey depends on these works.
- The rays should be fine and the serial number should be marked on each ray. The rays should not be long.
- The drawing board should be exactly flat.
- When the survey is not completed on a one paper you should transfer all the stations of the first hole by holes on the second paper.
- While drawing rays the alidade should not be move.

2.4 RADIATION, INTERSECTION AND TRAVERSING (OPEN & CLOSE)

There are four methods of plane table survey.

- Radiation method
- Intersection method
- Traverse (open & close)
- Resection

RADIATION METHOD

In this method of plane table surveying plane table is set up only one station and various points are located by radiating a ray from the instrument station to each of the points and plotting to scale along the ray and distance measured from the station to the point is sighted. Suppose ABCDEF is an open flat field. This field will be surveyed by radiation method as follows.

- First of all select a survey station (suppose P) in the middle of the field from where all the areas are clearly visible. This station can also be selected outside or the corner of any area, but sometimes doing so, any detail drawing cannot be inscribed within the bounds of the paper and all the work needs to be reworked. This problem is resolved by choosing the survey station in the middle station of the area and using the appropriate measures.
- Insert p point in the middle section of drawing paper and with the help of plumb bob or plumbing fork, correctly centering and balancing the plane table, keeping the p point right above the P station.
- Record the magnetic north direction by placing the trough compass in the upper corner of the drawing paper.
- Now put an alpin on the p point and by keeping alidade in support of this alpin , do rays on buried ranging rod A,B,C,D,E and F and other details within the area.
- Every buried ranging rod ABCDEF also measured distance from chain and tape from the P station. Cut these rays into the ray of drawing board according to the definite scale and

mark a b c d e f point in the drawing paper. Similarly, the details on the inside side of the area will be marked.

- After viewing the area, complete the boundary line in plan by joining a, b, c, d, e, and f points and write the name of the area and survey method on the plan and make the scale.

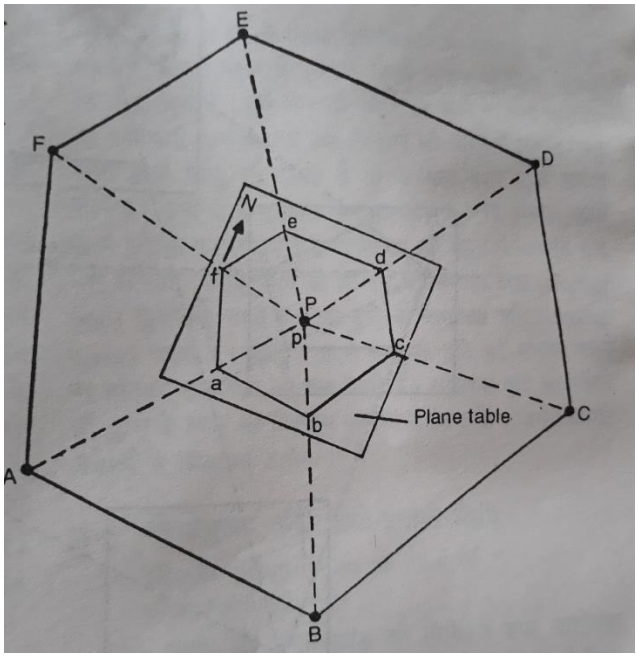


Fig. 2.1 Radiation Method Source Practical book J.P.Sharma

INTERSECTION METHOD

In this method, doing survey from the first station and then second, third, fourth, fifth and the next and reach at the first station. Any field, houses and settlements survey is done by the closed traverse method. In this method we can locate the point by plotting two rays from two known stations. The simple line joining the two survey stations from which the rays are drawn is called baseline. There is no need to measure any distance other than the baseline in the intersection mode. Hence this method is also called the triangulation method of the plane table. This method is particularly useful for placing the inaccessible areas of open areas in the plan. The purity of the plan of an area created by the intersection method depends on the correct selection of the baseline and its measurement. While selecting the baseline, the following points should be kept in mind.

- Every detail of the field is clearly visible from both sides of the baseline.
- The angle between the baseline and ray should not be too large or too low.
- The baseline should be selected on the level of flat and obstructive grounds so that it can easily be measured accurately with the help of chain and tape.

Procedure

According to the 2.2 figure, A B C D is an area. The process of survey and planning of this area through the intersection method will be completed in the following stages.

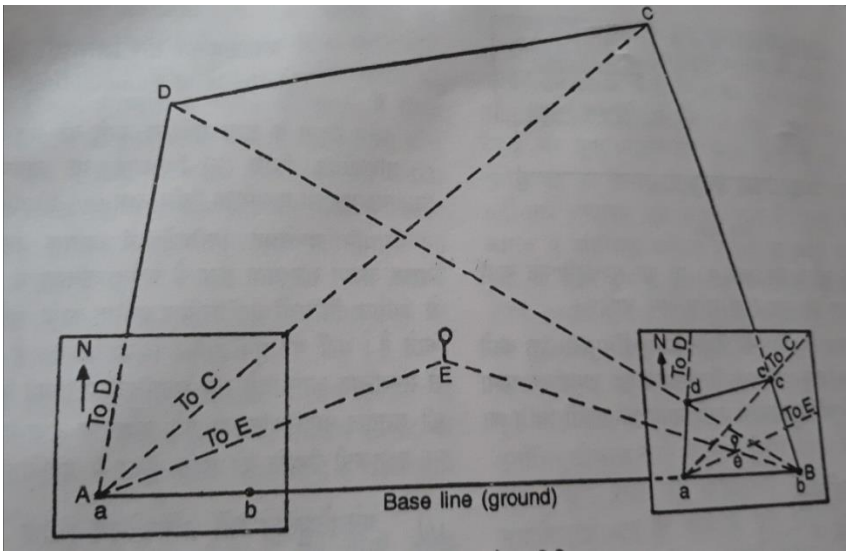


Fig. 2.2 Intersection Method Source Practical book J.P.Sharma

- Inspect the given area and choose the details to be displayed in the plan and buried ranging rod on border lines, so that they can be targeted with the alidade.
- Keeping in mind the above-mentioned points, select a suitable baseline in the area and measure this line from chain or tape. A B line is considered to be the base line in the given example.
- Fix the plane table on the A station and display the magnetic north direction with the help of a trough compass in the upper corner of the drawing paper.
- Using a plumb bob and fork, find 'a' point on the drawing board just above the A station and make an alpin on this point.
- Keeping alidade with the support of alpin, draw a ray by targeting the B station. According to the pre-determined scale of this ray, cut a line a b equal to A B distance, which will reveal the base line in the plan.
- After this, by rotating the other points or details of the field, draw the rays from 'a' point towards them. For identification mark the related details on each ray such as, To C, To D, and To E etc.
- After done this work, transfer the plane table to the B station. According to the pre method, do the leveling, centering and orientation of the plane table. Located on the drawing board just above the b point at B station.
- Now, by buried the alpin on the point b, like the previous one, rotate the details of the area by rotating the alidade while drawing the ray.

- The intersection of rays drawn by targeting any details from both stations will reveal the status of related details in the plan. So identify the related rays and mark the c, d, and e intersection point in the plan.
- After making the details, write the name of respective area and the name of the survey method on the plan and make the scale and signs.

TRAVERSING METHOD

This is the method used for locating plane table survey stations. In this method, ray is drawn to next station before shifting the table and distance between the stations measured. The distance is scaled down and next station is located. After setting the plane table at new station orientation is achieved by back sighting. To ensure additional checks, rays are taken to other stations also, whenever it is possible. Figure 2.3 shows a scheme of plane table survey of closed area. This method can be used for both traverses (Open & close).

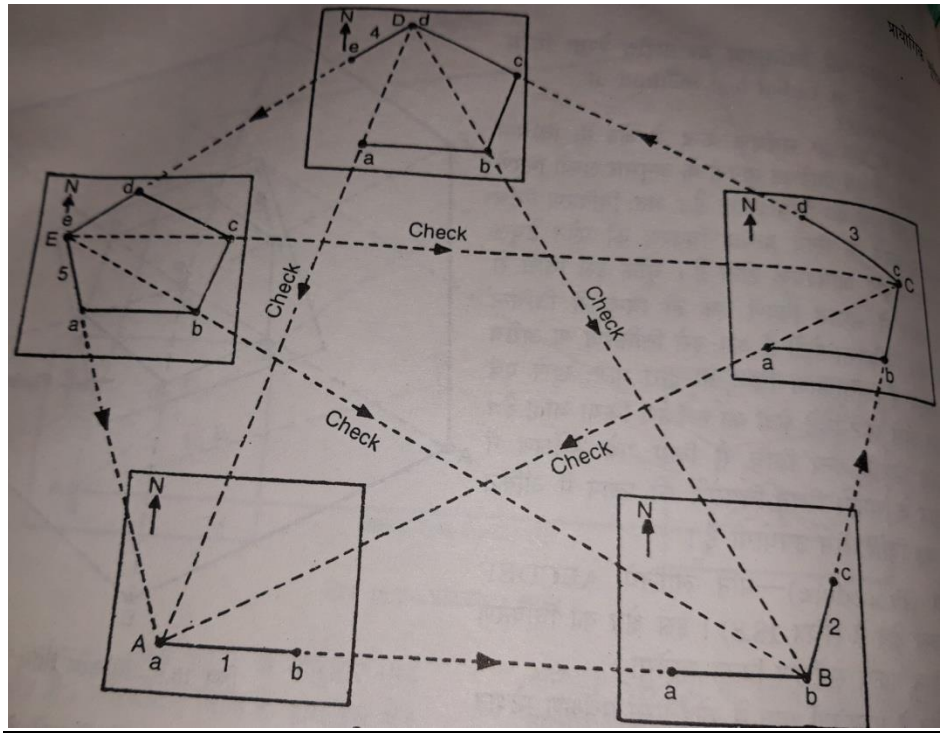


Fig. 2.3 Source Practical book J.P.Sharma

OPEN TRAVERSE METHOD

In this method, doing the survey work by setting up the drawing board at the first station and then setting up the second, third, fourth and next station and do not come back to the first station. That means base line and stations are open. These types of surveys can be of any way, canal and river.

2.5 RESECTION (TWO POINT & THREE POINT PROBLEM)

Determining the position of the plane table on the pre surveyed map based on known points in the field is called positioning. Plane table are placed in any place in the area and by drawing two or three details in the map, pulling the ray back and find the intersect point. This intersect point is the actual position of the map, from where the survey work is carried out. The following three methods of resection are:

1- Resection after Orientation by compass

In this method, the drawing board is fixing with the help of trough compass and targeting any two points in the field, draws the rays on back, which are intersect. This intersection will reveal the actual position of the drawing board.

- Let's say A and B are two such stations in any area, those who have been exposed from a and b points on the plan. There is also a new station P which is to be displayed in the plan.
- Placing the given plan on the drawing board, place the plane table on the P station.
- Keep the trough compass with the magnetic north south line on the plan and rotate the drawing board in the direction indicated by the compass needle. When the right orientation is done, tighten the drawing board.
- Keep the alidade with the help of an alpin at a point and target the station A. Back the ray with the help of alidade.
- Now keep the alidade with the support of the alpin at the b point and target the station B. Draw a second ray on back, which first cut the ray at p point. The p point will reveal the position of P station in the plan. This method is used only in small scale measuring plans.

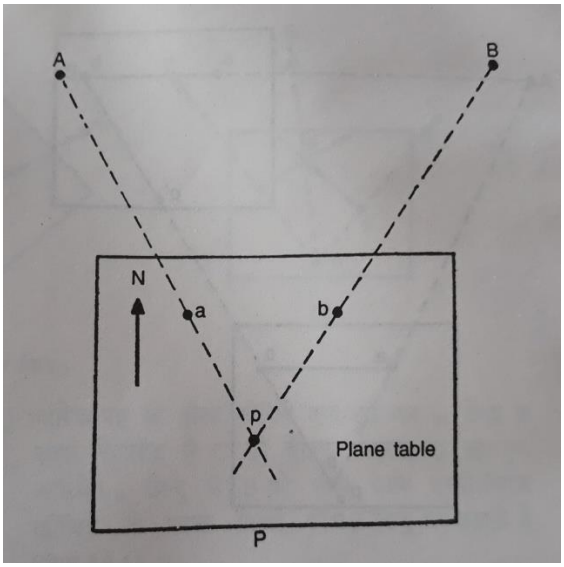


Fig. 2.4 Orientation by compass Source Practical book J.P.Sharma

2- RESECTION AFTER ORIENTATION BY BACK SLIGHTING

In this method, the orientation of the drawing board by the back sighting and know the status of plane table in the plan. It has the following process.

- Suppose A and B have two stations in the area. The distance between which is manifested by a b line in the plan. There is also a new station P which is to be marked on the plan.
- By placing the plan on the drawing board and place the plane table on the B station. After properly centering at the B station, keeping the alidade into b a line and turn the drawing board towards the station by back sighting. Tighten the drawing board on the right orientation.
- Take the plane table to the P station. Keep p' at the top of P station and flat the plane table.
- Keep the alidade with p' b line and move the drawing board and target the B station. When the right orientation is done, tighten the drawing board. Targeting the station A and draw ray towards own direction which cuts the b p' line at the P point. The p point will reveal the position of the P station in the plan.

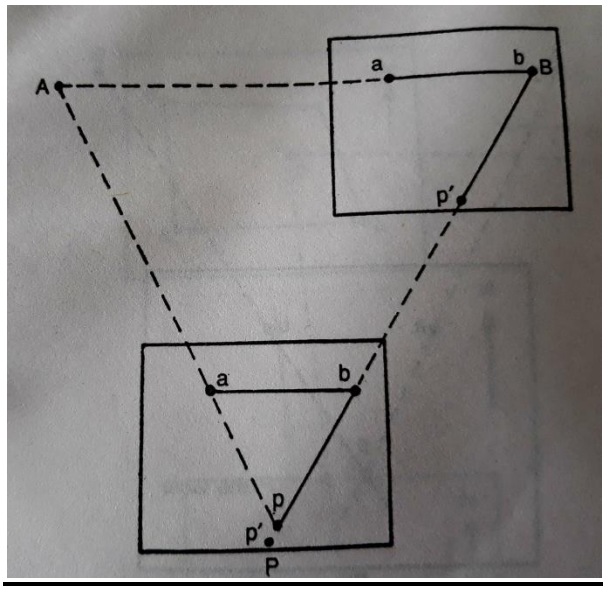


Fig. 2.5 Resection after orientation by back sighting (Source Practical book J.P.Sharma)

3- THREE POINT PROBLEM

There are three points in the plan, and with the help of these three points, the position of the plane table station to show in the plan is called three point problem. A B C is three such points that can be seen from plane table station P, in whose plan the positions are indicated by a, b and c. By selecting any one of the mechanical, graphical or other trial and error methods, the position of the p station can be mentioned in the plan. These methods are extensively written below.

1- MECHANICAL OR TRACING PAPER METHOD

This is a very simple method. In this method tracing paper are used.

PROCEDURE

Suppose the plane table has been fixed at any of the P station in the area from where the A B and C points in the area can be clearly seen. If A, B, and C points in the plan were written by a, b and c, respectively, according to the tracing paper method, the P station will be mentioned as follows.

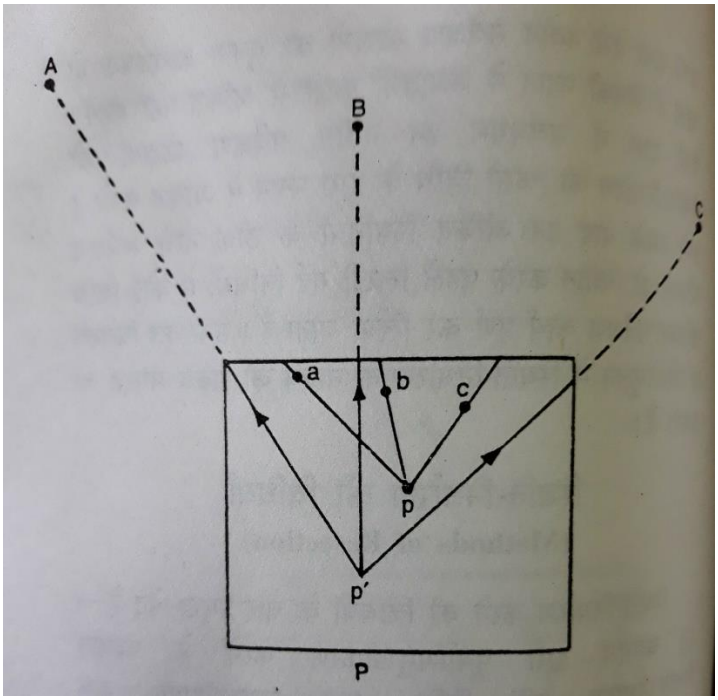


Fig. 2.6

- After placing the plane table on the P station, with the help of a trough compass make correct orientation of the plan.
- Placing a tracing paper with the help of pins on the drawing board. Use the plumb bob and plumbing fork to position (p') in the tracing paper on the P station.
- Draw the three rays targeting A, B and C points by placing the alidade to the p' point. For identification, write the names of the points related to these rays on the field.
- Now remove drawing pins from the drawing paper and move the drawing paper back and forth as needed and keep it on the plan that the rays drawn by targeting the A, B and C points on the drawing paper will be done right above the a b and c points in the plan.
- Now if every ray of drawing paper is located just above the corresponding point in the plan, mark the p' point in the plan by pinning the pin on the p point. p point will reveal the position of p station in the plan.

According to the above method, after placing the plane table station in the plan, check the accuracy of resection. For this purpose, keep alidade with the help of p a line and orient the plane

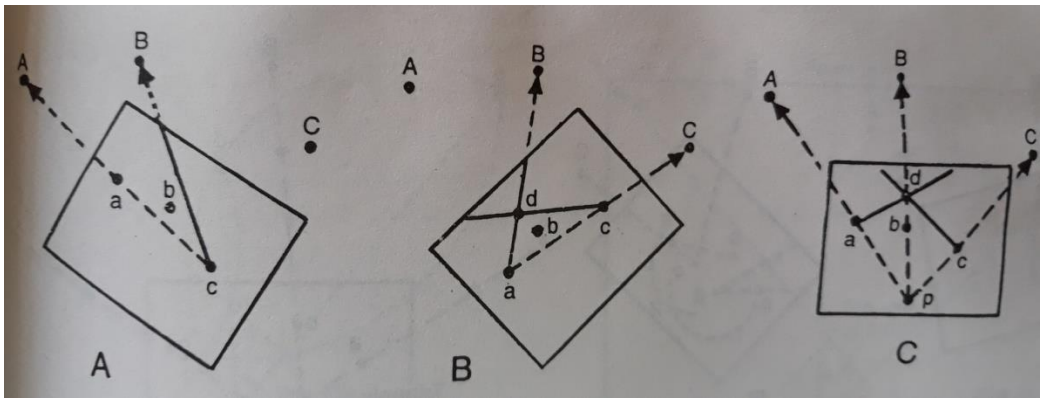
table directly in the A station by rotating the drawing board. If the resection is correct, then Bb and Cc will pass through every p point in the rays.

2- GRAPHICAL METHODS

There are many graphical methods to determine the position. Only one graphical method have been explained here.

(a) BESSEL'S METHOD

If there are three such points of view in the area A, B and C, which has been disclosed by a, b and c in the plan, then according to the Bessel's method, plane table station (P) will be mentioned in the plan as follows.



- Fixed the plane table on the P station. Keep alidade with the help of Ca line and target the A point and tighten the drawing board. Now draw a ray by targeting the point B from the point c. (fig.2.1 A)
- Loose the drawing board. This time keeping the alidade of ac line and look at the C and tighten the drawing board. Now by targeting the point B from a point, draw a second ray, which cuts the first ray on the d point. (fig.2.1B)
- Joint the point b and d and loosen the drawing board. Now according to fig. 2.1.C, keeping the alidade with the help of b d line and target the point B. Now tighten the drawing board. Now keeping the alidade with the help of alpin on the point, drawing the ray back on your side targeting at A point. this ray cuts on the d b line at p point. p point will reveal the position of P station in the plan.

Keep the alidade with the p c line to check the accuracy of resection. If you look in the alidade, if the sight line passes through C, The positioning will be considered as correct.

(b) Llano's method

3- Trial and error method

MERITS AND DEMERITS OF PLANE TABLE SURVEY

Plane table survey is better to other surveys in many forms. There are some flaws along with simplicity and accuracy.

Merits :

- Plane table survey method is easy as well as accurate.
- There is no need to make field book in it.
- All work of survey and mapping is completed in the field therefore knowledge of errors also knows at the same time.
- It only has the baseline horizontal measurements so the surveys are completed soon.
- The prismatic compass survey is not possible in the magnetic field, so this method is best for that.
- Along with the survey, it is also examined; therefore there is also a correction of the errors.
- In plane table survey two people also complete the survey.
- This survey is most suitable in terms of quickness, accuracy and thrift.

DEMERITS :

- Plane table survey cannot be in the wet climate because in this climate the paper becomes moist and there is difficulty in measuring.
- In this survey is not easy to carry all survey equipments from one place to another, so it is inappropriate for long scale areas.
- In the survey of huge terrain, the paper has to be changed repeatedly.
- This survey does not receive all the details of the area and the area is also not known.
- The selection of the base line in the mountainous parts is difficult and there are obstacles in determining the target points.

2.6 CONCLUSION

Plane table survey is simple and accurate. The field book is not required in the plane table survey. All the work of survey and mapping is completed only in the field. This is the useful survey for magnetic fields. The survey work is completed only by fewer persons. Apart from this, there is unsuitable for areas with humid climate. Difficulty to move its equipment from one place to another. Plane table survey also has difficulty in mountainous part.

2.7 SUMMARY

Plane table surveying is a popular survey technique, in which all the work is done in the field from survey to map. The surveyor examines all the equipment and creates an approximate image of the area. After this, the fixing of plane table in which laying the paper plating, determines the base line, determination of the north direction and the process of centralization is adopted. During the survey the board should be tightened. The rays should be straight and fine. Should

keep appropriate scale . North direction should be determined with accuracy. Base lines should be accurately measured. The leveling of plane table should be examined. All these precautions are necessary.

Plane table survey is done by three methods- Radiation, Intersection, and Traversing. The distances of all the target points are measured in the radiation method whereas in the intersection method only the length of the base line is measured and the target points determine from the intersection.

An open traverse method is adopted for survey of any way, canal, and river etc. survey conducted closed traverse for building, residential, settlements etc.

2.8 GLOSSARY

- **Fixing -** A plane table is set over a point and brought to precise horizontal level.
- **Mapping-** Make a map of the survey area with the appropriate scale.
- **Base line-** Line joining two stations.
- **Centralization-** To set the table vertically on the ground point.
- **Intersection-** Targeting a station by drawing the ray and intersect it from the other station draw a ray.
- **Traverse-** Series of survey stations and base line.

2.9 ANSWER TO CHECK YOUR PROGRESS

Q.1-Why do we not need for field book in plane table survey?
Q.2-What to do before going to the field for a plane table survey?
Q.3-What is the base line?
Q.4-How to check the level of the plane table?
Q.5-To make centralization apart from plumb bob which equipment can use?
Q.6-What do you mean by three point problem?
Q.7-Why plane table survey is easy?
Q.8-Why plane table survey completes early?
Q.9-What obstacles do the hilly parts in the plane table survey?

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2.12 TERMINAL QUESTIONS

Q.1-What is the difference between radiation and intersection method?
Q.2-Describe the merits and demerits of plane table survey.
Q.3-How many methods of plane table survey?
Q.4-What is traverse method?
Q.5-What is the resection?
Q.6-What is the two point problem?

UNIT 3 - PRISMATIC COMPASS SURVEYS

3.1 OBJECTIVES

After studying this unit, you will be able to:

- To know about prismatic compass instrument.
- To know about bearing, types of bearings and representation of bearing.
- Conversion of whole circle bearing into quadratic bearing.
- Observed bearings of open and closed Travers by radiation and intersection method.
- Local attraction of bearing, correcting the bearings for local attraction.

3.2 INTRODUCTION

Prismatic compass is an instrument used to measure the bearing of a line. It consists of a magnetic needle pivoted at the center and is free to rotate. Magnetic needle in balanced on a sharp pointed steel pivot, with the help of an agate cap. The area below the magnetic needle is graduated between 0 to 360 degrees. The needle carries an aluminum ring with graduations in degrees and half degrees, which are written in an inverted style. The instrument cover consists of a sighting vane and vertical hair to align the compass along the instrument station and the staff station. The compass case and lid is solid brass with a black powder coating. The prismcan be flipped up for use as a front sight, and at the same time view the compass heading. There are two colored filters that can be placed in the optical path of the measurement to reduce glare.

There is a small cover that can be swung into place to protect the prism. The degree markings on the compass rose are stamped mirror image so the heading reads properly when viewed through the prism. When taking a heading measurement, the magnetic heading appears clearly under the object being sighted. Two adjustment screws allow the height of the prism to be precisely set for proper focus. Pressing a small plunger button near the rear sight locks the compass card for easier reading. The compass has a needle lift mechanism to protect the agate compass jeweled bearing when being transported. The rear sight has a replaceable thread and a hinged mirror that can also be raised or lowered. The compass can be threaded onto the lightweight surveyor's tripod with a ball and socket head using standard 3/4 inch x 24 threads. The compass measures 11.1 cm in diameter, 3.8 cm thick, and weighs 539 grams. When mounted on its tripod, the height of the compass is adjustable from a minimum height of 31.7 cm tall is a maximum height of 53.3 cm tall. This compass is accurate with a resolution of about 1/2 a degree. Both the compass and tripod come with canvas cases.The other equipment and accessories used in this type of surveying are tripod stand, chain, tape, ranging rods, pegs, plumb bob, hammer, field-book, pencils, eraser.

PARTS OF PRIMATIC COMPASS

1 Metal box : metal box is having diameter of 8to 12 cm. It protects the compass and forms Elements of prismatic compass entire casing or body of the compass. It protect compass from dust, rain etc. Under revision

2. Magnetic needle : Magnetic needle is the heart of the instrument. This needle measures angle of a line from magnetic meridian as the needle always remains pointed towards north south pole at two ends of the needle when freely suspended on any support.

3. Graduated circle or ring : This is an aluminum graduated ring marked with 0° to 360° to measures all possible bearings of lines, and attached with the magnetic needle. The ring is graduated to half a degree.

4. Object vane : object vane is diametrically opposite to the prism and eye vane. The object vane is carrying a horse hair or black thin wire to sight object in line with eye sight.

5. Eye vane : Eye vane is a fine slit provided with the eye hole at bottom to bisect the object from slit.

6. Prism : prism is used to read graduations on ring and to take exact reading by compass. It is placed exactly opposite to object vane.

7. Prism cap : The prism hole is protected by prism cap to protect it from dust and moisture.

8. Glass cover: its covers the instrument box from the top such that needle and graduated ring is seen from the top.

9. Lifting pin : a lifting pin is provided just below the sight vane. When the sight vane is folded, it presses the lifting pin.

10. Lifting lever : The lifting pin with the help of lifting lever then lifts the magnetic needle out of pivot point to prevent damage to the pivot head.

11. Spring brake or brake pin : to damp the oscillation of the needle before taking a reading and to bring it to rest quickly, the light spring brake attached to the box is brought in contact with the edge of the ring by gently pressing inward the brake pin

12. Reflecting mirror : It is used to get image of an object located above or below the instrument level while bisection. It is placed on the object vane.

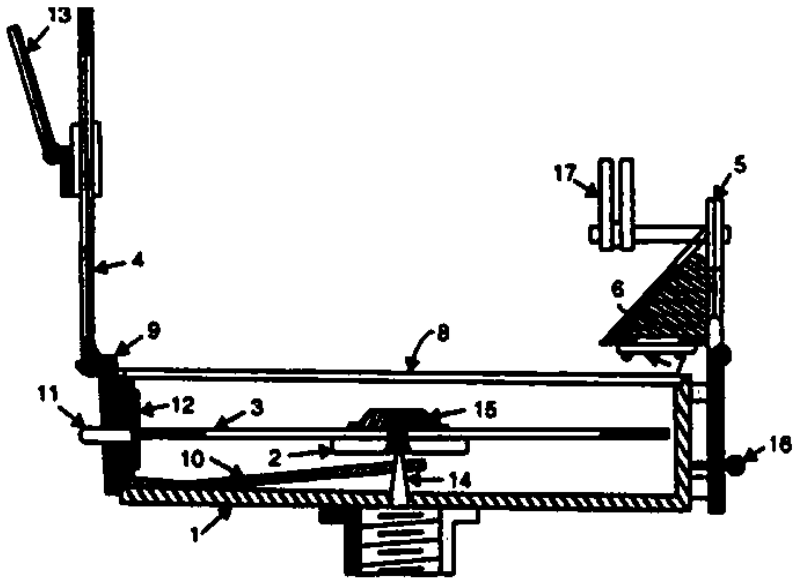
13. Pivot: pivot is provided at the center of the compass and supports freely suspended magnetic needle over it.

14. Agate cap:

15, Focusing stud : The prism is moved up or down in its slide till the graduations on the aluminum ring is seen clear, sharp and perfect focus. The position of the prism will depend upon the vision of the observer

16. Sun glasses : These are used when some luminous objects are to be bisected.

17. **Eye vane:** Eye vane is a fine slit provided with the eye hole at bottom to bisect the object from slit.



1. Box
2. Needle
3. Graduated ring
4. Object vane
5. Eye vane
6. Prism
7. Prism cap
8. Glass cover
9. Lifting pin
10. Lifting lever
11. Brake pin
12. Spring brake
13. Mirror
14. Pivot
15. Agate cap
16. Focusing stud
17. Sun glass

THE PRISMATIC COMPASS.

Fig -3.1

3.3 PRISMATIC COMPASS SURVEY

1. Set up the prismatic compass over a station at your convenient height.
2. The instrument must be exactly overhead the ground station .To do this, a plumb bob is .suspended from the bottom center of the instrument to touch the head of the ground pin
3. Unfold the object vane and also the eye vane.
4. Level the instrument either by hand or by using a round pencil so that the compass ring moves freely.
5 .Rotate the instrument so that the line of sight (i.e. ., the line joining the center of the eye vane and the object vane) joins the station with the ranging rod held vertically over another station.
6. Look through the eye vane and take the reading in degrees and minutes at the intersection of the horse hair/ ranging rod with the compass ring.

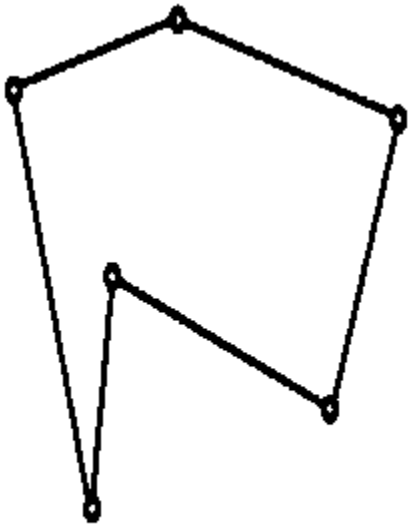
3.4 RADIATION, INTERSECTION AND TRAVERSING (OPEN AND CLOSE)

Radiation method : In this method, the approximate centre of the field is located and the compass is exactly centered over that stations, say 'O' by dropping a small pebble to fall from the centre of the compass and hit the peg. Then make the compass needle horizontal by adjusting the ball and socket joint. After centering and leveling of the compass, raise the sighting vane and prism of compass. The compass box is rotated until the ranging rod at first station 'A' hairline of object vane and slit of the sighting vane are in the same line. Then take the reading accurately and note down the bearing of line OA. In the similar way take bearing of lines OB, OC, OD and OE by rotating the compass box in the respective directions. The readings will indicate the angles with which the line, OA, OB, OC, OD and OE makes with the north line. Then with the help of chain, measure the distances OA, OB, OC, OD and OE on ground, after proper ranging.

Inter section method : Field Work This method poses a simple change from the previous method. In this method mark two points (P & Q) at a distance of 10 to 15 m in such a way that all the station points around the boundary of the plot can be seen clearly (either inside the area or outside). Set the compass over the station point 'P' and complete the temporary adjustments. Observe bearings to all the station points, (A, B, C, D& E) in clockwise direction. Take also the fore bearing of the line 'PQ'. Shift the compass to the other station 'Q' and complete the temporary adjustments and observed the back bearing of the line 'QP'. Rotate the compass box to all other station points, (A, B, C, D& E) and note down all the bearings clearly. Also measure the base line distance (PQ). In this method there is no necessity of measuring the internal distances. (b) Plotting With observed data, plot the observed bearings taken at P and project the corresponding rays. Set the distance PQ and get point 'Q' by taking a suitable scale. Then draw rays from station 'Q' to all the station points. The intersection of ray pa and qa will give the location of station 'A'. Similarly locate other stations B, C, D & E. For a check, measure the distance AB, of one side, and compare them with the plotted lengths. Then field can be divided into number of triangles and the area can be calculated, summering up all the areas we will get the total area of the field.

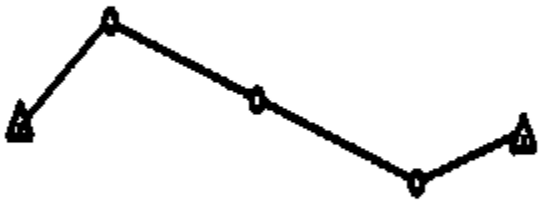
Closed Traverse : When a series of connected lines forms a closed circuit, i.e. when the finishing point coincides with the starting point of a survey, it is called as a 'closed traverse'; here ABCDEA represents a closed traverse. (Fig 3.1. (a))

Open Traverse : When a sequence of connected lines extends along a general direction and does not return to the starting point, it is known as 'open traverse' or (unclosed traverse). Here ABCDE represents an open traverse. (Fig 3.2. (b))



CLOSED TRAVERSE

FIG -3.1(a)



OPEN TRAVERSE

FIG-3.2(b)

We will setup the compass at point A, B, C and so on and note the Fore Bearing and back bearing of lines. The length of lines or legs are measured by chain twice and mean lengths are calculated.During taking measurements in the field the method used angular measurement and linear measurement should be of same standard of accuracy, i.e. either combination of Prismatic compass and Chain or combination of Theodolite and Metallic tape.

Forward and Backward Bearings In compass surveying, two bearings are observed for each line, one from each end of the line. The bearing of a line in the direction of the progress of survey is called the forward bearing or fore bearing while the bearing measured in the opposite direction is called as the backward bearing or back bearing.

Local Attraction A compass needle is affected by the presence of masses of iron and steel such as lamp posts electric cables, steel girders etc., they deflect the needle and the effect of this disturbance is called local attraction. Due to local attraction, the difference between the fore bearing and back bearing of a survey line will not be equal to 180◦ .The observed bearings of lines affected by local attraction are corrected by starting from the unaffected line and the correct bearings of the successive lines are calculated.

3.5 ELIMINATION OF CLOSING ERROR, USINGBOWDITCH'S RULE

Due to errors in observation and in plotting angles the plan may not close exactly. If the compass is in good order and there is no mistake in observation the backward and forward bearing of a line should differ by 180°. If the difference is not 180° there is probably local attraction at one or at both the stations.

The table 3.1 illustrates the method of elimination of local attraction in a closed traverse.

TABLE -3.1

LINE	F.B	B.B	Difference	Correction	Corrected bearing	
					F B	B B
AB	134° 30’	314° 30’	180°	_	134° 30’	3 14° 30’
BC	120° 0’	299°30’	179°30’	BB +0°30′	120° 0’	300° 0’
CD	174°30’	356° 30’	182°	FB +0°30′, BB -1°30′	175°0’	355°0’
DA	276°30′	95°0’	181°30′	FB -1°30′	275°0′ ’	95°0’

Correct the bearings of the lines for local attraction: from the above table **3.1** it is evident that the line there is no local attraction. The other lines shows attraction. The forward bearing of BC is 299°30’ and backward bearing 179°30’,CD forward bearing 174°30’and back ward bearing 356°30’ and DAforward bearing 276°30’and back ward bearing 95°0’ .This show that due to attraction the magnetic needle at BC line has been deflected by BB +0°30′ ,CD line by FB +0°30′, BB -1°30′ and DA line by FB -1°30′ .Thus the bearing BC,CD ,and DA line should be changed by corrected bearing.

Bowitch’ Rule: For rough survey, such as a compass traverse, the Bowditch rule may be applied graphically without doing theoretical calculations. According to the graphical method, it is not necessary to calculate latitudes and departures etc. however before plotting the traverse directly from the field notes, the angles or bearings may be adjusted to satisfy the geometric conditions of the traverse.

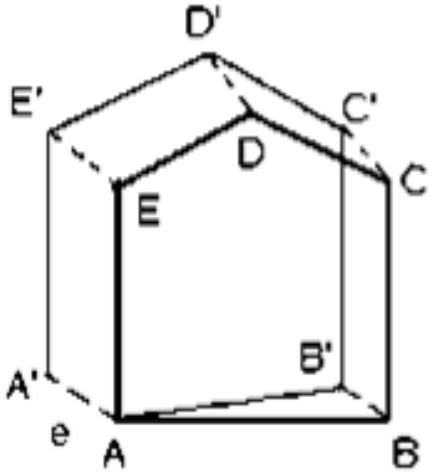


FIG -3.3(a)

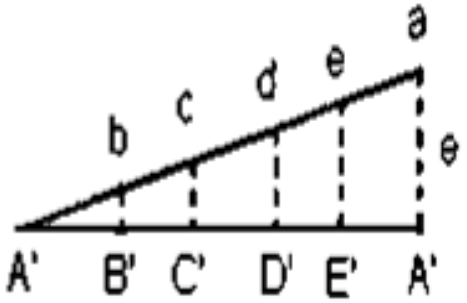


FIG-3.3(b)

Closing error by Bowditch’s rule

The polygon AB’C’D’E’A’ represents an unbalanced traverse having a closing error equal to A’A since the first point A and the last point A’ are not coinciding (fig-3.3 (a)). The

total closing error AA' is distributed linearly to all the sides in proportion to their length by a graphical construction shown in figure. AB', B'C', C'D' etc are represent the length of the sides of the traverse either to the same scale or reduced scale. The ordinate aA' is made equal to the closing error A'A. by constructing similar triangles, the corresponding errors bB', cC', dD', eE' are found. The lines eE', dD', cC', bB' respectively(fig -3.3(b)). The polygon ABCDE so obtained represents the adjusted traverse. It should be remembered that the ordinates bB', cC', dD', eE', aA' represent the corresponding errors in magnitude only but not in direction.

3.6 CONCLUSION

In this unit we learnt to:

1. Describe a prismatic compass.
2. List the different parts of a compass and various accessories used along with compass**.**
3. Adjustment of a prismatic compass.
4. Describe how to observe bearing.
5. Radiation and Intersection method and traversing (Open and Closed) method of prismatic compass.
6. Explain closing errors observation of bearing.
7. Elimination the closing error using Bowditch's rule.

3.7 SUMMARY

1. Prismatic compass is an instrument used to measure the bearing of a line.
2. In the radiation method, the approximate centre of the field is located, in the intersection method mark two points' bearings clearly. Also measure the base line distance. In this method there is no necessity of measuring the internal distances.
3. Closed traverse is a traverse in which the sides of a traverse form a closed polygon. Open traverse is a traverse in which the sides of a traverse do not form a closed polygon.
4. Meridian is a standard direction from which, the bearings of the lines are measured.
5. Bearing is a horizontal angle made by the survey line with reference to the meridian.
6. Bearings of survey lines are represented in (i) Whole Circle Bearing System.
   (ii) Quadrantal Bearing System.
7. The difference between fore bearing and back bearing of a line should be 180°.
8. Local attraction: A compass needle is affected by the presence of masses of iron and steel such as lamp posts, electric cables, steel girders etc. They deflect the needle and gives the working value of bearing the effect of this disturbance is called local attraction.

3.8 GLOSSARY

Compass - An instrument for determining direction.

Prism - Right angled isosceles type.

Eye vane - Eye vane is a fine slit provided with the eye hole at bottom to bisect the object from slit.

Bearing - Angles

Magnetic needle - This needle measures angle.

3.9 ANSWER TO CHECK PROGRESS

Q.1 What is bearing?

Q.2 What the difference between fore bearing and back bearing of a line?

Q.3 Which things a compass needle is affected?

Q.4 The following fore bearing and back bearing were observed while traversing an area with a compass:

Line	FB	BB
AB	37°30'	217°30'
BC	43°15'	224°15'
CD	73°00'	252°15'
DE	12°45'	193°15'
EA	60°00'	239°15'

Q 8 Find the corrected bearing of the line?

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3.12 TERMINAL QUESTIONS

Q.1. What is the uses of prismatic compass?

Q.2. Write the parts of prismatic compass?

Q.3. How many method of prismatic compass survey ?

UNIT 4 - INDIAN PATTERN CLINOMETER

4.1 OBJECTIVES

After studying this unit, you will be able to:

- Know about Indian Pattern clinometer instrument.
- Uses of clinometer.
- Determination of height.

4.2 INTRODUCTON

Indian Pattern clinometer is developed by survey of India, so it is known as Indian clinometer. It is also known as tangent clinometer. It issued to find out the heights of various objects as well as for contouring.

4.3 INDIAN PATTERN CLINOMETER

Indian pattern clinometer used for determining difference in elevation and depression between point and it specially adapted to plane tabling. The clinometer is placed on plane table.

Essentially it is a spirit level attached to brass plate at each end of which there is a flap which could be made to stand up vertically. The level of the instrument can be adjusted by a screw at one end. One of the folding leaves has a small sight-hole at the top. The other leaf has a vertical slit in the middle. Along one edge of the slit there is a scale is in level with the sight-hole.

To take an observation the instrument is levelled so that the bubble of the spirit level is in mid-run and object is sighted through the sight-hole. The point on the scale where the line of sight intersects is noted. If the distance between the observer and the object is known the rise or fall can be calculated from the reading on the tangent scale.

Suppose the reading on the tangent scale is 0.4. Since the graduation along the tangent scale shows the value of the ratios of the perpendicular it is obvious that the rise of the point from the level of the clinometer at O is 0.4 of the horizontal distance. If the height of the Clinometer above sea level is known the height of the observed point is obtained by adding the rise in level from O.

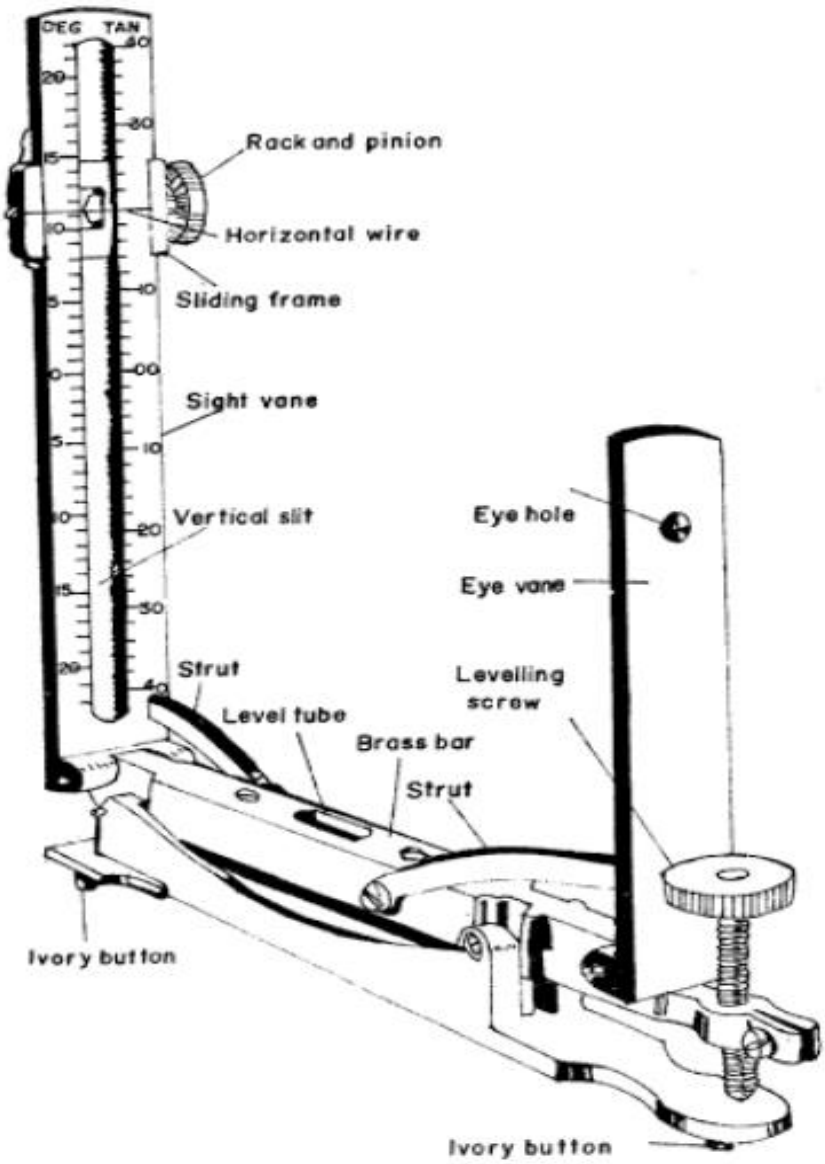

Fig . No. – 4. 1 Indian Clinometer

PARTS OF INDIAN CLINOMETERS

The parts of an Indian Pattern Clinometers are showing you in Fig .No.-4.1.

1. Base Plate-A base plate carrying a small bubble tube and leveling screw. Thus it can be accurately leveled.

2. Eye Vane- The eye vane carrying a peep hole. It is hinged at its lower end to the base plate.

3. Object Vane- The object vane having graduation in degrees at one side and tangent of the angles to the other side of the central opening.

4. Brass Bar- The brass bar attach above the base plate. In the middle of brass plate level tube and level of the instrument can be adjusted by a screw at one end.

4.4 DETERMINATION OF HIGHT BY INDIAN PATTERN CLINOMETR

The Survey of India clinometer is intended for determining differential heights. A small level is attached to the frame carrying the vanes and the instrument is so adjusted that, when made truly level, a line through the sight-vane to the zero of the object vane is horizontal. Above and below this zero, there is, on both sides of the object slit, a scale of natural tangents. The scale of natural tangents can be read by estimation to three places of decimals.

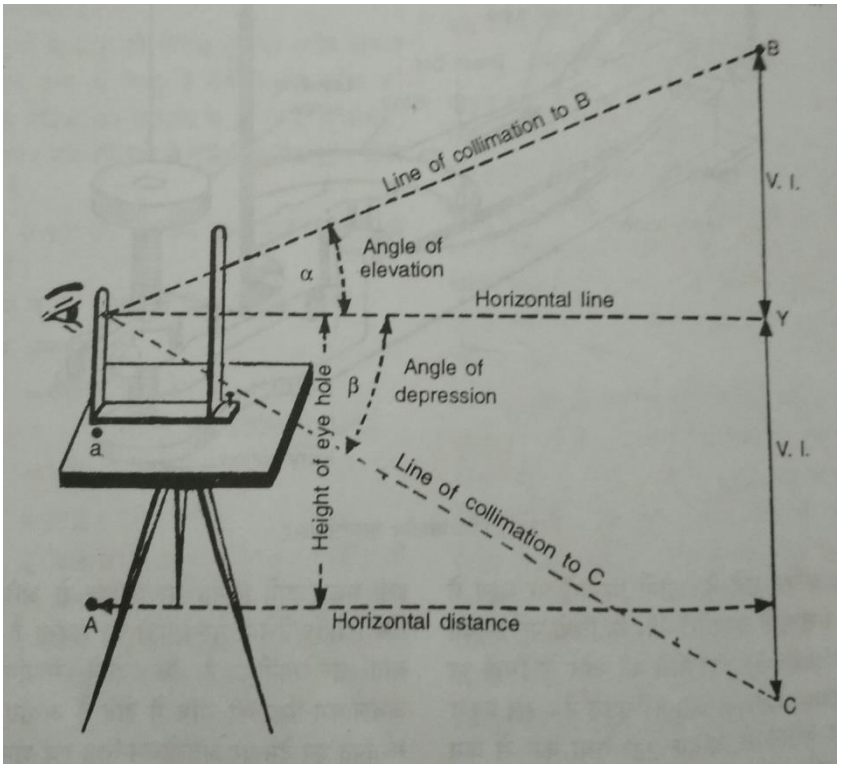

Fig. 4.2

In using the clinometer, care should be taken that the vanes are upright and parallel, and that they have not been bent. The clinometer should never be lifted on or off the plane-table by either of its vanes, to avoid bending them. The vanes are usually graduated for a horizontal distance, between vanes, of 20.32 cm; that is, the distance between the eye-hole and the zero of the graduations should be exactly 20.32 cm; also the distance from the eye-hole to the extreme graduation, + .40 above, or — .40 below the zero on the tangent scale, should be 21.88 cm. In observing, the eye should not be too close

to the eye-hole, but about 5 to 10 cm away from it. To obtain the difference of height between his own position and any other object in view, the observer looks through the hole in the sight-vane, after leveling the clinometer by means of the level on the base-plate, and notes what figure on the tangent scale is cut by the ray to the object.

1. Set the plane table over the A and keep the clinometer on it.

2. Level the clinometer with the help of leveling screw.
3. Loking through the eye hole, move the slide of the object vane till it bisects the signal at the other point to be sighted.
4. Note the reading tangent of the angle against the wire. Thus the difference in elevation between eye and object. Distance x tangent of vertical angle =ά tan x .
5. Put the above value in the following formula-

V.I.= H.IX tanө

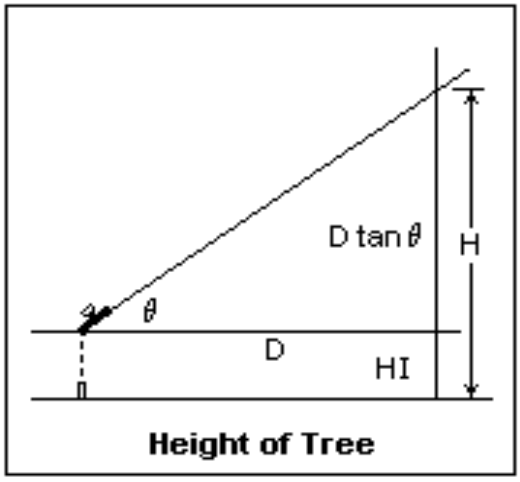

Fig. no -4.3 Determination of Height by Indian Clinometer

When a point is located very far from the instrument station or there is obstruction in the path. It is difficult to measure horizontal distance, then the height and depth of the point form the instrument station is find out on the basis of vertical angle formed by two collinear station and horizontaldistance betweenthem.

For example- Suppose we have to find the height of point B from instrument station A but, because of a lake in way, it is difficult to measure horizontal between A and B

.

4.5 CONCLUSION

In this unit we learnt to:
1. Describe a Indian Pattern Clinometer.
2. List the different parts of a Indian Clinometer.
3. Method of using the Indian Clinometer .
4. Describe how to determining the height of any object.

4.6 SUMMARY

Indian Pattern clinometer is developed by survey of India, so it is known as Indian clinometer. It is also known as tangent clinometer. Indian pattern clinometer used for determining difference

in elevation and depression between point and it specially adapted to plane tabling. The clinometer is placed on plane table.

4.7 GLOSSARY

1. Clinometer- Height determining instrument.
1. Base Plate-A base plate carrying a small bubble tube and leveling screw.
2. Eye Vane- The eye vane carrying a peep hole. It is hinged at its lower end to the base plate.
3. Object Vane- The object vane having graduation in degrees at one side and tangent of the angles to the other side of the central opening.
4. Brass Bar- The brass bar attach above the base plate. In the middle of brass plate level tube and level of the instrument can be adjusted by a screw at one end.

4.8 ANSWER TO CHECK YOUR PROGRESS

Q.1. What is the use of Indian Pattern Clinometer?
Q.2. Write the parts of Indian Pattern Clinometer?

4.9 REFRENCES

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4.10 SUGGESED READING

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4.11 TERMINAL QUESTION

Q.1 How we can determine the height by Indian Pattern Clinometer?
Q.2 Explain the function of an Indian clinometer with a sketch.