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GEOGRAPHY OF ASIA

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GEOGRAPHY
VI SEMESTER (B.A. / B.SC.)

Course No. GO-601 (Theory) **Title : Geography of Asia**
Duration of Exam. : 3 Hrs **Total Marks : 100**
Theory Examination : 80
Internal Assessment : 20

Credits : 04

Syllabi for B.A./ B.Sc. Semester - VI Theory Examination, 2015 onwards.

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1	Asia in the context of World	(1)
2	Asia - Physiographic Divisions	(2)
3	Asia - Factors affecting Climate, Temperature, Pressure and Rainfall Conditions	(2)
4	Asia - Major River Systems	(1)

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5	Asia - Types, Characteristic and Distribution of Forests	(1)
6	Asia - Major Soil Types	(1)
7	Asia - Agriculture (Conditions of Growth, Production and Distribution of Rice , Wheat, Jute and Tea)	(2)

8	Asia - Distribution and Density of Population and Urbanization	(2)

Unit-III

9	Japan - Physiography, Climate, Distribution and Density of Population.	(2)
10	Japan - Main Feature of Agriculture, Localization of Industries and Industrial Regions	(2)
11	Pakistan - Physiography, Climate, Distribution and Density of Population	(2)
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13	China - Physiography, Climate, Distribution and Density of Population	(1)
14	Contemporary Issues and Geospatial Technology in Geography	(2)
15	World Summits on Environment	(1)
16.	Global Warming - Causes and Consequences	(1)

Note for Paper Setters :

The question paper shall comprise of two sections A and B. Section A shall be compulsory covering all the units of the syllabus and shall consists of 8 questions. Each question carries 2 marks each answer should be limited to 50 words only. Section-B shall comprise of 8 questions from 4 units of the syllabus having internal choice and the students shall have to attempt 4 questions in all. Each question shall be of 10 marks and answer should be limited to 450 words.

Distribution of Internal assessment of 20 marks is as under :-

(i) Two Written Assignments 10 marks each

SUGGESTED READINGS

1. Cole, J: A Geography of the World's Major Regions, Routledge, London, 1996.

2. Dickenson, J. P. : The Geography of the Third World Routledge, London, 1996.

3. Stamp, L. Dudley : Asia : A Regional and Economic Geography, Methuen & Co. London, 1959.

4. Tirtha, Ranjit : Geography of Asia, Rawat Publications Jaipur & New Delhi, 2001

5. Tikkah, R. N. : Geography of Asia, New Academic Publishing Co. Educational Publishers, Mai Hiran Gate, Jalandhar, Latest Edition.

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LESSON NO. 1	**UNIT - I**

ASIA IN THE CONTEXT OF WORLD

1.0 STRUCTURE

1.1 Introduction

1.2 Objectives

1.3 Asia in Context of the World

1.4 Let us Sum up

1.5 Glossary

1.6 Lesson End Exercise

1.7 Suggested Readings

1.8 References

1.9 Answer to Check your progress

1.1 INTRODUCTION

In this lesson, you will learn about the position of Asia with reference to the world. You may learn, about the total area of the Asia as a Continent, its latitudinal and longitudinal extension, its physical features, its population etc. Not only this, but you may also come to known the current population size of Asia, its highest and lowest places, hottest and coldest regions, its agriculture and industrial position in the world, its main urban centres, and various other characteristics of this biggest continent.

1.2 OBJECTIVES

After going through this lesson, you will be able to learn about :-

1. The extent of Asia, its physical relief features.
2. The population size of Asia, its agriculture and industrial position in the world.
3. Various other important characteristics of Asia.

1.3 ASIA IN THE CONTEXT OF WORLD

Asia is the largest of all the continents and includes an area of 44,444,100 sq km which is about 33 percent of the world's total land surface and the greater part of the Eurasian landmass. The total population of Asia in 2017 was 4,504 million. About 37 percent of the total population of Asia is urban. The border between Europe and Asia is, traditionally, drawn as an imaginary zigzag lines passing down the spine of the Ural Mountains and through the Caspian Sea, Caucasus Mountains and Black Sea. The boundary dividing Asia and Africa is, generally, along the Suez Canal, and the boundary between Asia and Australia is, usually, placed between the island of New Guinea and Australia.

Asia covers one-third of the total land area of the earth. Asia is 1.5 time larger than African continent, 2.5 times than South American Continent, 4 times greater than European continent and it is 6 times larger than the Australian continent. Moreover, Asia is 15 times greater than the Indian sub-continent, thus it become quite clear that Asia is the largest continent in the world in its area.

The continent of Asia extend between 10° South of Equator to 80° North latitude and from 28° East longitude to 170° West longitude.

Asia is a land of huge physical feature. Dr. Cressey, who has beautifully, summarised the diversity of the continent in the following words:

"Too much of Asia is too cold, too hot too dry or too wet, too mountaineous or too infertile or too inaccessible".

Asia has a very young tertiary mountain range like Himalayas, which have many lofty peaks, like; Mt. Everest 8848 meters high on one side and on the other side, there are lowest places, like; Dead Sea Rift, which is 399 meters below the sea level. Marina Trench is a deepest part of the world in ocean floor near the Philippines Island which has a depth of 11033 meters.

Asia contains a very hot desert, like; Thar and Arabian on one side and on the other side, there are cold deserts like; Gobi, Mangolia and the coldest desert in the Tundra region, which is almost barren.

Asia also contains the highest plateau of the world i.e. the Pamir plateau. It is also known as Roof of the world. There are also lakes below the sea level, like; Baikal Lake and area of inland drainage in Takla Mukan deserts are also situated in Asia. Almost every type of climate is found in Asia.

There are about 35 large streams in the world, out of which 15 streams are flowing in Asia. Asia has the coldest place in Northern hemisphere in January and hottest in July. Verkhoyansk is the coldest place in the world and hottest spots like Jacohabad in Sindh (Pakistan).

In Asia there are places like Mawsynaram in Cherapunji having the highest amount of rainfall (1225 cm) in a year in the world. Asia extended from Red Sea to Mongolia, which have only 25 cm rainfall in a year. It is the driest area of the world.

Table : 1.1

Name	**Area sq. Km**	**% of Earth's Area**
Africa	44,418,500	29.5
N. America	21,510,000	16.3
S. America	17,598,000	11.8
Europe	9,699,550	6.5
Australia	7,699,000	5.2
Antarctics	13,600,000	9.6

Asia has the largest cultivable land of the world. It has also largest irrigated area of the world. Asia has a longest mileage of canals in the world. World's highest production of rice, tea, rubber, jute, oil seed, silk and rayon all are in Asia.

Asia may, fairly, be called a continent of extremes. There are still wide areas, which have never been mapped. A large part of the area is, practically, uninhabited, yet it contains some of the largest cities in the world, such as; Tokoyo Mumbai, etc.

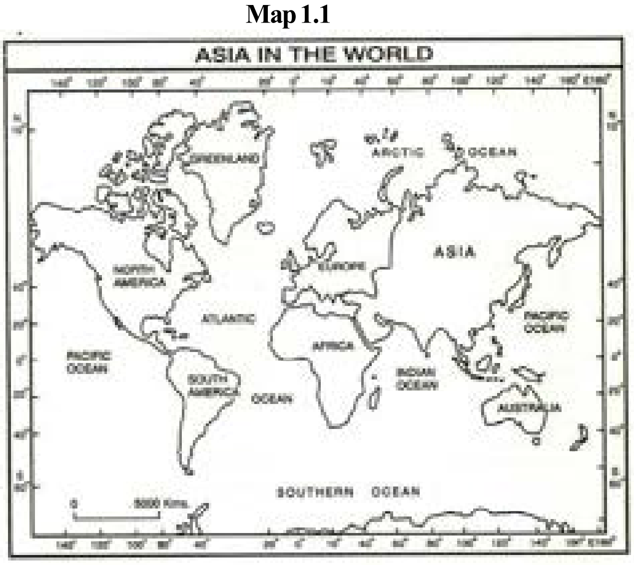
Asia is a land of rich heritage. It is also know as the land of future and past the valleys of Indus, Tigris, Euphrate and Hwang Ho are know the Cradles of civilization.

Asia is a unique even in population. It is the birth place of men. Almost all the main religions of the world have their roots in the soil of this continent. One can see the people of all colours, of every race and religion in Asia. Its population is 3 times greater than the population of Europe, 4 times of India and seven times greater than the population of North America. It will be great surprise to know that Asia's population is 170 times greater than that of Australia.

There is also a great diversity in languages, scripts, and dialects. There are more than 200 languages, of which 20 languages are such, which are spoken by about a million people.

There are some advanced industrial, nations like; Japan, India and China, all in Asia. There are also some industrial backward countries, like, as Iraq, Iran, Bangladesh, Nepal and Bhutan, etc. There is diversity in economic development. The nomads of Mongolian grass land leading a primitive life, where as the Japanese are industralists.

Map 1.1



CHECK YOUR PROGRESS

Note (a) Write your answers in the space given below

(b) Check your answers with those given at the end of the lesson

1. What is the latitudinal and longitudinal extent of Asia?.

____

____

2. How many languages are spoken in Asia?

____

____

3. Which place in Asia records the maximum rainfall?

____

____

1.4 LET US SUM UP

In the concluding lines it is important to mention here that Asia is the world's largest and most populous continent with over 4 billion people calling Asia as home. Asia also contains the world's most densely populated country, i.e China, and the world's largest country, i.e Russia. Asia is rich in diverse races, cultures and languages. Many of the world's major religious came out of Asia including 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 products and services that are used by every nation in the world Asia is also abundant in natural resources. Oil in the Middle East is a major supplier of much of the world's energy.

1.5 GLOSSARY

Caucasus Mountains - It is a mountain system in West Asia between the Black Sea and the Caspian Sea.

Gobi Desert - It is a Arid region in northern China and southern Mongolia. It is well known for its dunes, mountains and rare animals.

Pamir Plateau - The Pamir Plateau is a large plateau in the Pamir mountain range at an altitude of about 3500 to 5000 m with mountains upto more than 7000m.

Tundra - In physical geography, Tundra is a type of biome where the tree growth is hindered by low temperatures and short growing seasons.

Ural mountains - It is a mountain range that runs from north to south through western Russia, from the coast of the Arctic Ocean to the Ural River and northwestern Kazakhstan.

1.6 LESSON END EXERCISE

1. Explain the agriculture activities of Asia with special reference to China and India.
2. Write a note on population scenario of Asia and compare its position with other continents of the world.
3. Why Asia is called as a Continent of extremes?
4. Explain the Industrial position of Asia with reference to other parts of the world.
5. Write a note on the major rivers that flow in Asia.

1.7 SUGGESTED READINGS

1. Hussain, Majid (2004). World Geography. Jaipur & New Delhi: Rawat Publications.
2. Magray (2005). Geography of India & World Regional Geogrpahy. Srinagar (KMR):IQRA Publications.
3. Tikka, Bali, Sekhon (2008). Geography of Asia. Jallandhar: New Academic Publishing Co.

1.8 REFERENCES

1. Hussain, Majid (2004). World Geography. Jaipur & New Delhi: Rawat Publications.

2. Magray (2005). Geography of India & World Regional Geogrpahy. Srinagar (KMR):IQRA Publications.

3. Tikka, Bali, Sekhon (2008). Geography of Asia. Jallandhar: New Academic Publishing Co.

1.9 ANSWER TO CHECK YOUR PROGRESS

1. The latitudinal extend of Asia is 10º South of Equator to 80º North and longitudinal extend is from 28º East to 170º west.

2. Near about 200 languages are spoken in Asia.

3. Mawsynaram in India is the place which records maximum rainfall (1225cm) in Asia.

LESSON NO. 2	UNIT - I

ASIA - PHYSIOGRAPHIC DIVISIONS

2.0 STRUCTURE

2.1 Introduction

2.2 Objectives

2.3 Physiographic Divisions of Asia

- 2.3.1 The North-Western Lowlands
- 2.3.2 The Central Highlands
- 2.3.3 The Great Plains of Rivers
- 2.3.4 The Southern Plateau
- 2.3.5 The Eastern Island Chain

2.4 Let us Sum up

2.5 Glossary

2.6 Lesson End Exercise

2.7 Suggested Readings

2.8 References

2.9 Answer to Check your progress

2.1 INTRODUCTION

In this lesson, you will learn about the physiographic divisions of Asia. Asia is a continent of diversities, having different physiographic divisions. It is important to study the physiographic divisions of any area, or say Asia, as it gives the description of the physical features and the phenomenon of nature. After studying the physiographic divisions, we come to learn about the mountains, valleys, plains and coastal areas, and various other phenomenon associated with these features.

2.2 OBJECTIVES

After going through this lesson, you will be able to learn about:-

1. The different physiographic divisions of Asia.
2. Important characteristics of these physiographic divisions.

2.3 PHYSIOGRAPHIC DIVISION OF ASIA

The content of Asia is the largest of the seven continents of the world. It encompasses more mountain topography than any other continent of the world. Nature has developed certain relief features on gigantic scale. Here are found the lofty mountains like Himalayas whose highest summit Mount Everest is 8848 meters high above the mean sea-level, the high plateau of Tibet and Pamir and the vast plains of Siberia. The plateau of Pamir, situated at the height of 4800 meters above mean sea level, is called the roof of the world, because of its altitude. We can divide the Asia into five physiographic divisions.

(A) The North-Western Lowlands

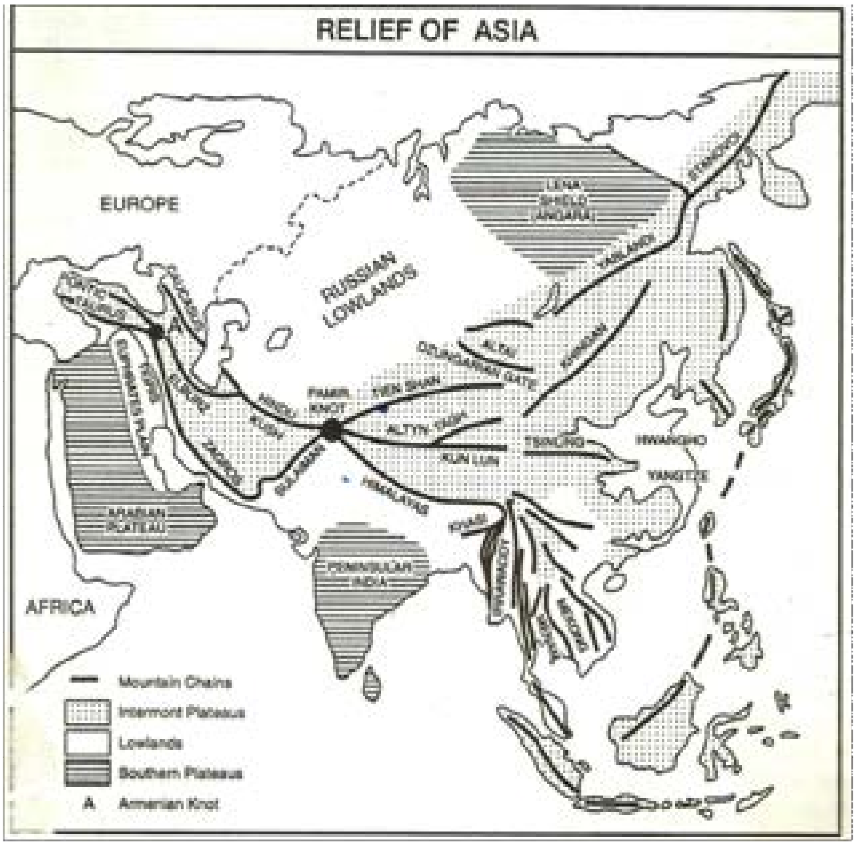
(B) The Central High Lands

(C) The Great plains of Rivers

(D) The Southern Plateau

(F) The Eastern Island Chain.

Map : 2.1



2.3.1 The North-Western Lowlands:

The most important feature is the relief of Asia is the great plain in the north extending from Bering Strait to Caspian Sea, between the Arctic ocean and the Central highlands. It has general slope towards the north and forms the continuation of north European plain. The Siberian plain which forms the Eastern, is crossed by -the Lena, the Ob its tributary, the Irish and Yenisei. The South-western portion of the plain is drained chiefly by Streams; flowing into the Caspain and Aral Seas. This lowland region is roughly triangular in Shape having its greatest breadth in the South-west and gradually becoming narrower towards the north-west. In the west of Siberia and in the Trans-Caspian region, it has the appearance of a true plain whereas the Central and Eastern Siberia is a region of complex hills, dissected plateaus and plains. This difference in altitude is partly due to difference in geological structure. The Caspian and the sea of Aral are in regions of Inland drainage and most of the lands around them is covered with shifting sands.

2.3.2 The Central highlands:

The Central Highlands is the major system of mountains and plateau which extend across the continent from east to west. The Armenian and Pamir knots form confluence of many mountain ranges. The Pamir knot divides the region into two parts the Eastern and the Western.

(a) Mountains:-

i) **The Himalayas:-** The Himalayas are the world's highest mountain system. They are the world's youngest and largest east-west mountain system rising upto more than 8000 meters above the mean sea level. They run in the East-West direction along the entire boundary of North India for 2400 km. The Himalayas are not a single continuous chain of mountains, but a series of parallel or converging ranges interspread by river valleys formed by river Indus, Sutlej, Ganga and its tributaries and Brahamputra.

ii) **The Karakoram and Kunlun:** The great mountain range called Karakoram range and the Kunlun range stretch eastwards from the Pamir knot like the Himalayas and behind it. The Karakorams which overlook the upper Indus, rise in Godwin Austin to an altitude of 5616 meters. Kunlun is a continuous and high range and forms the north border to Tibet. The Kunlun ranges, on the north-east are reinforced by Altyn Tang and Nanshan or Southern mountains of China. These rnages spread towards Northeast in a discontinuous manner.

(iii) Tien Tien Sheh: Towards the north-east of the Pamir knot, the Tien Shah runs is an eastward direction passing to the North Chinese mountains, the Pei Shah. A branch of Tien Shah extends westwards into the Kyrgyzstan Tarim basin lies between the Tien Shah and Altyn Tang.

(iv) Alai and Hissar towards the North-West: This group of mountains extends westward into Tajikistan and Uzbekistan, where it merges into plains.

(v) Hindu Kush to the South-West: This is another great chains of mountains radiating from the Pamir knot. It continues to west along the northern parts of Afghanistan and Iran passing into Elburz Mountains. The Elburez mountain skirt the Kazak region of Iraq and meets an other of the great knot called Armenian knot. From this knot, a great chain move in the north-west direction known as the Causcaus Mountains. An extension fringing Anatolian Plateau strikes due west and is known as Pontic Montains.

(vi) Suleiman towards the South-South-West: The Suleiman Mountains radiate almost in a South-South-West direction and continue to form a Kirthar Range. Kirthar countinues along the Southern fringe of Afgan-Iran Plateau in the north-west direction as the Zagros Mountains which meet the Armenian knot. A chain of mountains known as Taurus merges along southern fringe of Anatolian Plateau which is seen as a continuation of this Cordilleran system.

(b) Plateau:-

(i) The Plateau of Anatolia: It occupies much of the modern Turkey and is situated west of the Armenian knot. It is buttressed in the north of Pontic mountains and in South by Taurus mountains. The average height varies from about 600 meters in the east to 1800 meters in the West. It is also known as the Plateau of Asia Minor.

(ii) The Plateau of Iran: It lies East of Armenian knot and its eastern portion in Afghanistan and Baluchistan is known as Siestan. It is bordered on the north by Albruz and Hindukush mountains, on the east by Sulaiman and Kirthar ranges and on the South by Zagros mountains. The surface is very irregular. Salt lakes and salt deserts occur in many of its depressions and largely consist of salt steppe. The valleys, though often steep and fertile.

(iii) The Plateau of Tibet: The lofty plateau of Tibet, situated at height of from 4300 meters to 5200 meters above sea level, is bounded by the Kunlun Range in the north and the Himalayan Mountains in the South.

(iv) The Tsaidam Basin: It is relatively a small plateau averaging height one thousand meters above the mean sea level. It is bordered on the South by Kunlun range and on the north by Altyn Tagh mountains. A large portion of this plateau is covered with swamps.

(v) The Tarim Basin: It lies between Altyn Tagh mountains on the south and Tien Shah ranges on the north. Also knows as Si kiang basin, it is the most marked region. It is a depression and forms part of the 'Inland Drainage area of the continent.

(vi) The Gobi Plateau: The Gobi Plateau alongwith the Ordos Basin is located north-east of Tarim and Zungarian basins. It is buttressed on the east by Khingan mountains, and on the west and north lie the Altai, Sayan, Yabloni and Stanovoi Mountains.

2.3.3 The Great Plains of Rivers:-

Asia is a cradle of old civilizations which flourished in Tigris-Euphrates plain (Iraq), Indo-Gangeti Plain (India) and Hwang Ho Plain (China) etc. Civilization were established in Mesopotamia 7,000 years ago, and in the valleys of Indus and China several thousand years ago.

(a) Indus-Gangetic Plain: The Plain stretches from East to West for about 3,000 km between the Himalays and the Decan plateau in India and Pakistan. The average height above mean sea level is nearly 200 meters. This plain is very fertile and largerely used for cultivation.

(b) Tigris-Euphrastes Plain: It is situated in Iraq and is drained by the rivers, Tigris and Euphrates which in their lower courses unite to form Shatt-el-Arab. The name Mesopotamia, commonly used, as if it were synonymous with Iraq is properly the land between the two rivers. Baghdad, the capital city is situated in this plain. The ancient city of Babylonia also belong to this plain. The delta is very fertitle.

(c) The Irrawati Plain: This plain occupies the central and southern parts of Myanmar. It is comperatively narrow and extends from north-to-south. The monsoon bring heavy rains in this region. Agriculture is the primary occupation of the inhabitants. The capital city and the chief port, Rangoon is situated in the delta of Irrawady.

(d) The Menam Plain: River Menam flows from North to South in Thailand. It is also narrow like the Irrawati plain. The soil is very fertile and the rivers flood every year. Rice finds ideal conditions for growth. Bangkok, the capital of Thailand, is situated in the delta.

(e) The Mekong plain: River Mekong forms the boundary between Laos and Thailand, and then flows through Cambodia and forms its delta in-the south Vietnam. The river is of great value to the countries through which it flows. The plain is formed of alluvial soil which is very fertile.

(f) The Si-Kiang Plain: It is situated in Southern China. The river has its head waters in the hills of South West China and flows eastward to drain into the Pacific ocean. It forms an extensive plain in its lower course. Rice is major crop of the plain.

(g) Hwang-Ho Plain: This is the major relief feature of North China. Hwang-Ho is a very long river and brings very heavy flood every year which causes much damage to property and life. That is why it is called the 'Sorrow of China'. The flood plain is formed by the alluvium brought by the river and is very fertile.

(h) Yang-tze-Kiang Plain: This plain is a very important plain of China. Yang-tze-Kiang is well know for both irrigation and navigation. The plain is very fertile and is densely populated. The region lies in the central part of China.

2.3.4 The Southern Plateau:-

The Plateau of Southern Asia, namely Arabian Deccan and Yunan are separated from the Central Highlands by large alluvial plains deposited by mighty river originating in the central highland core. All three plateaus are lava plateaus resulting from massive volcanic eruptions.

(a) The Decan Plateau: It can be broadly divided into Six division:

(i) The Southern Plateau Block

(ii) The Narmada Tapti Trough

(iii) The Malwa Plateau

(iv) The Aravallis Mountain Complex

(v)The North Eastern Plateau Complex

(vi) The Eastern Ghats

(i) Southern Plateau Block:-This includes the Southern and the adjacent parts of the Peninsula. The mountain complex includes the Nilgiri Hills in the North and Anamalai Cardamon Hills joined together in the middle by Anamalai knot which is the highest Peak. If seen from the knot, the Anamalai stands to the North, the Palni in the North-East and Elaimalai in the South. The height of the Nilgiri Hills range from 1500-2000 meters above the mean sea level. Its highest Peak is Doda Beta (7,637 m). There is a gap between the Nilgiri in the North and the Anamalai Hills in the South. This gap is called Palghat which act as a route from the west to east. It is about 32 kms broad.

(ii). The Narmada Tapti Trough: River Narmada flows from the east to the west in a rift-valley between the Vindhyan and the Satpura ranges. South of the Satpura, there is another river Tapti, whose valley is situated between the Satpura and the Satmala Ajanta hills. The Tapti is 700 kms long but much shorter than the Narmada (13 10 km).

(iii) The Malwa Plateau: The slope of the Malwa Plateau is towards the north and north-east. It is situated between the Aravallis in the north- west and the Bundelkhand in the East. The Vindhyan Range forms Southern edge.

(iv) The Aravallis Mountain Complex: The main axis of the Aravallis lies from north-east to South-West. The mountains are 725 kms long from Delhi to Gujarat. Guru Shikhar (1,722 m) near Mount Abu is the highest peak. The Aravillis are Relic Mountains. These do not form one continuous range but are a complex of many ranges running almost-parallel to one another.

(v) The North-Eastern Plateau Complex: In this region, there are three main plateau starting with Bundelkhand in the west Bhagalkhand in the middle and Chhotangpur Plateau in the east. It is confined broadly by river Betwa in the west and Damodar in the east. This region has a water gap through which Ganga flows to the South into Hoogly delta. This Plateau extends to Shillong Plateau which really is a part of the Peninsula.

(vi) The Eastern Ghats: These Ghats are discontinuous hills and appear broken. As compared to the Western Ghats, these are lower, dissected and parallel to the Coast. Total length of these ghat is about 800 kms. Between the Mahanadi and the Godavari, these Ghats are less broad and almost continuous, but South of its, these Ghats have been dissected and lowered and appear less often as hills. Erosion over a long period has converted them into residual hills. Some well known ranges are Palkonda, Nallamalai, Javadi and the Shivroy Hills.

(b) The Arabian Plateau: It consists of the following Plateau:

(i) Badiayat-Al-Sham: It lies in the north and its capital is Damascus. It extends from the east of Aleppo and the edge of the middle Euphrates valley to the south as far as Aqaba-Kawait. It is upland plateau about 1,000 meter high in the north and about 600 meter in the South. Shallow ridges occur around the northern border such as Jebel Kalamun near Damascus, Jebel Mishri near Palmyra and the hills south of Aleppo.

(ii) The Nefud: It is a depression or a basin, some 300 km in east-west extent and 200 km at its widest. Aeolian erosion and weathering have converted it into pinnacles and cargs. Between the ridges lies the dunes, rising to 1000 meters. Day temperature reaches 46º-49ºC. Barchans dunes are found everywhere. In some lowland depressions, water is retained by an impermeable substratum which sometimes lies near the surface. A sandy corridor in the middle running north-south links with Rub-al-Khali of the South.

(iii) Rub-Al-Khali (The Empty Quarter): This is one of the world largest desert. It is situated in the south and east of the interior of Arabia. It has an extent of 6,00,000 sq. km measuring 1200 x 500km. It is not uniform as its name suggests. It is an irregular tilted basin about 1000 meters high. It is lower in the east and south-east near Oman. On the south-west Yemen, there is a high rim of mountains which create rain shadow effect. Dunes reach 200 meters in height. This is a Bahr es-safi where the few water holes have been obliterated by sand. There is practically no habitation. In the southeast, there are saline surface water features.

(iv) Yunan Plateau: The Yunan Plateau of China extends into Thailand from the north. From the foothill zone of the Yunan, four rivers parallel to one another drain this area from north to South. The river from west to east are Me Ping, Me wong, Me Yom and Me Nan. Granitic ridges, about 1500 meter high, separate these from one another.

2.3.5 (E) The Eastern Island Chains:

It extends from Kamchatka Peninsula to Phillipines and Borneo. These Eastern Islands mark the true Eastern limit of Asia and appear to have been formed by the submergence of a mountain. The Islands are characterized by fertile soil, deep valley and steep conical mountains. They are arranged in festoons which enclose five seas namely Sea of Okhotsh, Sea of Japan, Yellow Sea, East China Sea and South China Sea. Of these, Yellow and East China Seas are the shallowish. They occupy basins made by the subsidence of block of the earth's crust. The festoons are (1) Aleutian Islands (2) Borneo (3) The Kunte Islands (4) The Japanese Island (5) The La Chnn Islands Phillippines. The ranges of these islands are largely volcanic of Fujiyama, the sacred mountain of Jajian, has the most prefect Cone. The Islands are grouped into the great volcanic belt which encircles the pacific ocean and it is known as 'The Fire Ring' of the Pacific.

CHECK YOUR PROGRESS

Note (a) Write your answers in the space given below
(b) Check your answers with those given at the end of the lesson

1. Name the Physiographic division of Asia.

____

____

2. Write a note on the Paleau of Tibet.

____

____

3. Name the seas that we find along the Eastern Island Chain.

____

____

2.4 LET US SUM UP

In the concluding lines, it is important to mention here that Asia is the largest of the world's continents, and covering approximately 30 percent of the Earth's land area. Asia shows a great diversity in the physiographic division. There is a complex system of mountains and plateau as well as intermontane plateaus on one hand, as well as fertile river valley and plains on the other hand. These high mountains are most important in modifying the climatic condition of different regions in Asia. The fertile valley and plains are largely used for agriculture activities and are well known for some high population density region of the world.

2.5 GLOSSARY

1. **Fold Mountains:-** Fold mountains are the mountains that form mainly by the effects of folding of layers within the upper part of the Earth's Crust.
2. **Intermontane Plateau:-** When a plateau is surrounded by mountains on all sides, it is called intermontane Plateau.
3. **Plains:-** These are flat surface formed due to deposition of sediments by the rivers.
4. **Relic Mountains:-** These are the residual hills formed due to the erosional work done by wind.
5. **Valleys:-** These are depressions, or say gorges, formed by the rivers due to headward and vertical erosion.

2.6 LESSON END EXERCISE

1. Name the physiographic divisions of Asia. Explain each of them briefly.
2. Write a note on the Indian Ocean drainage system.

3. Which are the important river plains of Asia. What is the economics importance of them?
4. Write a note on the Nefud, Rub-Al-Khali and Badiyat-Al-Sham.
5. Explain in details The Eastern Island chain.

2.7 SUGGESTED READINGS

1. Hussain, Majid (2004). World Geography. Jaipur & New Delhi: Rawat Publications.
2. Magray (2005). Geography of India & World Regional Geogrpahy. Srinagar (KMR):IQRA Publications.
3. Tikka, Bali, Sekhon (2008). Geography of Asia. Jallandhar: New Academic Publishing Co.

2.8 REFERENCES

1. Hussain, Majid (2004). World Geography. Jaipur & New Delhi: Rawat Publications.
2. Magray (2005). Geography of India & World Regional Geogrpahy. Srinagar (KMR):IQRA Publications.
3. Tikka, Bali, Sekhon (2008). Geography of Asia. Jallandhar: New Academic Publishing Co.

2.9 ANSWER TO CHECK YOUR PROGRESS

1. The physiographic division of Asia consist of the Northwestern lowlands, the Central Highlands, the Great Plains of rivers, the Southern Plateau and the Eastern Island Chains.
2. It is a lofty plateau, situated at a height from 4300 meters to 5200 metres above sea level. It is bounded by Kunlun mountains on the North and the Himalayan mountains on the South.
3. There are five seas along the Eastern Island Chain. These are Oktosk Sea, Sea of Japan, Yellow Sea, East China Sea, and South China Sea.

ASIA – FACTORS AFFECTING CLIMATE, TEMPERATURE, PRESSURE AND RAINFALL CONDITIONS

3.0 STRUCTURE

3.1 INTRODUCTION

In this chapter, you will learn about the Climate of Asia and various other factors that helps in modify the climatic conditions of Asia. Asia is a continent that experiences almost every type of climate. If we move from equator towards the North Pole, the continent experiences equatorial Moist (Af) to permafrost (EF) type of climatic conditions. The Central Highland Mass experiences cold semi-arid and arid climate mainly due to its physiography. The Arctic coast of Russia is in the permafrost belt where as to its south lies the Taiga region. A large part of Asia experiences semi-arid and arid type of climate while smaller portion as humid and moist.

3.2 OBJECTIVES

After studying this lesson, thoroughly, you will be able to learn about :

1. the winter and summer conditions of Asia.
2. the rainfall conditions of Asia.
3. the various climatic regions of Asia.

3.3 FACTORS AFFECTING CLIMATE OF ASIA

There are many factors, which make the climate of Asia very varied. Among them are:

1. Vast size
2. Situation
3. Relief
4. Seas and Ocean

1. Vast size: Asia is the largest continent having an area of 45 million square kilometres. From meterological point of view, it is, infact, part of the bigger land area including Europe and Africa. The alternate heating and cooling of this land mass during summer and winter, respectively, cause large seasonal variation in climate. Monsoon or the seasonal winds, which are the special features of climates of a large part of Asia, are the direct outcomes of this alternate heating and cooling.

The greater part of the continent is a compact mass lying between the tropic of cancer and 70°N and is less exposed to the influence of Westerly or Easterly trade winds as compared with other continents, which extend North and South. The moisture laden wind from ocean do not reach into the central parts. That is one reason, why this parts of Asia occupies many big deserts. Due to dryness of climate, the temperature becomes very high in summer and very low in winter.

2. Situation: Most of the huge land area of Asia is in the temperate zone. A narrow belt lies within the Arctic Circle, and three peninsular projected into the torrid zone. The tropic of Cancer passes through Southern China, the mouth of the Ganga and Southern Arabia, so that by for smaller part of Asia is in the tropic. Almost every known climate occurs in Asia, from the equatorial rainy type of Malaya to the Ice field climate of Nova Zemlya.

3. Relief: The continent of Asia is traversed by great range of mountains and plateaus. The highest point on the land is found in the Himalaya Mount Everst (8848 m) and the deepest in the Dead sea in the South-West Asia. (339 m). The central mountain belts starting from Turkey to Southern China prevent the moist wind coming from the Indian Ocean from crossing it to the North. This is the main reason, why Southern Asia has heavy rainfall, while central norther parts have dry climate.

The Northern part of Asia is famous for low temperature; the area near the Arctic Ocean is known as the 'cold pole' of Asia.

The Himalayas and associated mountains prevent the cold winds of the North from, freely entering the Southern parts. That is why, Pakistan, India, Burma, Thailand, Vietnam and the Southern China are saved from the intense cold of the Northern China.

4. Seas and Oceans: Asia is surrounded by the Indian Ocean on the South, Pacific Ocean on the East and the Arctic Ocean on the North. The three great peninsulas, Arabia, Deccan and Indo-China project through the Indian ocean. Due to the situation of many seas, and gulfs the wind blowing over these water bodies provide rain to the adjacent land area. The temperature of these land areas also does neither rise very high nor cool much.

CHECK YOUR PROGRESS-I

Note (a) Write your answers in the space given below

(b) Check your answers with those given at the end of the lesson

1. Name the Various factors affecting the climate of Asia.

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2. Which area is known as the cold pole of Asia?

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3. Which mountains ranges prevent the cold winds of north from entering the South

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3.4 CONDITIONS IN WINTERS

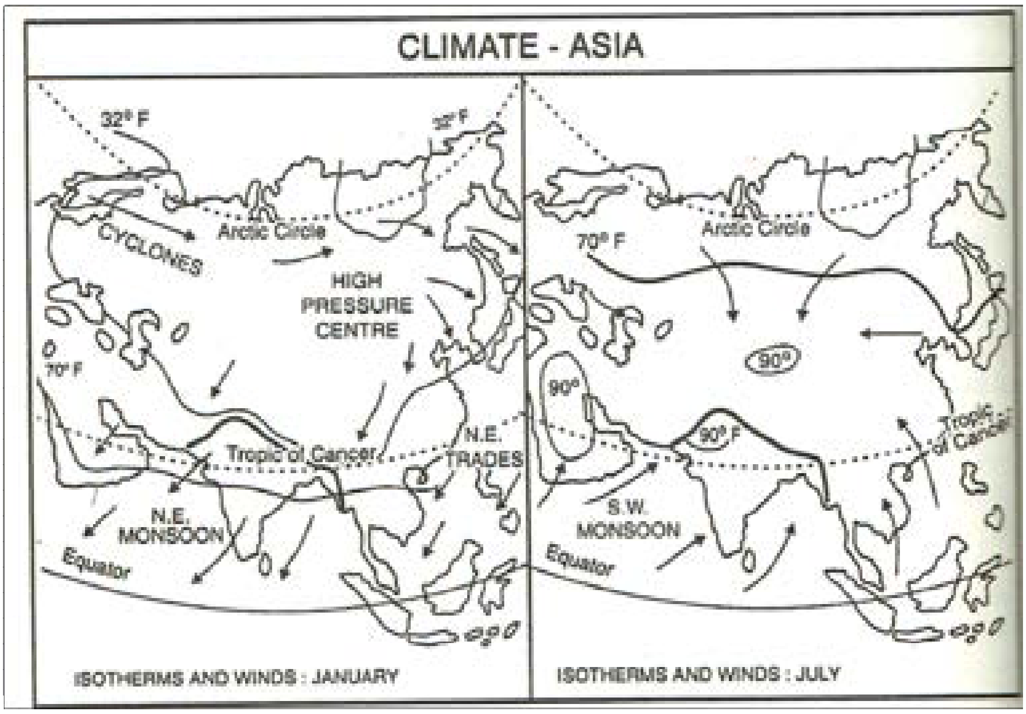
In winter months in the northern hemisphere, the thermal equator shifts towards the south, leaving less of solar energy for this region. The gigantic size reduces the warming influence of North Atlantic Drift. The Central Highland and their associated mountains chains cut off the warm air from the pacific and the Indian Ocean but do not stop the freezing air from the Polar Region to rush in. This is further compounded by the altitude of Central Highland zone where the air is already very cold. Therefore, in winters, whole of Asia is covered by a large and dense continental Polar Air mass. This forms a large high pressure area from where fast cold winds blow towards the low pressure coastal areas.

This high pressure system and the associated winds chill most of the Asian mainland resulting in extreme cold condition. Since these winds are blowing from the dry region, the affected areas receive very less or no rainfall. The Himalayas, Kunlun, Arakan and Khingan prevent these winds from reaching Indian sub-continent, South East Asia and East Chinese coast, therefore, these areas are comparatively warmer. Wherever these winds cross a water body, they pickup some moisture and bring rainfall as in the case of Japan. The scanty rainfall that is experienced by Asian mainland is from the temperate cyclones originating in North Atlantic and Mediterranean Sea. The coastal areas receives rainfall from retreating monsoons. The only areas receiving adequate rainfall are the equatorial belt comprising of South East Asian Countries.

Conditions in Summer:- As summer approach, the land heats up rapidly and the high pressure system of the winters is completely dissipated. A succession of low pressure cells develop over the North West India, Baluchistan, Arabian Peninsula and Tibet. The low pressure areas are segregated because of the influence of intermediate mountain ranges. As the temperature increases, the pressure decreases and the wind directions are reversed. Moisture laden winds from the oceans rush in and yield moderate to heavy orographic rainfall to those parts of Asia which fall on the windward side of the mountain systems. The system is unique to Asia and is known as the Monsoon system. Intermontax basis of Asia are arid because they are surrounded by lofty mountain chains on all the sides and are always at the leeward side or in rain shadow area.

The temperature starts increasing in the month of march and as the summer sets in the temperature in the inland areas reach beyond 45ºC. In the central Asian and Northern Asian regions, the temperature increases to well above freezing point. By the end of June, the temperature peaked and the low pressure depression are at their strongest. This is when the rains commence and bring the temperature down to bearable limits.

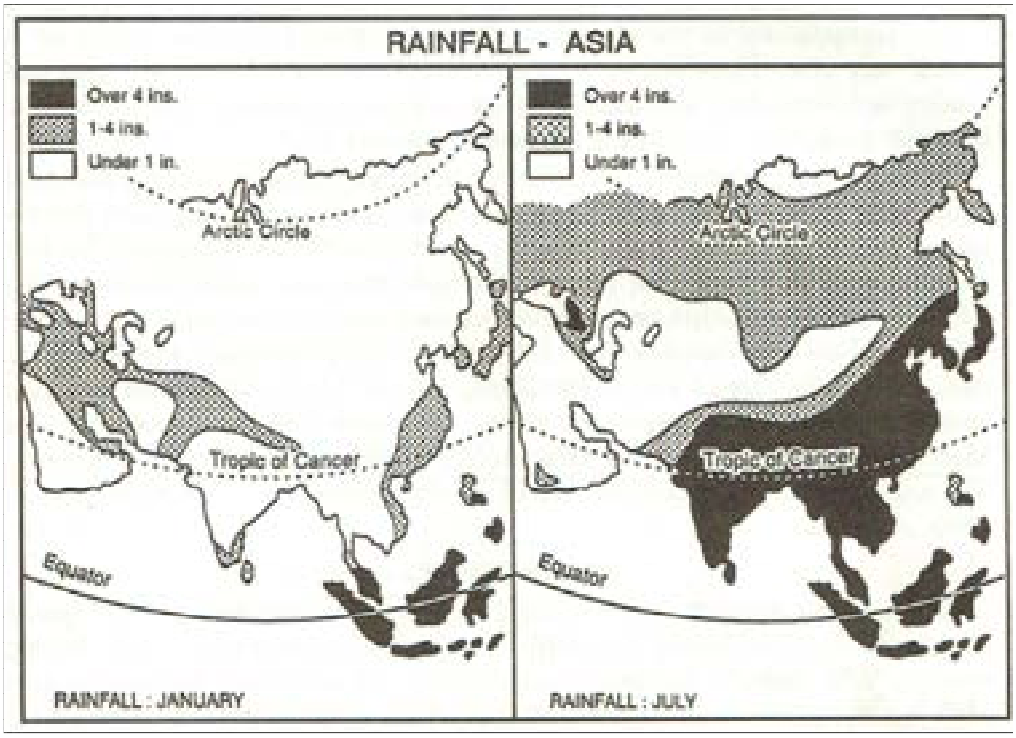
Map - 3.1



Rainfall Patterns:- The size of the continental landmass and its physiography also affect the moisture and precipitation patterns. About 2/3rd of the continent receives upto 75cm of rainfall. As a result, most of the continent is semi-arid or arid. The precipitation decrease as we more towards the middle of the continent because of the distance from sea and the presence of high mountain range which cut off the moist maritime winds from this region. West Asia receive less than 25cms of rain and is arid except the wastal areas which receive upto 75 cm of precipitation in winters only. The south and South East Asia are hot and wet. This region receives maximum amount of precipitation. The island and the coastal areas fall in the equatorial belt, so they receive precipitation throughout the year A lot of rainfall also occurs in the coastal regions. The total precipitation received per annum is more than 250 cms Japan, China and Indian sub-continent get higher rainfall in summer due to the monsoons. These moist winds shed their moisture due to orographic effects of high mountain chains of the central highland complex which fall in their paths. The monsoon regime is more pronounced over India than China and Japan. These areas receive up to

250 cms. of precipitation annually. Bulk of the precipitation in the Russain steppes and Siberia is due to the temperate cyclones that originate in the North Atlantic and Mediterranean seas and follow northerly paths throughout the year. In winters some weak temperate cyclone drift south bringing rainfall to Iran, Pakistan and north-west India.

Map - 3.2



3.5 CLIMATIC REGIONS OF ASIA

Koppen has divided the continent Asia into a number of climatic types. Infact, there is no climatic type described in Koppen's classification which is not found in Asia starting from hot Wet (Af) to frozen (EF).

1. Equatorial Climate:- This is a mega thermal climate in which there are no winters and no dry period. The annual range of temperature is not more than 2ºC. The precipitation occurs almost everyday of the year and annual average precipitation is between 200 and 300 cms. this type of climate is found in the Island Archipelago of South East Asia, Phillipines, Malay, Peninsula parts of southern Vietnam, Andaman and Nicobar Island and south western parts of Kerala on the Indian Peninsula.

Tropical Savannah (AW):- This is again a mega thermal climate but the annual temperature range is up to 15ºC and the rainfall of upto 150cms. it is characterized by expanses of tall grasses, drought resistant shrubs and thorny trees. Central parts of Indian Peninsula, Yuman Peninsula, Laos, Cambodia, Vietnam and Thailand experience this climate.

Steppe or Semi-Arid (BS):-In this type of climate, the rainfall is between 25cms and 75cms. The mean temperature of hottest month exceeds 30º C and coldest 12ºC. This climate is found in Central strip of Deccan, in Indo Gangetic Plains around the Thar desert, Southern parts of Iran and Afghanistan, coastal strip of Persian Gulf and Mesopatamian region of Iraq. These narrow strips are, in fact, the zones of transition towards the Equator, they transpose to tropical savannas and towards north and east into Mediterranean type (Cs) of climate. These regions are typical grasslands with short grasses and Xerophytic trees and shrubs.

Tropical Hot Desert:- (BWH) These are the world's hottest and driest areas. The temperature goes upto 50ºC in the day time and fall to almost freezing point at night time. The annual rainfall is less than 25cms. Occasional plants founds are only xerophytes. The major hot desert of Asia are the Arabian Desert, Syrian Desert, Rann of Kutch and Thar desert of India

Cold Steppes and Mid latitude Desert (BSK and BWK):- These are the cold steppes of temperate region found around the mid-latitude deserts of Kazakhstan,Gobi, Ordos and Takla Makan.

Warm Temperate Climate with Dry winters (CW):- The average temperature of the warmest months does not go below 10ºC and coldest months not below 3ºC. the rainfall is between 100 to 150 cms. the winter are dry. These are characterized by deciduous, hardwood forests, short grasses, thorny shrubs. Such regions are found on the windward side of Himalayas and the eastern mountain chain of China.

Mediterranean type(Cs):- In this types of Climate, summers are dry, and the rainfall is received only in winters from the temperate cyclones. This climate is found in a narrow belt along the Mediterranean coast in Turky, Cyprus, Israel, Lebnon, Syria and Jordan.

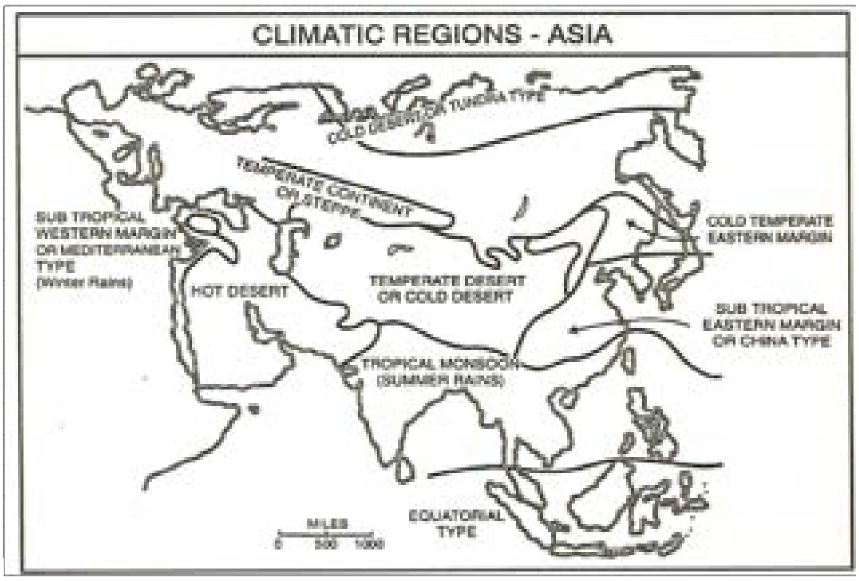
Continental Humid or Taiga (Df):- These regions have precipitation through out the year as they lie in the frontal zone of the polar continental air masses and tropical maritime air masses. They stretch between 40ºN and 70ºN. This vast area has a mean temperature of below 10ºC in the warmest month and below -3ºC in the coldest month. Eastern coast of Russia, Sakhalin, Hakkaido Island of Japan, Central and West Siberia experience this climate.

Continental Dry Winter (Dw):- These climates are similar to Df but differ in the precipitation regime, which is limited to summer months only. Eastern Siberia, interior parts of Eastern Russain, North Korea, Manchuria and Kansu province of China experience this climate.

Tundra Type (ET):- This climate is found along the Arctic coast of Eurasia. The temperature of warmest month is below 5ºC. The entire region is treeless with sparse grasses, sedges, mosses and lichens (between 70ºN and 75ºN). Soils of Tundra are affected by permafrost and only top 5 to 10cms. thaw in summers.

Permafrost or Ice Caps (EF):- The northern most fringes of the Eurasian land masses are always frozen as they lie close to the North pole. The temperature of all months are below 0ºC. Even the Arctic Ocean is always frozen at the surface. The cole pole of the earth is found in Noth East Siberia.

Map - 3.3



CHECK YOUR PROGRESS-II

Note (a) Write your answers in the space given below

(b) Check your answers with those given at the end of the lesson

1. What are the Characteristics of Mediterranean type of Climate ?

____

____

2. Write a short note on the Rainfall pattern in Asia.

____

____

3. What are the Characteristics of Summers of Asia?

____

____

3.6 LET US SUM UP

In the concluding lines, it is important to mention here that the climate of Asia is wet across southeast sections, and dry across much of the interior. Some of the largest daily temperature ranges on earth occur in western sections of Asia. The monsoon circulation dominates across southern and eastern sections, due to the presence of the Himalayas, forcing the formation of a thermal low, which draws in moisture during the summer. Southern section of the continent experience low relief as result of the sub tropical high pressure belt, they are hot in the summer, warm to cool in winter, and may snow at higher attitude, Siberia is one of the coldest places in the Northern Hemisphere, and can act as a source of arctic airmass for North America.

3.7 GLOSSARY

1. **Cold Pole of Asia** The area near the arctic ocean which lies in the continent of Asia is known as cold pole of Asia.

2. **Equatorial Moist Climate** This is a type of climate in which there are no winter and no dry season. The annual range of temperature is only 2ºC and the precipitation is about 300 cms per annum.

3. **Permafrost** Permafrost mean permamently frozen with temperature below 0ºC and precipitation is in the form if snow.

4. **Savannah** This types of climate is having annual range of temperature of 15Cº and the precipitation upto 150cm. it is characterized by tall grasses and thorny tress.

5. **Steppe** This type of climate is having rainfall between 25cm to 75cm. the mean temperature of the hottest month exceeds 30ºC and coldest 12ºC. these region are having typical grassland with short grasses.

3.8 LESSON END EXERCISE

1. What are the main factors affecting the climate of Asia?
2. Explain the characteristics of summer season and winter season of Asia.
3. How the relief of Asia effect the climate of Asia to a great extent?

4. Name the various types of climatic regions of Asia. Explain them in detail.
5. Explain the Rainfall patterns of Asia.

3.9 SUGGESTED READINGS

1. Hussain, Majid (2004). World Geography. Jaipur & New Delhi: Rawat Publications.
2. Magray (2005). Geography of India & World Regional Geogrpahy. Srinagar (KMR):IQRA Publications.
3. Tikka, Bali, Sekhon (2008). Geography of Asia. Jallandhar: New Academic Publishing Co.

3.10 REFERENCES

1. Hussain, Majid (2004). World Geography. Jaipur & New Delhi: Rawat Publications.
2. Magray (2005). Geography of India & World Regional Geogrpahy. Srinagar (KMR):IQRA Publications.
3. Tikka, Bali, Sekhon (2008). Geography of Asia. Jallandhar: New Academic Publishing Co.

3.11 ANSWER TO CHECK YOUR PROGRESS

(1)

1. Factors which affect the climate of Asia are vast size, situation relief and seas and oceans.
2. The area near the arctic ocean is known as the cold pole of Asia.
3. The Himalayas and the associated mountains prevent the cold winds of North from entering the south.

(2)

1. Meditteranean types of climates is characterized by rainy winter and dry summers.

2. About 2/3rd of Asia receives 75cm. of rainfall. The precipitation decreases as we more towards the middle of the continent because of the distance from sea and the presence of high mountain ranges which cut of the moist maritime winds from this region west Asia receives less than 25 cm of rain except the coastal regions, which receives 75cm of rainfall during winter.

3. In summers, the temperature starts increasing in the month of march, and as the summer sets in the temperature in the inland areas reach beyond 45ºC. In the Central Asian and Northern Asian regions, the temperature increases well above freezing point.

ASIA – MAJOR RIVER SYSTEMS

4.0 STRUCTURE

4.1 INTRODUCTION

In this chapter, you will learn about the drainage of Asia which is a big continent, and it gives birth to a number of rivers. Among these rivers, much of the rivers are in the category of largest rivers of the world. Most of the rivers are perennial in nature, whereas some are seasonal or inland rivers. Many rivers gave birth to the old civilizations of the world, like Mesopotamia and Sumer. These rivers also make some of the world known fertile plains and deltas like Great Plains of India and Hwang Ho Plains of China. These plains and deltas are thickly populated because they are, chiefly used for agricultural activities.

4.2 OBJECTIVES

After studying this lesson, we will be able to learn about.

1. Major rivers systems of the Pacific, Arctic and Indian Ocean.
2. Major river systems of the Mediterranean Sea.
3. Important rivers of the Inland drainage of Asia.
4. Characteristics of the Pacific, Arctic and Indian Ocean drainage system.

4.3 Drainage System of Asia

The drainage or river systems of Asia can be divided into six systems:

1. Arctic Ocean Drainage or North Flowing Rivers.
2. Pacific Ocean Drainage or East Flowing Rivers.
3. Indian Ocean Drainage or South and South-East Flowing Rivers.
4. Arabian Sea Drainage or South and South – West Flowing Rivers.
5. Mediterranean Sea Drainage System.

1. Arctic Ocean Drainage or North Flowing Rivers:- Rivers Ob, Yenesei, Lena, Yana, Indigirika and Kolyma are the main river that flow into the Arctic Ocean. Their courses are almost towards north, from their sources which lie in the northern mountain chains of the Central Asian Highland core. Rivers Ob, Yenesei and Lena are amongst the twelve longest rivers in the world. The main rivers are:-

(i) The Ob. It is about 5,568 km long. It orginates on the northern slopes of the Altai mountain. Its main tributary Irtysh has its origin nearby. Both of them cover western Siberia and join beyond 60º N at Khardy Manstysk. The main tributaries of the Irtysh river are R. Tobol and R. Ishim.

(ii) The Yeniesei. It is about 4,130 km long. It originates on the southern slopes of the Sayan Mt. Its eastern divide is occupied by Tungusk mountains, from where it receives its eastern tributaries, the Upper Tunguska, the Stony Tunguska and Lower Tunguska. On the west, there is no conspicuous tributary. The Yeniesei basin is smaller than that of the Ob. The river meets the Arctic Ocean through the Gulf of Yenisei.

(iii)The Lena. It is further east of the Yeniesei. It originates in the Baikal mountain, slopes in the south. It is separated from the Yeniesei by Tungusk mountains. and on the east by the Orulgun and Verkhoyansk mountains. It has a limited basin. Its main eastern tributary is R. Aldan while on the west the main tributary is the Vilyui.

(iv)Other Rivers flowing into the Arctic:- Towards the east, the Indigarka River originates on the eastern slopes of the Cherskogo mountains,., the Kolyma River on the western slopes of the Kolymaski mountain. and a few other small rivers which rise from the mountains near the coast also drain into the Arctic Ocean.

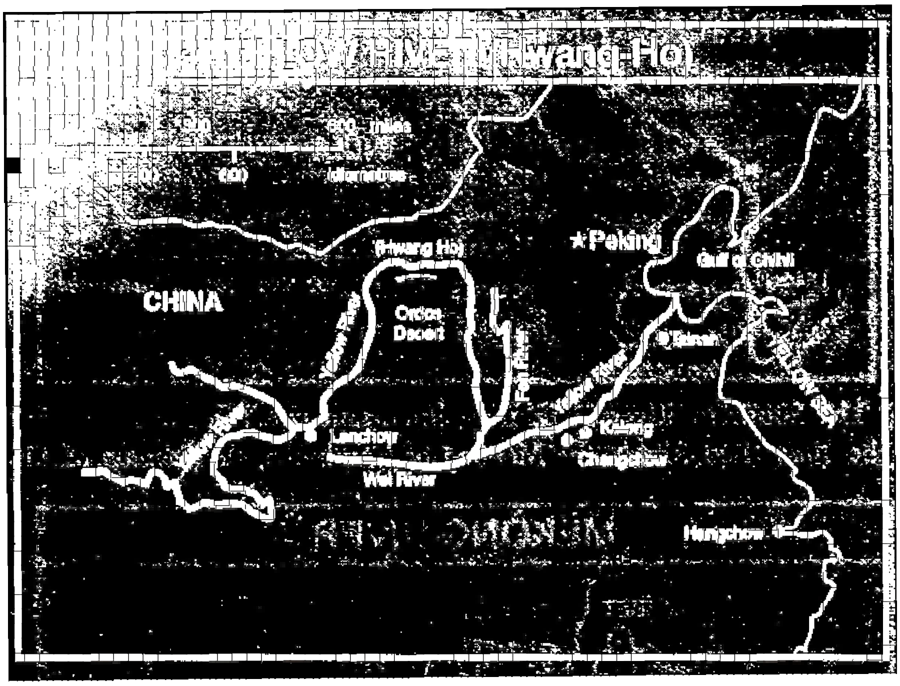
Characteristics of Arctic Ocean Drainage System:

1. The slope towards the north is gentle. The rivers flow slowly and meet the Arctic Ocean.
2. The climate is hard and inhospitable in the area close to the Arctic Ocean. Thus rivers are frozen for nearly six months in a year.
3. Rivers have dendretic pattern of drainage.
4. Since source areas of these rivers receive scanty rainfall as such quantum of water in these rivers is less.

2. Pacific Ocean Drainage or East flowing rivers:- The plains or middle and lower courses of these rivers are some of the world's most densely populated areas. The major rivers of this drainage system are Amur, Yangtze Kiang, Hwang Ho (Yellow River), Si Kiang and Red. Most of these drain the Chinese plains and flow into the Pacific Ocean. Hwang Ho is also known as "the Sorrow of China" as flooding of this great bring untold misery to the densely populated regions of north-eastern Chinese plain. The important rivers are:-

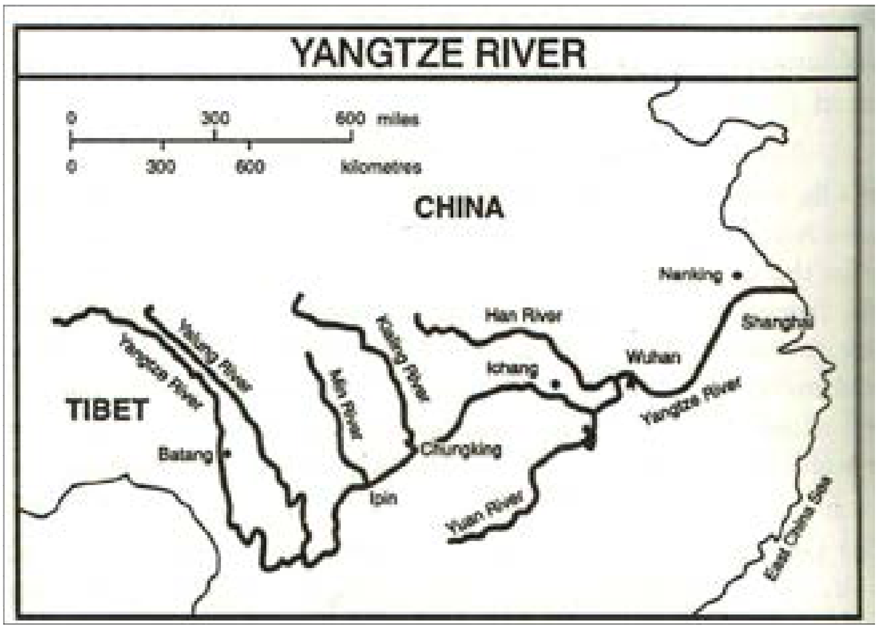
(i) The Hwang Ho:- It is about 4,670 km long. It originates in the west of the Min Shan mountains around 33°N and 102°E. The flow of the river is fast when it crosses Tibetan Plateau and enters Kansu Province. It slows down as it crosses the Great China Wall and struggles through the sand dunes. Its main tributary rivers are the Wei Ho and the Fen Ho. In the Yellow Plain, the sand dunes abound. When the river meanders through the plain and is in spate, causes destruction to life and property.

Map - 4.1



(ii) The Yangtze-Kiang:- It is about 5,520 km long. It is navigable from the Pacific Ocean to the Tibetan Plateau. Its main tributaries are the min, the Han and the Kan. It flows through the Tungting and the Poyang lakes. The river makes a large delta before entering the Pacific Ocean.

Map - 4.2



(iii) The Amur:- It originates towards the west of the Khingan Shan Mt. It virtually makes boundary between China and the Eastern Russia. Its important tributaries are the Ussuri, the Sungari, the Lia Ho, the pei Ho, etc.

(iv) The Southern Rivers. The most important rivers in the South are the Si Kiang, the Yuan (Red River), the Mekong of Cambodia, the Menam of Thailand etc.

3. Characteristics of the Pacific Ocean Drainage System

1. The rivers flow towards the east and the south and then flow into the Gulf of Thailand and the South China Sea.
2. The rivers form a dendratic drainage pattern.
3. **Indian Ocean Drainage Or South and South-east Flowing Rivers** : - Like the Pacific Ocean Drainage System, this drainage area also is home to some great rivers like the Ganga, Brahmaputra, Mahanadi, Godavari, Krishna, Cauvery, Irrawaddy, Salween, Mekong and Menam. All these rivers except Mahanadi, Godavari, Krishna and Cauvery, originate in the Himalayas or the Trans-Himalayan

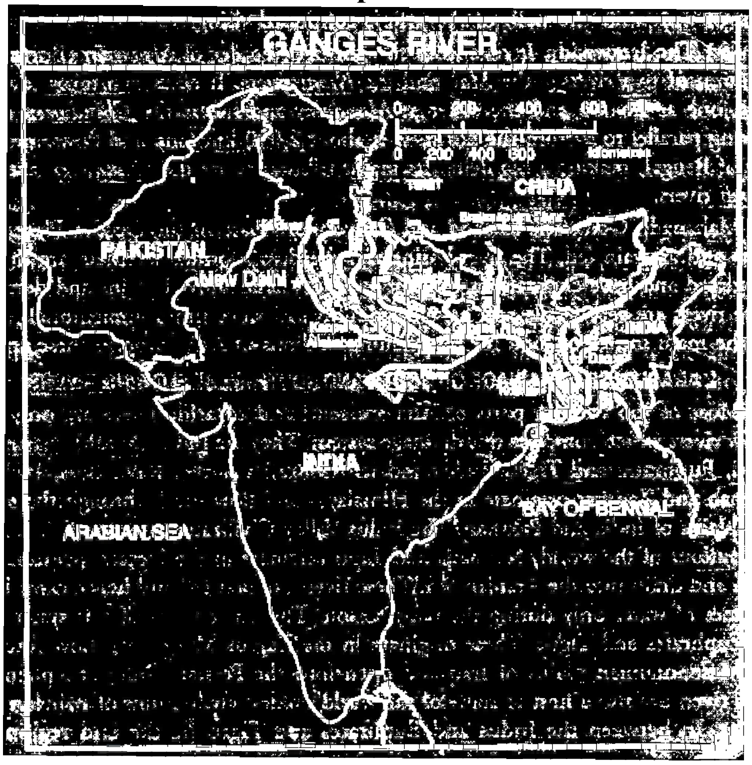
ranges and flow due south or in the south-east direction. These great rivers are snow and rain fed, hence they are perennial. The central mountain and plateau areas of Asia give rise to perennial rivers which flow into the gulfs and seas of the Indian Ocean. Some South-West Asian rivers also open into the Indian Ocean.

(i) **The Sindh (Indus):-** It originates on the northern slopes of the Kailash Range in the Himalayas. It flows north-.west in Kashmir and-then turns south-west and meets the Satluj, the Beas, the Ravi, the Chenab and the Jhelum. These rivers are its eastern tributaries. The river Kabul is the western tributary of the river Indus.

(ii) **The Ganga:-** Its source is the Gangotri glacier in the Himalayas. It passes through the North Indian Plain and Bangla Desh and opens into the Bay of Bengal. Here, it forms a large delta known as Sunderbans. The Ganga is about 2,506 km long.. It is known as the Padma and the Meghna in Bangla Desh. Its northern tributaries are Gandak, Ghagra, Kosi while the western one is the Yamuna. The tributaries which descend the Deccan Plateau edge are the Chambal the Betwa, the Kosi and the Son.

(iii) **The Brahmaputra:-** It originates in the Himalayan Glacier and runs for 1,450 kms through Tibet, till it reaches Namcha Barwa where it turns south as the Dihang river and enters India at Jido. It then flows in the Assam Valley. Here it is known as the Brahmaputra. When it reaches Bangla Desh it turns south. The main stream is called the Jamuna. An arm of the Ganga river called the Padma, meets the Brahmaputra at Goulinda. The river's total length is 2,900 km and is navigable for 1,285 km from the sea. It is Antecedent to the Himalayas, because it maintains its right way while the walls of the valleys continued rising.

Map - 4.3



(iv) The Irrawaddy:- It rises from the northern border of Myanmar (Burma) in the form of two rivers - the Mali and the Nmai rivers. It takes two turns towards west, one at Bhamo and the other at Mandalay and meets the Chindween river, flowing parallel to it from the north. It is about 2,090 km long and flows into the Bay of Bengal, making a big delta. Its Major tributaries are the Chindween and the Salween rivers.

Mahanadi, Godavari, Krishna and Cauvery originate in the Deccan Plateau of India and are rain fed. The river basins and the deltas formed by them are thickly populated and have civilizations of great antiquity. The alluvial plains and deltas of these rivers are very fertile and have been cultivated since times immemorial. They are the source of food for the taming millions of Asians living in these areas.

4. Arabian Sea Drainage or South and South-west Flowing Rivers:- Most of the western parts of Asia are semi-arid to arid. There are only five major rivers which comprise this drainage system. They are Indus (Sindh), Narmada, Tapti, Euphrates and its tributaries Sutlej, Ravi, Beas, Jhelum, Chenab and Zanskar, originate in the Himalayas and flow south through the semi-arid plains of India and Pakistan. Narmada and Tapti originate in the Deccan peninsula of India and drain into the Arabian Sea. These rivers are rain fed and hence carry large volumes of water only during the rainy season. The other rivers of this system are the Euphrates and Tigris. These originate in the Zagros Mountain, flow through the Mesopotamian plain of Iraq and open into the Persian Gulf. The plains of these rivers are also a host to some of the world's oldest civilizations of Babylon and Sumer. In between the Indus and Euphrates and Tigris lie the arid region of Afghanistan and Iran with their own inland drainage and no rivers flowing down to the sea. In the south-west of Mesopotamia lies the great Arabian Desert which again has no water surplus for river flow.

5. The Mediterranean Sea Drainage System Many rivers rising in the Anatolia Plateau cut across the southern mountains and meet the eastern Mediterranean Sea. From the east to the west, the main rivers are the Seyhan, the Aksu, the Dalaman, the Menderes, the Gediz, etc. The other river which is flowing outside Turkey is the Orontes. It rises in Lebanon near Baalbeck and flows through Syria into the Mediterranean Sea.

6. Inland Drainage The sixth drainage system is equally important as these rivers never reach the open oceans. These drain into inland water bodies or are lost in the sands of vast arid lands of Central Asia.

Amu and Syr Darya originate in the Hindu Kush Mountains and flow into the AraI Sea. River Ili flows into Lake Balkash while Selenga flows into Lake Baykal. Other than this, a large number of smaller rivers fed by melting snows on the slopes of Central Asian highlands flow into the intermontane basins like the Dzungarian, Tarim and Tsaidim where they are lost in the sands as these basins are mid-latitude deserts. The inland drainage system predominates in Iran area from Anatolia upto Afghanistan, Central Asia, Sikiang of China and Mongolia. In Central Asia the rivers like the Syr and the Amu struggle to reach the Aral Sea which itself is a shrinking lake and is likely to disappear in the desert where it exists. In Afghanistan, the Helmand river disappears in the central part of the country. In the Sikiang region of China, a large number of rivers from the south run towards the Takla Makan desert and are lost. Famous 'among them is the Yarkand river which rises from the mountain peak Mt. K-2,)

CHECK YOUR PROGRESS

Note (a) Write your answers in the space given below

(b) Check your answers with those given at the end of the lesson

1. Name the Important river systems of Asia.

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2. What do you mean by Inland drainage?

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3. Which are the important rivers that drains into the Mediterranean Sea?

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4.4 LET US SUM UP

In the concluding lines, it is important to mention here that there are a number of rivers that flow in the Asia. Asia continent is in the shape of giant inverted cone, with the apex near the geometric centre and a general slope in all directions from the middle. Rivers, fed by rain and snow melt, originate in the Central Highlands and flow in all directions radially as spokes of wheel. Barring the Tigris and Euphrates, all other rivers originate in the Central Asian Highlands abd drains the vast continent. The Arabian Peninsula, being a desert, is devoid of perennial rivers. No single river valley dominates the drainage of Asia all rivers form great alluvial plains. These plains have been seats of some of the greatest and oldest civilizations of the worlds.

4.5 GLOSSARY

1. **Dendretic Pattern:-** A pattern in which the main stream and its tributaries forming the pattern of a tree.

2. **Drainage:-** A drainage basin is any area of land where precipitation collects and drains off into a common outlet, such as into a river, bay, or other body of water.

3. **Inland Drainage:-** A drainage in which rivers do not reach an ocean or sea but empty their waters in a lake or an inland sea.

4. **Perrennial Rivers:-** A river that has continuous flow in parts of its stream bed all year round during years of normal rainfall.

5. **Tributaries:-** A stream that flows into a larger stream or main stream. It does not flow directly into a sea or ocean.

4.6 LESSON END EXERCISE

1. Name the important river systems of Asia. Explain them briefly.
2. Write a note on the Inland drainage system of Asia.
3. Write the characteristics of the south and southeast flowing rivers of Asia.
4. Why the rivers Hwang Ho & Yangtze-Kiang are considered to be very important for China from Agriculture point of view?

4.7 SUGGESTED READINGS

1. Hussain, Majid (2004). World Geography. Jaipur & New Delhi: Rawat Publications.
2. Magray (2005). Geography of India & World Regional Geogrpahy. Srinagar (KMR):IQRA Publications.
3. Tikka, Bali, Sekhon (2008). Geography of Asia. Jallandhar: New Academic Publishing Co.

4.8 REFERENCES

1. Hussain, Majid (2004). World Geography. Jaipur & New Delhi: Rawat Publications.
2. Magray (2005). Geography of India & World Regional Geogrpahy. Srinagar (KMR):IQRA Publications.

3. Tikka, Bali, Sekhon (2008). Geography of Asia. Jallandhar: New Academic Publishing Co.

4.9 ANSWER TO CHECK YOUR PROGRESS

1. The important river systems of Asia are Arctic Ocean Drainage system, Pacific Ocean Drainage system, Indian Ocean Drainage system, Arabian Sea Drainage system & Mediterranean Sea Drainage System.

2. Inland drainage includes the rivers which are lost in sands of arid land, and do'not reach to the seas or oceans.

3. The important rivers which drains into the Mediterranean Sea are the Seyhan, the Aksu, the Dalaman, the Menderes, the Gediz etc.

ASIA - TYPES, CHARACTERISTICS AND DISTRIBUTION OF FORESTS

5.0 STRUCTURE

5.1 INTRODUCTION

The first unit was devoted to the study of various attributes of Asia, its physical setting, Physiography and drainage network. In lesson 4, you have studied about river system of Asia, its major drainage and its impact on the soils. You have also studied that the drainage of an area is the outcome of the physiographic attributes of that region and is influenced by the topography and climate of the area. There exists a strong relationship between the climate and vegetation of an area. Further, forest resource of an area greatly influences the physical and cultural landscape of the area. Hence, it assumes great significance to study the forests. Thus, in the present lesson, we will study about the forests in Asia, their characteristics and distribution.

5.2 OBJECTIVES

Main objective of this lesson is to make you aware of the relationship between the climate and vegetation of an area and after going through the lesson you will be able to –

1. Define the forest and the meaning of forest.
2. Classification of forest.
3. Describe the characteristics of forest.
4. Distribution of various forest in Asia.
5. Conservation of forest.

5.3 DEFINITION OF FOREST

Definition:

Although *forest* is a term of common parlance, there is no universally recognized precise definition, with more than 800 definitions of forest used around the world.

*"A **forest** is a large area dominated by trees, incorporating factors such as tree density, tree height, land use, legal standing and ecological function."*

Forest can be defined as a plant community predominantly of trees and woody vegetation, usually with closed canopy. Legally it is defined as an area proclaimed to be forest under forest law. Also it is defined as area set aside for the production of timber and other forest produce, or maintained under woody vegetation for certain indirect benefits.

Meaning of Forests:

Etymologically, The word forest comes from French word 'forès' which means vast expanse of land covered by trees"; first introduced in English as the word for wild land set aside for hunting without the necessity of the existence of trees.

Forests are essential for the survival of all the living organisms and for maintaining the ecological balance while some forests are specially valued by man to satisfy his material needs and desires such as soft wood forests.

Views of prominent scholars and bodies is reproduced here to make you more aware about the concept of forest-

- **UNFAO, 2000** - Land with tree crown cover of more than 10 % and area of more than 0.5 hactre. The trees should be able to reach a minimum height of 5 m at maturity in situ. May consist either of closed forest formations where trees of various stories and undergrowth cover a high proportion of the ground; or open forest formations with a continuous vegetation cover in which tree crown cover exceeds 10 %.

- **United Nations Framework Convention on Climate Change (UNFCCC; 2002)** - A minimum area of land of 0.05–1.0 ha with tree crown cover (or equivalent stocking level) of more than 10–30 % with trees with the potential to reach a minimum height of 2–5 m at maturity in situ. A forest may consist either of closed forest formations where trees of various stories and undergrowth cover a high proportion of the ground or open forest.

- **United Nations Convention on Biological Diversity (UN-CBD; 2010)** - A land area of more than 0.5 ha, with a tree canopy cover of more than 10 %, which is not primarily under agriculture or other specific non-forest land use.

- **International Union of Forest Research Organizations (IUFRO; 2002)** - A land area with a minimum 10 % tree crown coverage (or equivalent stocking level), or formerly having such tree cover and that is being naturally or artificially regenerated or that is being afforested

The ecological variables like trees, plants, herbs and shrubs are combined referred to as forests. Till now, you must have understood that a forest is a collection of various vegetation types, which maintains the ecological balance, thrive as a breeding ground for various species, inherits many cultural functions like material and medicinal requirements etc.

CHECK YOUR PROGRESS - I

Note (a) Write your answers in the space given below

(b) Check your answers with those given at the end of the lesson

1. What do you understand by the term 'forest'?

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2. Give the etymological meaning of a forest.

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5.4 FACTORS AFFECTING THE GROWTH OF FORESTS

As has been studied from the meaning- a forest is the collection of trees and is essential for the survival of life. Thus, luxurious growth of forest is important for its role in producing resources and maintain the climate. But the growth of forest depends on many factors listed below-

1. Physical factors like-

a)	Temperature	b)	Precipitation	c)	Relief
d)	Topography	e)	Sunlight	f)	Soil
g)	Wind				

a) Temperature : Temperature is the single most important factor influencing the growth of forest. Vegetation requires at least 6°C of temperature to survive, in below than that temperatures plants cease to exist. Very high temperatures are also detrimental to the growth of plants. Moderate temperatures are conducive for the luxurious growth of the vegetation.

b) Precipitation : Both high and low rainfall supports different varieties of plants. Very high rainfall is worst for the soft wood trees and xerophytic plants, but is suitable for tropical rainforest. Less precipitation suits coniferous and desert vegetation.

c) Relief : Plant species varies as the altitude from the ocean increases. Deciduous trees in the plains and coniferous trees in the higher altitudes.

d) Topography : The mountain slopes facing the sun or southward slopes in Asia, receiving higher sunlight have luxurious growth of vegetation where as the leeward slopes or northward slopes encompass scanty vegetation.

e) Soil : Fertile soils support high growth of vegetation where as infertile soils impedes plant growth.

f) Winds : Moderate winds are favourable for effective growth of vegetation, where as gale winds, cyclones etc. uproots the trees and destroys forests.

CHECK YOUR PROGRESS - II

Note (a) Write your answers in the space given below
(b) Check your answers with those given at the end of the lesson

1. Name the factors affecting growth of forest?

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2. Write a short note on the influence of temperature on forest growth.

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5.5 CLASSIFICATION, CHARACTERISTICS & DISTRIBUTION OF FORESTS

From the above reading, till now you must have an idea about the forests. Lets study about the various types of forests, their properties and their spatial location in Asia. The natural vegetation is perhaps the best summary of the physical environment, for it reflects the temperature, rainfall, drain-age, elevation and soil conditions. In nature, all physical phenomena are interre-lated; together, these provide us with an understanding of the physical environ-ment.

Asia's enormous territory, immense variety of relief and a wide range of cli-mates combine to produce most types of vegetation forms. A dominant feature of the continent's vegetation is that a larger territory on the western side has no oce-anic border, and receives scanty rainfall in relation to summer temperatures that can allow appreciable forest growth. The broad pattern of natural vegeta-tion generally follows the climatic types; it is thus convenient and useful to describe it in association with the climatic patterns of Asia.

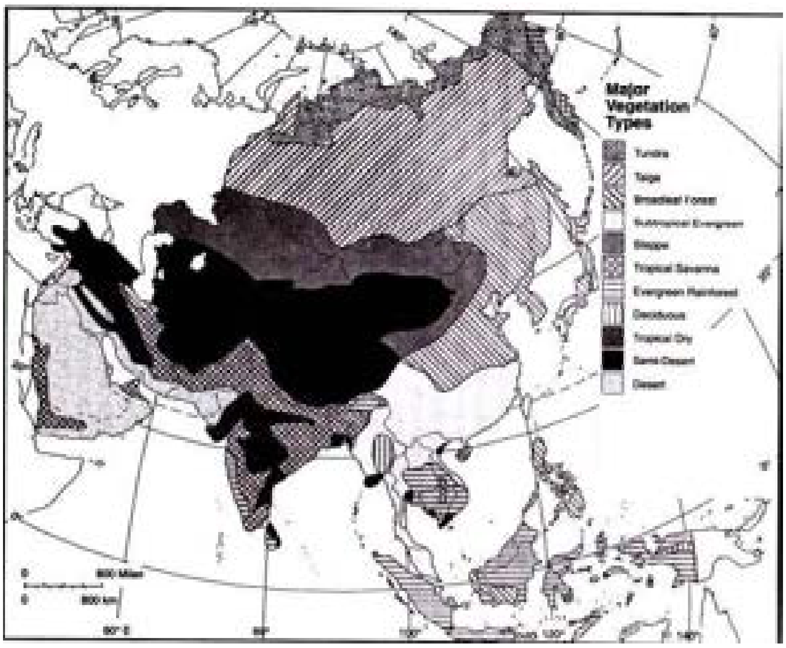
On the basis of climate, forests have been classified as-

1. Tundra Forest. 2. Taiga Forest.
3. Temperate Grasslands, the Steppe Forest.
4. Mediterranean Scrubland and Forest.
5. Desert Vegetation.
6. Monsoon Forest.
7. Tropical Rainforest.
8. Montanne Vegetation.

The Tundra: The Tundra climate correlates with its namesake vegetation Tundra vegetation, that borders the Arctic Ocean. It is a region of cold, treeless plains with permanently frozen subsoil. Lichens, mosses, sedges and some grasses may occupy more favored locations. The Tundra belt extends to 70°N and with further south extensions on high altitudes Chersk, Verkhoyansk and Kamachatka mountains.

The Taiga: South of the Tundra region is the Taiga, a belt of coniferous forests, or the needle-leaf evergreen forest, with a small, transitional zone of "wooden tundra". It covers most of Siberia from the Urals to the Pacific and northern part of Japan. The trees have small leaves, deep roots, and thick bark, and thus most species (pine, spruce, fir, etc.) are successful in cold and dry environment. Further east and southwest of Siberia is a transitional zone of coniferous forest mixed with hardy, deciduous trees such as aspen and birch, with sections of grass and shrubs in the drier areas.

Map - 5.1 : Vegetation Types of Asia



Temperate Grasslands, the Steppes: To the south of Taiga is elongated, unbroken stretch of the Steppes from Ukraine to Manchuria—a broad belt of several thousand miles of temperate grasslands in southern Siberia— a parkland country of open grasses. A large area of flat unforested grassland in SE Europe or Siberia. There is some precipitation although the winters are still very cold, but the extreme temperature ranges of the Taiga are softened by the warm summers. However, the higher elevations in the mountains are covered with forests, and the dry valleys are bare except for the occasional cultivated oasis.

Mediterranean Scrubland and Forest: A belt of scrub forest that is particularly attuned to the Mediterranean climatic regime rims the eastern shore of the Mediterranean that includes the countries of Israel, Lebanon, Syria, Iraq, and the plateaus of Turkey and Iran. The summers are hot and dry; the winters mild and moist. Thus, the circumstances for the plant community are unusual; winters become the growing period.

Plants must adapt to conditions of drought and higher temperatures in summers. They share the adaptive characteristics of small plant size, short leaves, deep roots, and thick barks to retain moisture. The most distinctive vegetation community of this region consists of a scrubland and short trees.

Desert Vegetation: The desert climatic and associated vegetation types are found in the trade wind deserts of the Arabian Peninsula, the deserts of Tibet, Mongolia, and the desert-like steppe-lands bordering the Caspian Sea. The mid latitude deserts of Tibet and Mongolia in the interior resemble the Arabian Desert only in aridity, but contain a clear altitudinal zonation of vegetation.

Plant cover in the deserts is sparse, with a considerable bare ground dotted by a scattering of individual plants. Typically, the plants are moisture combating, waxy, deep rooted or thorny shrubs and sporadic stunted trees. The upper reaches of the highlands in Tibet or Mongolia may be bare, or contain Taiga and Tundra like vegetation depending on the amount of available moisture.

Monsoon Region: This region is associated with monsoon climates. The natural vegetation varies with the amount of annual rainfall. Areas receiving between 40 and 80 inches of rainfall annually contain tropical deciduous (shedding leaves season-ally) forests, and those which receive less than 40 inches have savanna (tall grasses) and steppe like (of short grasses) vegetation, below which semi desert and desert vegetation prevails. The monsoon lands have been extensively modified by human settlement and put to cultivation, and little trace of the original vegetation survives.

Tropical Rainforest: Tropical rainforests are typical to the equatorial regions. In Malaysia and Indonesia rainforests cover large section of the countries, whereas in southern Sri Lanka and Java they have almost entirely replaced by agricultural landscapes where plantations of tea, coconut palms, and rubber trees cover the Mountain slopes and hills.

The vegetation consists of evergreen, broad leafed tall, dense, high crowned trees of several species having a dense canopy above the floor because the region gets a high amount of precipitation throughout the year, and is constantly warm. The savannas and deciduous trees cover the ground, the subequatorial and the areas that lie in the rain shadow on the leeward slopes.

Montanne Vegetation: The mountains of southern and eastern Asia show a remarkable altitudinal zonation in natural vegetation. A zone of forest followed higher up by meadows, and snow cover at the highest elevations is characteristic. On the lower slopes are the broad-leafed deciduous forests, and on higher ground the coniferous trees occur.

Still higher up stunted trees, subalpine meadows and near the highest ridges perennial snow, and glaciers are found in a vertical zonation pattern. Elsewhere in the equatorial region in Malaysia and Greater Sunda Islands, (Indonesia) where the snow line is very high and moist-hot conditions predominate, the vegetation zonation is practically absent.

CHECK YOUR PROGRESS -III

Note (a) Write your answers in the space given below
(b) Check your answers with those given at the end of the lesson

1. Discuss briefly the Taiga forest.

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2. Write a short note Temperate Grasslands (Steppes).

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3. Discuss the main characteristics of Tropical Rainforest.

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5.6 CONSERVATION OF FOREST

From the above discussion, by now you have learnt that the forest forms a major part of the biosphere and is essential for the survival of life on the planet. It is important to note that over one- third of the continent's surface has been cleared for human settlement or given to permanent agriculture. Vegetation in such areas no longer remains "natural". In most areas of dense settlement the original forest has been entirely removed and no trace of undisturbed forest remains. For example

1. The Indus-Ganga plains in India, lower Chao plains in Thailand, the lower basin of Huanghe, Chang Jiang, and Xi Jiang rivers in China are almost covered with cropland. In-tensely settled areas in Java (Indonesia) and Japan, imported plants have replaced the indigenous vegetation.

2. Original cover can only be found in the remote and inhospitable areas, such as northern and northeastern Siberia, and parts of Southeast Asia. Reflecting the growing awareness of the consequences of deforestation and loss of natural vegeta-tion, reforestation is becoming increasingly popular, and preservation and recovery of forest areas has become a national priority for several Asian nations, although this practice is not as widespread as in the U.S.A. or in the European nations.

3. The nations in the Indian subcontinent, because of their enormous populations and deficiency in timber resources, are sensitive to the issue and have launched several reforestation programmes. China, Malaysia, and Turkey have also included in their national plans aimed at increasing forest lands and in the case of Turkey to reduce timber imports.

Methods for Conservation of Forests-

Forest conservation is the practice of planning and maintaining forested areas for the benefit and sustainability of future generations. Forest conservation involves the upkeep of the natural resources within a forest that are beneficial to both humans and the ecosystem. Following are the main steps required to be taken for the conservation of forests-

1. ***Regulated and planned cutting of trees.***
2. ***Control over forest fire.***
3. ***Reforestation and afforestation.***
4. ***Regulated forest clearance for agricultural and habitation purposes.***
5. ***Protection of forests ruthless industrial use.***
6. ***Proper utilisation of forest and forests products.***

7. ***Strict policies of government for forest conservation.***

CHECK YOUR PROGRESS - IV

Note (a) Write your answers in the space given below

(b) Check your answers with those given at the end of the lesson

1. Why conservation of forests is required? Write a short note.

____

____

2. Name the various methods of forest conservation?

____

____

5.7 LET US SUM UP

While reading this lesson, you have learnt about the forest and the basic concept of the forest. You have come to know that a forest is a natural resource comprising of collection of plants, wood, herbs and shrubs. Forests are essential for the survival of all the living organisms and for maintaining the ecological balance while some forests are specially valued by man to satisfy his material needs and desires such as soft wood forests. There has been great variability in the types and distribution of forest throughout the Asia, because of the climatic, soil, physiographic variations of the landscape. Climate is the single most important factor influencing the forest in an area. Thus, climatic classification of forest in Asia has been studied with their characteristics and distribution over space. Further, forest plays an important part in the existence of life on the surface of earth, but due to ruthless exploitation of forest have resulted in the global warming and ecological imbalance causing threat to the survival of life. Hence, it becomes imperative to study the methods for the conservations of forests, with which we have dealt in the later part of the lesson.

5.8 GLOSSARY

1. ***Afforestation*** - *Afforestation is the establishment of a forest or stand of trees in an area where there was no previous tree cover.*
2. **Ecological Balance** - The condition of equilibrium among the components of a natural community such that their relative numbers remain fairly constant and their ecosystem is stable. Gradual readjustments to the composition of a balanced community take place continually in response to natural ecological succession and to alterations in climatic and other influences.
3. **Relief** – Relief means the altitudinal variations in a landscape, generally from the mean sea level.
4. **Reforestation** - *Reforestation* is the natural or intentional re-seeding of existing forests and woodlands that have been depleted, usually through deforestation.
5. **Rainforest** - A luxuriant, dense forest rich in biodiversity, found typically in tropical areas with consistently heavy rainfall..
6. **Taiga** – Taiga also known as boreal forest or snow forest is characterized by coniferous forest consisting mostly of pines, spruces and larches located to the south of Tundra belt in the higher latitudes.
7. **Tundra** - A level or rolling treeless plain that is characteristic of arctic and subarctic regions, consists of black mucky soil with permanently frozen subsoil, and has a dominant vegetation of mosses, lichens, herbs, and dwarf shrubs.
8. **Tree Canopy** - Tree canopy is the aboveground portion of a plant community or crop, formed by the collection of individual plant crowns. Sometimes the term canopy is used to refer to the extent of the outer layer of leaves of an individual tree or group of trees
9. **Vegetation** – Vegetation refers to the collection of varieties of plants in a

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5.9 LESSON END EXERCISE

1. Define a forest. Discuss the etymological meaning of forest.
2. Enlist the factors affecting the growth of forests.
3. Classify the forests on the basis of climate.
4. Discuss the characteristics of Savanna forest with distribution.
5. Why conservation of forest is required?
6. What are various methods of forest conservation?

5.10 SUGGESTED FURTHER READINGS

1. Tirtha, R. (2001) Geography of Asia; Rawat Publications, New Delhi.
2. Drevitch, G. (2009) Asia; Scholastic Publications Pvt. Ltd; New Delhi.
3. Mamoria, C.B. (2018) Geography of Asia; Sahitya Bhawan Publications, Agra.
4. Khalid, R. (2008) Geography of Asia; Saksham Books International, Jammu.
5. Stamp, L.D. (1967) Asia: Regional & Economic Geography; Methuen Young Books.

5.11 ANSWERS TO CHECK YOUR PROGRESS

EXERCISE – 1

1. A forest comprise of plant community predominantly of trees and woody vegetation, usually with closed canopy. Legally it is an area proclaimed to be forest under forest law, an area set aside for the production of timber and other forest produce, or maintained under woody vegetation for certain indirect benefits.
2. Etymologically, The word forest comes from French word 'forès' which means vast expanse of land covered by trees"; first introduced in English as the word for wild land set aside for hunting without the necessity of the existence of trees.

EXERCISE – 2

1. Temperature, Precipitation, Relief, Topography, Sunlight, Soil and Wind are some of the physical factors influencing the growth of forests.

2. Temperature is the single most important factor influencing the growth of forest. Vegetation requires at least 6^{o}C of temperature to survive, in below than that temperatures plants cease to exist. Very high temperatures are also detrimental to the growth of plants. Moderate temperatures are conducive for the luxurious growth of the vegetation.

EXERCISE – 3

1. South of the Tundra region is the Taiga, a belt of coniferous forests, or the needle leaf evergreen forest, with a small, transitional zone of "wooden tundra". The trees have small leaves, deep roots, and thick bark, and thus most species (pine, spruce, fir, etc.) are successful in cold and dry environment. It covers most of Siberia from the Urals to the Pacific and northern part of Japan.

2. To the south of Taiga is elongated, unbroken stretch of the Steppes from Ukraine to Manchuria—a broad belt of several thousand miles of temperate grasslands in southern Siberia— a parkland country of open grasses. A large area of flat un-forested grassland in SE Europe or Siberia. There is some precipitation although the winters are still very cold, but the extreme temperature ranges of the Taiga are softened by the warm summers.

3. The vegetation consists of evergreen, broad-leafed tall, dense, high crowned trees of several species having a dense canopy above the floor because the region gets a high amount of precipitation throughout the year, and is constantly warm. Tropical rain-forests are typical to the equatorial regions. In Malaysia and Indonesia rainforests cover large section of the countries

EXERCISE – 4

1. The forest forms a major part of the biosphere and is essential for the survival of

life on the planet. It is important to note that over one- third of the continent's surface has been cleared for human settlement or given to permanent agriculture. Vegetation in such areas no longer remains "natural". In most areas of dense settlement the original forest has been entirely removed and no trace of undisturbed forest remains necessitating the conservation of forests.

2. Regulated and planned cutting of trees; Control over forest fire; Reforestation and afforestation; Regulated forest clearance for agricultural and habitation purposes; Protection of forests against ruthless industrial use; Proper utilisation of forest and forests products; Strict policies of government for forest conservation.

ASIA - MAJOR SOIL TYPES

6.0 STRUCTURE

6.1 INTRODUCTION

In lesson 5, we have studied about forest and the factors influencing the growth of forest. Till now, we knew that the survival of the life on the planet is impossible without forests, and soil at a place is one of the most vital factor responsible for the growth of forest. Also, we know that there is marked variation in the forests throughout the world caused by the variety of soils. Thus in the current lesson you will study about the soil, the factors responsible for soil genesis, types of soils, importance and methods of soil conservation.

6.2 OBJECTIVES

The main objective of this lesson is to make you aware-

1. Of the soil and the genesis of soil.
2. Basis of classification of soil.
3. Classification of soil.
4. Distribution of soil in Asia.
5. Conservation of soil.

6.3 DEFINITION & MEANING OF SOIL

Soil can be defined as "*the uppermost thin layer of the earth's crust consisting of loose, friable particles which sustains the organic and inorganic life forms.*" The soil covering the surface of the earth has taken millions of years to form. Soil is formed at a rate of only 1 cm every 100 to 400 years and it takes 3000 to 12000 years to build enough soil to form productive land. This means that soil is a non-renewable resource and once destroyed it is gone forever. If we disregard this, a time will come when there would not be enough soil left to sustain life on earth, because the soil is a necessary growth medium for plants, a home for certain insects and animals, as well as a medium from which we get minerals. It is important therefore to treat soil, especially topsoil, as a living being.

The word 'soil' carries different meaning for different people depending upon its properties. For a botanist soil means the top most layer of the crust where micro and macro insects thrive; for a geologist it means the structure, shape, rock type and the mineral content; for a pedologist it is the physical and chemical properties of the soil particles which are important; for an engineer soil refers to the sheer strength of its particles; whereas for a farmer soil means its fertility levels. Thus word soil has different connotations for different people.

CHECK YOUR PROGRESS

Note (a) Write your answers in the space given below

(b) Check your answers with those given at the end of the lesson

1. Define soil?

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2. What do you understand by the meaning of soil?

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6.4 GENESIS OF SOIL

In this portion we will study about the factors and processes responsible for the genesis of soil, also known as **Pedogenesis.** Formation of soil at a place is a function of many factors which works together to form the soils at a place, these include-

- Parent Rocks
- Climate
- Relief
- Organic Matter
- Time

Out of these the first four factors are the active factors whereas time is a silent factor. Parent rock provides the basic material for the formation of soil, which is weathered by the physical and chemical agencies of weathering. The soils in warmer climates are more mature due to higher bacterial activity as compared to cooler climates. The soil on the steep slope is thin whereas on the gentler slopes, the soil layer is deep. The humus content in the soil is high in the areas of warmer climate and rich vegetative cover as compared to cooler climates.

Along with the climate the distribution of soils is critically important to agricultural productivity, and thus has a special signifi-cance in Asia, as most Asians depend on agriculture for their livelihood. Wide range of interacting natural phenomena: **climate, natural vegetation, parent rock material** and **relief features** determines the de-velopment and nature of soils.

CHECK YOUR PROGRESS

Note (a) Write your answers in the space given below

(b) Check your answers with those given at the end of the lesson

1. Discuss the factors responsible for the formation of soil.

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____

6.5 CLASSIFICATION OF SOILS:

Soil classification is both complicated and subject to constant revision. In the case of Asia, the difficulty is compounded by the fact that a large part of it is physi-cally remote, or climatically inhospitable. It may be interesting to note that a small fraction of Asia's land surface comprise of really rich soils that have given sustenance to a large mass of humanity.

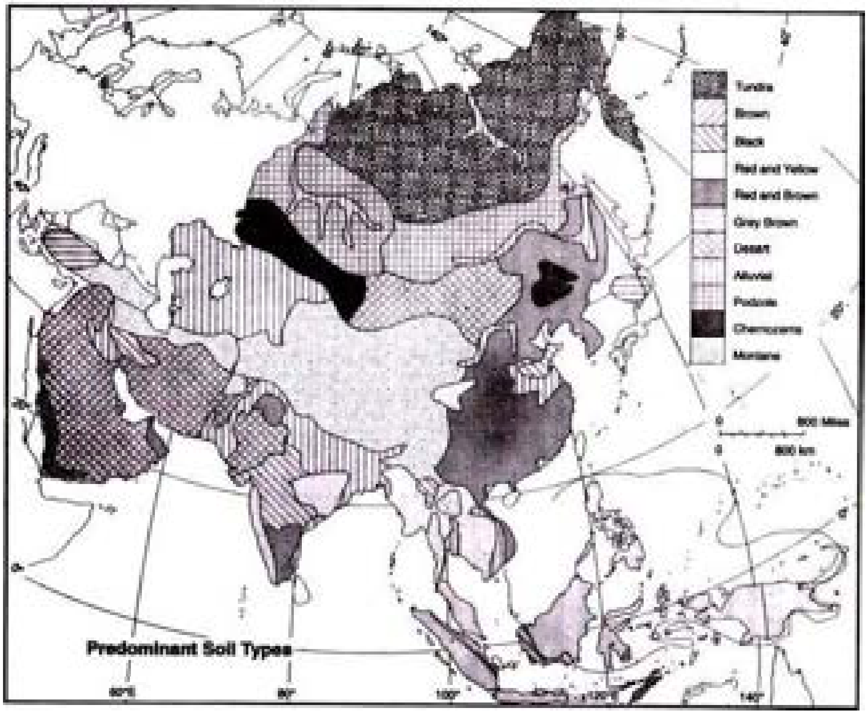
The most commonly used current classification at the present time—that of the U.S. Department of Agriculture known as the Seventh Approximation— has not gained much acceptance in most of the Asian nations. It may be convenient to generalize the distribu-tion patterns of soils by recognizing that there are basically three complex processes by which soils are formed; those of the hu-mid latitudes, of the tropical regions and of the deserts. Each of these processes are responsible for the formation of specific types of soils which can be defined in broad terms-

1. Pedocals - calcium-bearing soils.

2. Pedalfers - the aluminum-bearing soils.

In simple terms, this division separates the basic soils from the acidic soils. Soil patterns based on such classification point to some general tropi-cal regions.

Map 6.1 : Soil Types of Asia



Physiographic Classification of Soils-

It is an older system of classification developed mainly in the erst while USSR, which links the distribution of various soil types to the distribution of climate and vegetation. It is through the works of Dukuchaiev (former USSR), Glinka (former USSR) and Masbut (USA) that the zonal system of classification evolved.

According to this system, there are three major classes of soil types:

(i) Zonal soils are characterized by the dominant influence of climate.

(ii) Intra-zonal soils, on the other hand, have some local factor like moisture or parent rock having the dominant influence. The intra-zonal soils occur within broad zonal types on poorly draining sites.

(iii)Azonal soils are poorly developed and occur along the recent alluvium, steep slopes or sand deposits.

These main varieties have been further classified into the following soil types-

1. **Tundra Soils:** These soils extend over the tundra region, covering northern parts of Asia in Siberia bordering the Arctic Ocean. The exact character of these soils depends on the ground ice position, slope and the vegetation. If the slope is stable, peaty soils are formed due to slow organic and chemical action. In case of steep slopes, thin soils result. These soils are brown due to the glacial alluvial deposits and have a thick, organic horizon-A. The tundra soils generally have poorly developed horizons as there is no downward movement of moisture.

2. **Podzols:** These soils occur south of the tundra region in Central Siberia, Eastern Asia and Northern Japan and are associated with conifers plants. In these soils, the horizon-A is humus rich, horizon-E is bleached and ash- grey, horizon-B is brown clayey. These soils are generally infertile and require lime and fertilizers if put to agricultural use.

3. **Brown Forst Soils :** The soils are usually distinguished by their browncolor and lumpy, nutty texture. These soils occur south of the podzol region in milder climates of east Asian regions of Siberia, Cambodia, Laos, northern east India. These soils are associated with deciduous forests and derive their brown appearance from the equitable distribution of humus. The brown forest soils are generally less acidic.

4. **Lateritic Soils:** These soils cover large areas of Asia, in central and eastern India, Indonesia, eastern China, Myanmar and Sri Lanka. These soils are generally associated with tropical and sub-tropical climates with a short wet and long dry season and thick vegetation. During the dry season, there is intense physical and chemical weathering and organic activity and during the wet season, an intense leaching causes percolation down of humus, organic and mineral colloids, clay and other soluble material. The upper horizons are, acidic with minimum organic content. The insoluble oxides of iron and aluminium give the upper layers a red colour. The lower horizons are clayey. These soils are generally infertile due to low base status.

5. **Alluvial Soils :** These soils are formed by the sediments brought down by the rivers.

They are also rich in chemical ingredients. The rivers deposit very fine particles of soil called alluvium in their plains during their long course of journey. Alluvial soil is also known as riverine soil because it is mainly found in the river basin. Alluvial soils are very fertile. They contains potash, phosphoric acid and lime which are ideal for the growth of sugarcane, paddy, wheat and other cereal and pulse crops. The soils over the river val-leys of the Tigris-Euphrates, the plains of Indus-Ganga Rivers, the lower Irrawaddy basin, the deltas of the Mekong and the lower basins of Chang Jiang, Huang ho Rivers, as well as the river plains of smaller rivers in India, Malaysia, the Philippines, Taiwan, Korea, and Japan. These, in a very large measure, provide substance to the growing population of Asia.

6. **Black Soil :** Black lava soil is characteristic of Deccan Trap region of Peninsular India. The soils are sticky when wet and develop cracks when dry. These soil suits cotton cultivation.

7. **Chernozem/Prairie/Steppe Soils:** These soils are associated with grasslands receiving moderate rainfall in the western Siberia, Asia Minor, Afghanistan, western India. The chernozems are characterized by high mineral content and low organic content. Calcium carbonate is quite high in the profile. The upper horizons are dark, mineral base rich. The humus content is around 10 percent. The parent material of chernozems may be 'loess' (wind eroded sediments). The soft, crumb structure imparts fertility to these soils.

The chestnut soils occur on the arid side of chernozems, and are associated with low-grass steppe. The lime content is still higher in these soils compared to the chernozems.

The prairies represent the transitional soils between chernozems and the brown forest soils and reflect the element of increasing wetness. These soils are characterized by less leaching, no calcium content and taller, coarser grasses.

8. **Reddish Brown Soils:** These are dark clayey soils of savanna grasslands which occur on the drier margins of the laterites. These regions experience warm climate with wet-dry seasons. The whole soil is base-rich which gives these soils a dark appearance. These soils support scattered trees, low scrubs and grasses. During the dry season, these soils show cracks. These soils are located in central India, western Pakistan, central Japan and western China.

9. Desert Soils: The desert soils occur in the tropical deserts of the Arabia, central Asia, China, western India. These soils are characterized by lack of vegetation and lack of leaching. The insoluble oxides of aluminum give these soils a light grey to dark colour. The desert soils are generally base rich, sandy and gravelly.

10. Volcanic Soils : Several islands of Indonesia and south-ern Philippines contain active volcanoes that periodically provide a new layer of rich basic soils of recently deposited vol-canic materials (not all volcanic soil consists of basic material; some retain their fertility for long periods as these are re-newed occasionally by new deposits, and account for enormous densities of rural population in Java and some areas of the Philippines).

CHECK YOUR PROGRESS

Note (a) Write your answers in the space given below

(b) Check your answers with those given at the end of the lesson

1. Discuss the two main varieties of Seventh Approximation Classification.

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2. Discuss the three main classes of physiographic classification of soil?

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3. Write a short note on Alluvial soil.

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6.6 EROSION & CONSERVATION OF SOIL

We know that, it had taken million of years for the surface of earth to get covered with soil. The process of soil formation is extremely slow and it takes around 400 years to build 1cm thick soil cover over the rock surface and around 10,000 to 15,000 years to form soil cover just enough to sustain crop and making a fertile land. This means that soil is a non-renewable resource and once destroyed it is gone forever.

If we disregard this, a time will come when there would not be enough soil left to sustain life on earth, because the soil is a necessary growth medium for plants, a home for certain insects and animals, as well as a medium from which we get minerals. It is important therefore to treat soil, especially topsoil, as a living being.

Soil Erosion

"The conservation of natural resources is the fundamental problem. Unless we solve that problem, it will avail us little to solve all others." - ***Theodore Roosevelt***

"Soil erosion occurs when soil is removed through the action of wind and water at a greater rate than it is formed."

When a raindrop hits soil that is not protected by a cover of vegetation and where there are no roots to bind the soil, it has the impact of a bullet. Soil particles are loosened, washed down the slope of the land and either end up in the valley or are washed away out to sea by streams and rivers. Erosion removes the topsoil first. Once this nutrient-rich layer is gone, few plants will grow in the soil again. Without soil and plants the land becomes desert like and unable to support life.

Factors Influencing Soil Erosion:

There are many factors which influence the process of soil erosion; these are discussed below:

1. **Rainfall:** Precipitation is the most forceful factor causing erosion. Erosion is dependent on the amount, duration, intensity and frequency of rainfall. By the action of dashing rain drops on soil, soil granules are loosened, detached and separated into fine particles. Erosion is greater where the rainfall is not only heavy, but concentrated over short periods.

2. **Slope of Topography:** The slope accelerates erosion as it increases the velocity of the flowing water.

3. **Vegetation:** The vegetative cover protects the soil from the beating and dispersing action of the raindrops by forming a canopy over the soil surface. Vegetation also acts as a mechanical obstruction to flowing water, thus reducing its erosive potential. The plant

roots help in building a better structure. They said in opening the soil and thereby accelerating water absorption and reducing surface run-off.

4. Tillage: The infiltration and permeability of the soil is improved by the practice of proper tillage and thereby reducing the chances of erosion. But excess tilling exposes the soil to erosion, especially by wind.

5. Nature of the Soil: Erodability of the soil is influenced by the nature of the soil, particularly its texture, structure, organic matter, amounts and kinds of salts present, presence of hard pan in the soil and presence of high water table.

6. Soil Moisture: The presence of high water table checks the infiltration and permeability, thus allowing more flow of water on the surface, and greater erosion. At the same time, long continuous rainless periods cause loosening of soil and thus expose the soil to erosion by wind.

7. Wind Velocity: Stronger winds have greater erosive potential, thus wind velocity is directly proportional to intensity of erosion.

8. Overgrazing: Overgrazing caused by the animal flocks in the pastures which uproots the grass from the soil and disintegrates the soil particles, which becomes susceptible to erosion.

CHECK YOUR PROGRESS

Note (a) Write your answers in the space given below
(b) Check your answers with those given at the end of the lesson

1. What do you understand by soil erosion?

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2. What are the factors of soil erosion?

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3. Discuss tillage as a factor of soil erosion.

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Conservation of soil

The ruthless exploitation of fertile soil has brought the land at the verge of losing its fertility, by loosing many of its nutrients; which greatly affects the production of crops and will put the society on the verge of food shortage and put the brakes on the pace of development. An all out effort is required to conserve the soil from physical factors like wind and rain water.

Soil conservation includes all those measures which help in protecting the soil from erosion and exhaustion. Soil erosion has been continuing over such a long time that it has assumed alarming proportions. Soil is our most precious asset and no other gift of nature is so essential to human life as soil. Productive soil alone ensures prosperous agriculture, industrial development, economic betterment and a higher standard of living. The main methods of soil conservation are-

1. ***Afforestation:*** The best way to conserve soil is to increase area under forests. Indiscriminate felling of trees should be stopped and efforts should be made to plant trees in new areas. A minimum area of forest land for the whole country that is considered healthy for soil and water conservation.

2. ***Checking Overgrazing:*** Overgrazing of forests and grass lands by animals, especially by goats and sheep, should be properly checked. Separate grazing grounds should be earmarked and fodder crops should be grown in larger quantities. Animals freely move about in the fields for grazing and spoil the soil by their hoofs which leads to soil erosion.

3. ***Construction of Dams:*** Much of the soil erosion by river floods can be avoided by constructing dams across the rivers. This checks the speed of water and saves soil from erosion.

4. ***Changing Agricultural Practices:*** We can save lot of our valuable soil by bringing about certain changes in our agricultural practices like crop rotation, cropping patterns, manuring etc..

5. ***Contour Ploughing:*** If ploughing in done at right angles to the hill slope, following the natural contours of the hill, the ridges and furrows break the flow of water down the hill This prevents excessive soil loss as gullies are less likely to develop and also reduce run-off so that plants receive more water.

6. ***Terracing and Contour Bunding :*** Terracing and contour bunding which divides the hill slope into numerous small slopes, checks the flow of water, promotes absorption of water by soil and saves soil from erosion. Retaining walls of terraces control the flow of water and help in reducing soil erosion.

CHECK YOUR PROGRESS

Note (a) Write your answers in the space given below

(b) Check your answers with those given at the end of the lesson

1. Why conservation of natural soil is the need of the hour?

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2. Write various methods of soil conservation.

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3. Write a note on contour ploughing.

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6.7 LET US SUM UP

In this lesson, you have learnt about the soils and its meaning which varies for different professionals. Various factors responsible for the genesis of soil are studied. Classification of soil has been studied on various basis such Seventh Approximation and Physiographical. Further you have studied about the depletion or erosion of soil which requires judicious management of soil and discouraging the tendency of over-grazing and faulty agrarian activities. Also, you have studied about the need for conservation of soil, so that the food safety and development in the society can be ensured. In the last, you have studied about the factors of soil erosion and the methods of soil conservation.

6.8 GLOSSARY

1. **Azonal soil** – These soils are poorly developed soils that occur along the recent alluvium, steep slopes or sand deposits.
2. **Chernozem** – The chernozems are characterized by high mineral content and low organic content. Calcium carbonate is quite high in the profile. The upper horizons are dark, mineral base rich. The humus content is around 10%. The parent material of chernozems may be 'loess' (wind eroded sediments).
3. **In situ** – In situ refers to the location of a phenomenon to its original place of origin.
4. **Parent rock** – Parent rock is the basic rock which provides basic material for the formation of soil. On this basic material, all other factors operate to create soil.
5. **Pedology** – Pedology is the branch of science which deals with the study of various aspects of soil – its structure, texture, permeability and chemical attributes.
6. **Pedocals** – These are soils having higher content of calcium.
7. **Pedalfers** – These are the soils having higher content of aluminium.
8. **Soil -** The uppermost thin layer of the earth's crust consisting of loose, friable particles which sustains the organic and inorganic life forms.

6.9 LESSON END EXERCISE

1. Define soil and discuss its meaning.
2. Discuss the factors of pedo-genesis.
3. Write a note on the basis of soil classification.
4. Discuss the main types of physiographic classification of soil with distribution in Asia.
5. What do you understand by the soil erosion?

6. What are the main methods of soil conservation?

6.10 SUGGESTED FURTHER READINGS

1. Tirtha, R. (2001) Geography of Asia; Rawat Publications, New Delhi.
2. Drevitch, G. (2009) Asia; Scholastic Publications Pvt. Ltd; New Delhi.
3. Mamoria, C.B. (2018) Geography of Asia; Sahitya Bhawan Publications, Agra.
4. Khalid, R. (2008) Geography of Asia; Saksham Books International, Jammu.
5. Stamp, L.D. (1967) Asia: Regional & Economic Geography; Methuen Young Books.

6.11 ANSWERS TO CHECK YOUR PROGRESS

EXERCISE – 1

(i) Soil can be defined as "*the uppermost thin layer of the earth's crust consisting of loose, friable particles which sustains the organic and inorganic life forms.*"

(ii) The word 'soil' carries different meaning for different people depending upon its properties. For a botanist soil means the top most layer of the crust where micro and macro insects thrive; for a geologist it means the structure, shape, rock type and the mineral content; for a pedologist it is the physical and chemical properties of the soil particles which are important; for an engineer soil refers to the sheer strength of its particles; whereas for a farmer soil means its fertility levels. Thus word soil has different connotations for different people.

EXERCISE – 2

(i) Formation of soil at a place is a function of many factors which works together to form the soils at a place, these include parent rocks, climate, relief, organic matter, time. Out of these the first four factors are the active factors whereas time is a silent factor.

EXERCISE – 3

(i) The most commonly used current classification at the present time—that of the

U.S. Department of Agriculture known as the Seventh Approximation. There are basically three complex processes by which soils are formed; those of the hu-mid latitudes, of the tropical regions and of the deserts. Each of these processes are responsible for the formation of specific types of soils which can be defined in broad terms-

1. Pedocals - calcium-bearing soils.
2. Pedalfers - the aluminum-bearing soils.

In simple terms, this division separates the basic soils from the acidic soils.

(ii) There are three major classes of soil types:

1. **Zonal soils** are characterized by the dominant influence of climate.
2. **Intra-zonal soils**, on the other hand, have some local factor like moisture or parent rock having the dominant influence. The intra-zonal soils occur within broad zonal types on poorly draining sites.
3. **Azonal soils** are poorly developed and occur along the recent alluvium, steep slopes or sand deposits.

(iii) These soils are formed by the sediments brought down by the rivers. They are also rich in chemical ingredients. The rivers deposit very fine particles of soil called alluvium in their plains during their long course of journey. Alluvial soil is also known as riverine soil because it is mainly found in the river basin. Alluvial soils are very fertile. They contains potash, phosphoric acid and lime which are ideal for the growth of sugarcane, paddy, wheat and other cereal and pulse crops.

EXERCISE – 4

(i) "Soil erosion occurs when soil is removed through the action of wind and water at a greater rate than it is formed."

(ii) Rainfall, slope of topography, vegetation, tillage, nature of the soil, soil moisture, wind velocity, overgrazing are some of the factors of soil erosion.

(iii) The infiltration and permeability of the soil is improved by the practice of proper tillage and thereby reducing the chances of erosion. But excess tilling exposes the soil to erosion, especially by wind.

EXERCISE – 5

(i) The process of soil formation is extremely slow and it takes around 400 years to build 1cm thick soil cover over the rock surface and around 10,000 to 15,000 years to form soil cover just enough to sustain crop and making a fertile land. This means that soil is a non-renewable resource and once destroyed it is gone forever. that is why conservation of soil is the need of the hour.

(ii) Afforestation, checking overgrazing, construction of dams, changing agricultural practices, contour ploughing, terracing and contour bunding are some of the methods of soil conservation.

(iii) When the ploughing in done at right angles to the hill slope, following the natural contours of the hill, the ridges and furrows break the flow of water down the hill. This prevents excessive soil loss as gullies are less likely to develop and also reduce run-off so that plants receive more water.

ASIA - AGRICULTURE (CONDITIONS OF GROWTH, PRODUCTION AND DISTRIBUTION OF RICE, WHEAT, JUTE AND TEA)

7.0 STRUCTURE

7.1 INTRODUCTION

Previous lesson was concerned with the study of soil resource of Asia, its physical and chemical attributes, classification of soil, various causes of soil erosion and the methods of soil conservation. Since, soil of an area greatly influences the agriculture of that very region and Asia is the largest continent on earth, inhabiting around 60 percent of the world's total population. Thus the study of agriculture assumes significance because of the food requirements of such huge population base. So, in present lesson, you will study about the agriculture in Asia, factors affecting agriculture, the conditions suitable for the production of various food and cash crops and the problems faced by agriculture in Asia.

7.2 OBJECTIVES

Main objective of this lesson is to make you aware of the relationship between the agriculture in an area and the physical attributes of that area and after going through the lesson you will be able to :–

1. Define agriculture and factors influencing agriculture.
2. Conditions for the growth of rice, wheat, jute and tea.
3. Production and distribution of rice, wheat, jute and tea in Asia.
4. Problems faced by agriculture in Asia.

7.3 DEFINITION OF AGRICULTURE

Definition: The word *agriculture* comes from the Latin words ager, means the soil & cultura, means cultivation. "*Agriculture* can be defined as the cultivation and/or production of crop plants or livestock products." It is the cultivation of land and breeding of animals and plants to provide food, fiber, cereal and other products to sustain and enhance life. Agriculture was the key development in the rise of sedentary human civilization, whereby farming of crops created food surplus that enabled people to think about other aspects of life. The study of agriculture is known as agriculture science. The history of agriculture dates back thousands of years; people gathered wild grains at least 105,000 years ago and began to plant them around 11,500 years ago.

7.4 FACTORS AFFECTING AGRICULTURE

There is marked variations in the agriculture practices and cropping patterns throughout Asia because of various factors. These factors can be categories in the following headings-

1. **Physical Factors** : Physical factors affecting agriculture includes: (i) climate (ii) soil and (iii) topography.

(i) Climate : Climate plays a dominating role in agriculture. Plants require sufficient heat and moisture for their growth. Plant life is not possible in dry areas except that with the help of irrigation. The moisture requirements vary from plant to plant and region to region. In the lower latitudes, where temperature is high, plants need more moisture for their growth (75cm to 100cm).

(ii) Soils : The richness of soil is another important physical factor affecting agriculture. The chemical composition of the soil determines its productivity. The fertility of the soils decreases with constant cultivation. Soils become infertile if the fertility is not renewed. This can be achieved by leaving the land fallow, by rotation of crop and by use of manures and fertilizers.

(iii) Topography : The nature of topography plays a significant role in the development of agriculture. Plain regions have fertile soils. The flat topography encourages the use of machines. The alluvial plains, the river valleys and the deltas are very suitable for agriculture.

2. **Economic Factors**

The most important economic factors affecting agriculture are: (a) market (b) transport facilities (c) labour (d) capital (e) Government policies.

(a) Market : Market is an important economic factor in agriculture. The distance from the market determines the cost of transportation. Agricultural crops like vegetables etc. are grown near the market. Sugarcane is grown close to the urban centres, where sugar mills have developed. Similarly, dairy farming is developed around the cities, which serve as markets for the dairy products.

(b) Transport Facilities : The development of efficient means of transportation widen the market for agricultural products.

(c) **Capital :** Agriculture, in the modern times is becoming mechanized. This involves huge capital investments. Purchase of machinery, fertilizers, pesticides and high yielding variety seeds require plenty of money. The factor of availability of capital plays a significant role in the development of agriculture.

(d) **Labour** : The supply of labour determines the character and type of agriculture. Intensive cultivation requires a large supply of cheap labour. Availability of cheap and efficient labour is essential for the cultivation of crops like rice, tea, cotton and rubber.

(e) Government Policies : The policies of the Government also influence agricultural land use. The Government may restrict the cultivation of a crop or may force the farmers to grow a particular crop.

3. Other Factors

(i) The level of scientific and technological development has a great bearing on agriculture. Farmers, using primitive methods obtain poor yields. But on the other hand, where farmers are using modern farm technology in the shape of fertilizers, pesticides, machinery and high yielding variety seeds etc. the farm yields are high.

The system of land tenure also plays a significant role in the patterns and productivity of agriculture crops.

CHECK YOUR PROGRESS

Note (a) Write your answers in the space given below
(b) Check your answers with those given at the end of the lesson

1. What do you understand by the term 'agriculture'?

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2. Discuss the factors affecting agriculture.

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7.5 PROBLEMS OF AGRICULTURE IN ASIA

Asian agriculture has been tradition bound in majority of the regions and is reeling with the problems of declining production, fragmented landholdings, less use of fertilizers and poor post harvest technologies and diminishing returns etc. Following are some of the problems being faced by the agriculture in Asia.

1. **Stagnant, Decelerating and Declining Productivity :** Yield decline is noticed when in order to get the same yield level, increased amounts of inputs are needed. Yield decline may occur when management practices are held constant on intensive irrigated systems, owing to changes in soil properties and improper nutrient balance. It also leads to a depletion of soil fertility when inputs do not replenish extracted nutrients. The need for designing regional programmes of action to enhance and sustain production and to attain durable food security and environmental protection in the Asian Region is required. The development of more location specific technologies for crop management, Integrated Pest Management, Integrated Nutrient Management, technology transfer to further reduce the yield gap, and manpower development in appropriate areas would needs to be handled. The sharing, testing and utilization of technology and knowledge across national boundaries have to be facilitated.

2. **Declining Production Resources :** Owing to industrialization, urbanization, crop diversification and other economic factors land under agriculture is shrinking. Under these pressures in China, the rice area declined from 37 million ha in 1976 to 31 million ha in 1996. A similar trend of negative growth is visible in many countries. Growing urbanization and industrialization will further reduce the agricultural labour, increase the labour wages and farm size, needing more mechanization.

3. **Deteriorating soil health :** The continuous cropping, either singly or in combination, has brought about a decline in soil health through nutrient deficiencies, nutrient toxicity, salinity and overall physical deterioration of the soil. Saline and alkaline soils cover millions of hectares in several South and South-East Asian countries. Also upland cultivation has promoted soil erosion in the fields and clogged irrigation and drainage canals down stream. The over use or improper use of irrigation without drainage encouraged waterlogging, resulting in salinity build-up and other mineral toxicities. Proper technology backed by policy support and political will is needed for addressing these issues.

4. Low Efficiency of Nitrogen Fertilizers: Urea is the predominant source of nitrogen (N) in the fields. But its actual use by the plant is not more than 30 percent meaning thereby that 70 percent of the applied nitrogen goes either into the air or into the water, endangering the environment and human health. Further research is needed to understand and avert this situation.

5. Ever-changing balance of rice and pests : Pests (including insect-pests and diseases) of crops evolved under the influence of host genes are changing the cropping-environment. Thus, scientists are in a continuous war with ever changing races, pathotypes and biotypes of pests. New and more potent genes, being added continuously using conventional or biotechnological tools, fight a losing battle. But these efforts are essential to add stability to production and avoid the recurrence of the great Bengal famine of the Indian sub-continent, or brown plant hopper catastrophe of Indonesia and the Philippines, or blast and cold damage experienced in the Republic of Korea and Japan during 1996.

6. Increasing cost of production : By the adoption of modern high yielding varieties and technologies, the unit cost of production and global prices have came down. But since the beginning of the 1990's, unit production costs are beginning to rise and the farmers are facing declining profits. A stagnant yield frontier and diminishing returns to further intensification are the primary reasons for the reversal in profitability. Contemporaneous changes in market factors especially land, labour and water are driving up input prices. Rapid withdrawal of labour from the agricultural sector, diversion of land for other agricultural and non-agricultural purposes, increased competition for water, and withdrawal of subsidies for inputs have contributed to the current situation and may worsen it in the future.

CHECK YOUR PROGRESS

Note (a) Write your answers in the space given below
(b) Check your answers with those given at the end of the lesson

1. Enlist the main problems faced by the agriculture in Asia?

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7.6 CONDITIONS FOR THE GROWTH, PRODUCTION & DISTRIBUTION OF RICE

More than 90 percent of rice is produced and consumed in Asia. In terms of food consumption, what distinguishes Asia from the rest of the world is its great dependency on rice. It is the basic staple for the majority of the population. The introduction of high-yielding varieties in the late 1960s, which marked the beginning of the Green Revolution, has more than tripled Asian rice production in the past four-plus decades, from 200 million tonnes (paddy equivalent) in the early 1960s to more than 600 million tonnes in 2010. This has been possible with the introduction of modern varieties with assured irrigation, subsidized inputs such as fertilizer, fuel, and pesticides. During this period, more than 1,000 modern varieties were released to farmers in Asian countries.

Conditions for the Growth of Rice

Suitable factors required for the cultivation of rice are : 1. Temperature, 2. Rainfall, 3. Soils, 4. Surface, 5. Fertilizers and 6. Labour.

1. **Temperature:** Rice is a tropical crop and grown where the average temperature during the growing season is between 20°C and 27°C. Abundant sunshine is essential during its four months of growth. The minimum temperature should not go below 15°C as germination cannot take place below that temperature.

2. **Rainfall:** Paddy requires more water than any other crop. As a result, paddy cultivation is done only in those areas where minimum rainfall is 115 cm. Although the regions having average annual rainfall between 175-300 cm are the most suitable. Paddy also needs flooded conditions with the depth of water varying over 25 mm at the time of transplanting to as much as 150 mm for 10 weeks of the growing period.

3. **Soils:** Paddy is grown in wide range of soil, from the podzolic alluvium of China to the impermeable heavy clay of central Thailand and riverine alluvium of Indo-Gangetic Plains. Fertile riverine alluvial soil is best for rice cultivation. Clayey loam soil in monsoon land is considered to be the best for rice cultivation as water retention capacity of this soil is very high. Rice is also grown in saline areas of deltic region. Rice cultivation needs high fertilizer appli-cation.

4. **Topography:** Unlike other crops, paddy needs a level surface to enable the fields to be flooded at least during the growing period. It's ideal habitat is therefore in the great alluvial deltas and river basins of the world: the Ganges, Siking, Yangtzekiang, Irrawaddy, Menam Chao Phraya and Mekong, where there is practically no gradient.

5. **Fertilizers:** Paddy requires three essential plant nutrients: nitrogen, phosphorus and potassium. Most paddy lands have a moderate quantity of such nutrients, but if they are deficient, organic manure or artificial fertilizers have to be used.

6. **Labour:** Paddy cultivation is extremely labour-intensive, therefore, requires more labour in comparison to other cereal crops. Labour is necessary for- preparing the field, weeding, sowing, transplanting, manuring, harvesting, threshing, winnowing and milling. For rice cultivation large number of cheap labour is required.

Production of Rice

The seed of rice had its origin from China some 5000 years ago. Today, the majority of all rice produced comes from China, India, Indonesia, Bangladesh, Vietnam, Thailand, Myanmar, Pakistan, Philippines, Korea and Japan. The tropical region of Asia or Monsoon Asia is the largest rice-producing area. The countries of this region together produce 90 per cent of the global output of rice. The total production of paddy in Asia was 447 mmt in 2014. China has been a leading producer with a share of around 32 percent in Asian output, followed by India with a share of 23 percent, Indonesia is ranked third in rice output in Asia. Bangladesh, Vietnam, Thailand and Philippines are ranked fourth, fifth and sixth in Asia in the production of rice (Table 7.1).

Table 7.1 : Asia Rice Production in major countries of Asia

Countries	Production in MMT (2014)	%age
China	142.3	31.8
India	105.0	23.4
Indonesia	37.4	8.3
Bangladesh	34.6	7.7
Vietnam	27.8	6.2
Thailand	20.5	4.6
Philippines	11.6	2.6

Distribution of Rice in Asia

More than 90 percent of global rice is produced and consumed in Asia. In terms of food consumption, what distinguishes Asia from the rest of the world is its great dependency on rice: it is the basic staple crop for the majority of the population.

1. **China :** In China rice culture has been developed in early phase of civilization, therefore, it is a traditional rice-producing country. With the intro-duction of several HYV rice seeds, China now has increased its production several times and is in a position to provide food to its large population. China is the not only Asian but world's largest producer of rice, and the crop makes up a little less than half of the country's total grain output. China accounts for 26 percent of all world rice production. In a given year total rice output came from four different crops. The early rice crop grows primarily in provinces along the Yangtze River and in provinces in the south mainly Hunei, Guanxi, Shanxi, Shandung, Szechuan; south-west China, Kwangtung region.

2. **India :** India is the second largest rice-producing country in the Asia. Its average annual production is 105 million metric tonnes, which is about 20 per cent of the world total. Rice is the staple food and cultivated in most of the states of India. Among the regions Ganga-Brahmaputra valley contributes the largest amount of rice followed by coastal regions. The major rice-producing states in India are West Bengal, Bihar, Tamil Nadu, Andhra Pradesh, Uttar Pradesh, Madhya Pradesh, Karnataka, Assam and Odisha. With the help of irrigation, improved seeds, use of fertilizers, multiple cropping, the production of rice is increasing but its average yield is still low in comparison to other important rice-producing countries.

3. **Indonesia:** It is the third largest rice-producing country in the Asia. The average annual rice production of Indonesia is 37 million metric tonnes. In Indonesia rice is produced in many islands but the main rice-producing areas lie in Java, Sumatra and Borneo.

4. **Bangladesh:** The total area under rice average of nearly 10 million hectares and the annual output of nearly 30 million metric tonnes make Bangladesh a major Asian rice producer. The bulk of the rice fields are un-irrigated in the Ganges delta region, where annual rainfall is more than 250 cm and soil is heavy and wet all the time.

5. Vietnam: Vietnam is the Asia's fifth largest rice-producing country. Rice production has continuously increased, from 25 million tonnes in 1995 to almost 28 million tonnes in 2014. This increase can be attributed to some expansion of rice harvested area and higher yield. Rice yield improved to 5.3 t/ha in 2014 from 3.7 t/ha in 1995.

6. Japan: Japan is the country which has not only developed rice cultivation under adverse topographical conditions but is also a leading producer of rice. It ranks 10th in world and 5th in Asia in rice production. In Japan rice dominates the low alluvial filled valleys and coastal plains. Kwanto plain is the main rice producing region of Japan. The Japanese have introduced high yielding 'Japonica' paddy hybrids which increase output tremendously. The average yield of rice in Japan is as high as 6,166 kg/hectare. Double cropping of rice is also practised in the southern regions of Japan.

7. Others: Apart from above mentioned countries, South-East Asian countries are also leading producers of rice. In fact, all the countries of South-East Asia produce rice. But, the main countries are Vietnam, Thailand, Myanmar and Philippines. These countries rank 6th, 7th, 8th and 9th in rice production. Thailand and Myanmar are considered the 'rice bowl of Asia'. Other countries of South-East Asia which produce rice are Cambodia, Laos and Malaysia. Pakistan also produces rice and ranks 12th in world's rice-producing countries. Rice is also produced in South Korea. In Taiwan, paddy is grown on the wetter west coast. Rice was grown in some areas of Mesopotamia (southern Iraq). With the rise of Islam it moved north to Nisibin, the southern shores of the Caspian Sea (in Gilan and Mazanderan provinces of Iran) and then beyond the Muslim world into the valley of the Vilga. Rice is also grown in Saudi Arabia at Al-Hasa Oasis and in Yemen.

CHECK YOUR PROGRESS

Note (a) Write your answers in the space given below

(b) Check your answers with those given at the end of the lesson

1. Write a short note on the origin of rice?

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2. Discuss the production of rice in Asia.

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7.7 CONDITIONS FOR THE GROWTH, PRODUCTION & DISTRIBUTION OF WHEAT

Wheat is third most produced valuable cereal on earth. Highest wheat producing countries are mostly from hot areas. Presently around 700 million ton of wheat is cultivated on the planet. Wheat producing countries have large export around the globe. Instantly it is utilized as a part of diverse sort of eating things like scones and bread. Wheat, the basic 'bread-grain" of the European civilization, has been the Chief Source of human food for at least the past 6,000 years. It probably originated in Asia Minor and the middle East, gradually spreading across the Mediterranean to European countries much later it was taken by colonist to the new world.

Types of Wheat : Depending upon the season of sowing the wheat have been classified into the following two types-

Winter Wheat: Wheat is called winter wheat when sown in the late autumn or early winter season and harvested with the onset of summer. In the areas at or below 40^{O} latitudes, Winter wheat is grown as it requires low temperatures at the sowing time whereas winter is mild and cool in these regions. Almost three-fourth world requirement of wheat is met by winter sowing of wheat.

Spring wheat: When wheat is grown during the summer season is referred to as spring wheat. It is generally grown in the colder areas above 60^{O} latitudes, where the summers are cool, such as the Siberian plains, the Canadian prairies, the Scandinavian region etc. In these areas winter temperature may drops below freezing point and cultivation is not possible.

Geographical Conditions favourable for the growth of Wheat

Suitable graphical conditions required for wheat cultivation are: 1. Temperature, 2. Rainfall, 3. Soils, 4. Topography and 5. Economic Factors.

1. **Temperature:** The temperature required for wheat during growing season is around 15.5°C. The weather should be warm and moist during the early stage of growth and sunny and dry in the later stages. The average temperature of the hottest month should not exceed 20°C. A frost-free period of 100 days is usually required but some fast-ripening varieties may mature only in 90 days.

2. **Rainfall:** The amount of rainfall required for wheat cultivation varies between 30 cm and 100 cm. The major wheat lands of the temperate regions have an annual rainfall of 38 cm to 80 cm. The spring wheat region of Canadian Prairies only receives around 46 cm of rainfall, but it comes in the early summers when the wheat is growing. Wheat is also grown in areas having lesser amount of rainfall, i.e., 25 cm. This has been done by adopting dry farming method. Also where irrigation facil-ities are available, wheat is cultivated in dry lands also.

3. **Soils:** The soil suitable for wheat is either light clay or heavy loam. The world's best wheat comes from the chernozem soils in the 'Black Earth' region of the Ukrainian Steppes, the dark brown soil of South and Central Asia and also the grey brown podzolic soils of the deciduous forest region.

4. **Topography:** Wheat is grown in plain as well as in rolling topography, which provides adequate drainage and at the same time facilities of the use of machinery. The world's largest commercial wheat lands are the undulating temperate grasslands of Steppes and Prairies.

5. **Economic Factors:**

   The economic factors that favour wheat cultivation are:

   (i) Technology: In wheat cultivation maximum use of technology is possible. The commercial wheat farming is technology-intensive cultivation which requires tractors, harvesters, threshers, elevators, etc.

   (ii) Transport: Wheat farming is also linked up with export. Therefore, a good transport network is essential for its successful cultivation.

   (iii) Capital: It is a capital-intensive farming; therefore, sufficient capital is required.

(iv) Market: Both internal and external markets are essential for the profitable wheat cultivation.

Production and Distribution of Wheat (2015)

The total wheat production in the world in 2007-08 was 610 million metric tonnes, which increased in 2008-09 to 658 million metric tonnes and in 2009-10 as 683 million metric tonnes, by the year 2015 wheat production in the world increased to 717 million metric tonnes. China produces highest quantity of wheat in Asia as well as in the world, i.e., 130 million metric tonnes, followed by India at 89 million metric tonnes. Pakistan and Uzbekistan are at third and fourth position in wheat production in the Asia. The other leading countries in wheat production are Afghanistan, Nepal, Bangladesh, Tajikistan, Japan etc. All these countries together used to produce more than 10 million metric tonnes of wheat annually. About 35 percent of the world's wheat is grown in China, India, Pakistan and Uzbekistan.

Map : 7.1- Distribution of Wheat in Asia

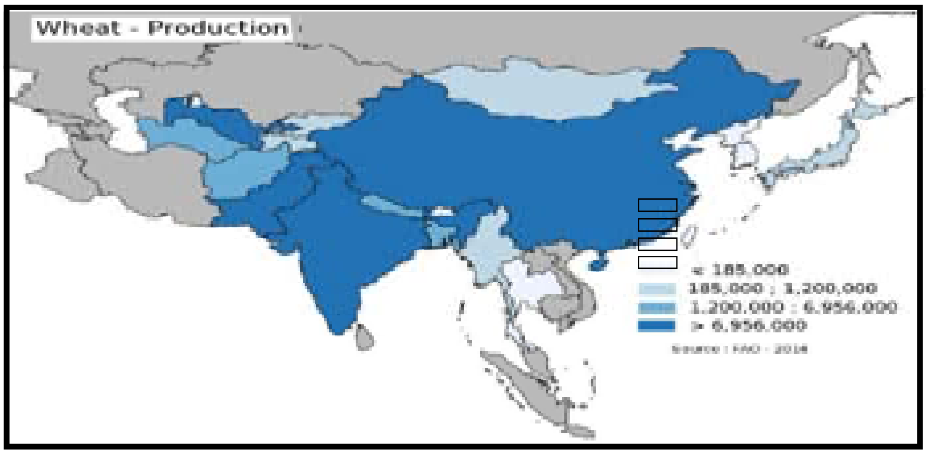

Table 7.2 - Production of Wheat 2015

Rank	Country Name	Production in Million Metric Tonnes	%age share
1	China	130.19	18.15
2	India	88.94	12.40
3	Pakistan	27.9	4.1
4	Uzbekistan	7.95	1.6
5	Afghanistan	5.93	1.1
6	Nepal	1.97	0.7

Wheat-producing areas of the Asia are distributed in all parts of the continent.

China: China is the largest producer of wheat in the Asia as well as the world and its average annual production is 130 million metric tonnes. Production of wheat in China has registered a spectacular increase in recent years. The productivity of wheat is 4.69 metric tonnes per hectare. In China intensive-mechanized wheat farming is done. Wheat is produced chiefly in the north of the country in the Huang He (Hwang Ho) basin and in Manchuria. But now wheat is also grown in other areas like -

(a) North-East China includes Beijing and Manchurian plain.

(b) South-East China includes Human and Yangtze fertile plain. In this region spring wheat cultivation is done.

(c) North China Plain and Kaoliang Region are famous for winter wheat. The Hwang Ho valley is considered as the best wheat-producing region.

India: India is the second largest producer of wheat in the Asia. In 2015, it produced 89 million metric tonnes of wheat. India has registered a massive increase in wheat production after 'Green Revolution'. The climate of northern plain of India with its mild, rainy winter and hot dry summer is highly favorable for wheat production. The major wheat-producing states are: Punjab, Uttar Pradesh, Haryana, Madhya Pradesh, Bihar, Rajasthan, Maharashtra and Gujarat. The yield of wheat in India is 2.79 tonnes per hectare, which is lower in comparison to other leading wheat-producing countries.

Pakistan: Pakistan is also a leading wheat-producing country in the Asia and ranks 4th in wheat production. Its wheat production in 2007-08 was 23.30 million metric tonnes which has increased to 27.91 million metric tonnes in 2015. The Indus Plain is the main wheat-producing region of Pakistan. The geographical conditions of the Indus Plain are suitable for wheat production, besides it is also grown in North-West Frontier Province and Baluchistan.

Uzbekistan: Uzbekistan is the 4th largest producer of wheat in Asia and its production was 7.95 million metric tonnes in 2015 accounting for 1.6 percent of the total production of Asia. The major areas of wheat cultivation are Surkhandarya, Kashkandarya, Tashkent, Samarkhand, Bukhara etc.

Afghanistan : Afghanistan ranked 5th in the production of wheat in Asia with a percentage share of around 1 percent with a production of 5.93 million metric tonnes in the year 2015. The main provinces engaged in wheat production are Heart, Bamyan, Helmand, Balkh provinces etc. Wheat is a major staple crop in Afghanistan.

Others: Apart from above mentioned important countries, wheat is also produced in many other countries of the Asia. The other important wheat-producing countries are Iran, Turkey, Nepal, Indonesia, Japan, Bangladesh, Tajikestan etc.

CHECK YOUR PROGRESS

Note (a) Write your answers in the space given below

(b) Check your answers with those given at the end of the lesson

1. Discuss conditions suitable for wheat cultivation.

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2. Write a short note on the varieties of wheat.

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3. Name the chief wheat producing nations of Asia.

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7.8 CONDITIONS FOR THE GROWTH, PRODUCTION & DISTRIBUTION OF JUTE

Jute is a natural fiber popularly known as the golden fiber. It is one of the cheapest and the strongest of all natural fibers and considered as fiber of the future. Jute is second only to cotton in world's production of textile fibers. India, Bangladesh, China and Thailand are the leading producers of Jute. It is also produced in southwest Asia and Brazil. The jute fiber is also known as Pat, Kosta, Nalita, Bimli or Mesta. The two main types of jute, white jute and dark jute or tossa are grown in India, Bangladesh, Thailand, China, south Asian countries.

Conditions for the growth of jute

Jute is a kharif crop. It is sown in March-April on lowlands and in May-June on uplands. The geographical and climatic conditions for jute cultivation is given below:

1. **Temperature and Humidity:** Jute thrives well in a hot damp climate. Monthly average temperature to the extent of 26ºC is ideal. Temperature may fluctuate between 24ºC and 37ºC, the optimum being around 34ºC. Average humidity of 80 percent to 90 percent is necessary.

2. **Rainfall:** Jute is a thirsty plant. Jute requires sufficient rainfall well distributed over the period of growth. The pre-monsoon fall though low (varying from 25 centimeter to 55 centimeter) is necessary as it promotes the growth of the plant until it gets heavy rainwater. An annual average rainfall exceeding 150 centimeter is ideal for Jute cultivation-. Occasional rainfalls at intervals favour the growth of Jute.

3. **Soils:** Jute plant is called fertility-exhausting plant. Therefore, Jute needs new alluvial soils. In absence of new alluvial soils, application of chemical fertilizer is needed. Jute is also grown in clayey soils, but the fibers become sticky. Sandy soils produce coarse fiber.

4. **Water bodies:** Water for soaking of plants and washing the striped fiber is needed.

5. **Labor:** A large supply of cheap labor is needed.

6. **HYV:** In order to increase the yield of Jute fibers, improved seeds such as JRC-212, JRC-7447, JRO-632, JRO-7835, etc. are used.

Production of Jute : Jute is one of the most important natural fibers after cotton in terms of cultivation and usage. Cultivation is dependent on the climate, season, and soil. The world production of jute was 35.7 lakh tonnes in 2011 out of which Asia's contribution was 34 lakh tonnes. Continent of Asia is undisputed leader in jute production. In Asia as well, it is concentrated mainly in the two countries of India and Bangladesh which produces more than 90 percent of the world production. The other countries in the production of jute are China, Uzbekistan, Nepal, Vietnam, Myanmar etc.

Table 7.3 - Production of Jute in Asia

Countries	Production in LMT (2011)	%age
India	19.6	54.7
Bangladesh	15.2	42.5
China	0.4	1.1
Uzbekistan	0.2	0.5
Nepal	0.1	0.3

Distribution of jute in Asia : Jute is a rain-fed crop with little need for fertilizer or pesticides, in contrast to cotton's heavy requirements. Production is concentrated mostly in Bangladesh, as well as India's states of Assam, Bihar, and West Bengal. India is the world's largest producer of jute, followed by Bangladesh.

India : Almost 85 percent of the Asia's jute cultivation is concentrated in the Ganges Delta. This fertile geographic region is shared by both Bangladesh and India. India is the largest producer of jute goods in the Asia. The cultivation of Jute in India is mainly confined to the eastern region states West Bengal, Bihar, Assam, Tripura, Meghalaya, Orissa and Uttar Pradesh. Nearly 50 percent of total raw jute production in India alone comes from West Bengal.

Bangladesh : Bangladesh is the largest producer of raw jute in Asia as well as in the world. The districts for jute cultivation are Mymensingh, Dacca, Rangpur, Bogra and Paina all bordering on the Brahmaputra or the Jamuna in Bangladesh; they also provide clear water for retting the jute than the Ganga.

The cultivation of jute decreases towards the south in the Ganga Delta where the land is too low for jute and towards west where the rocky ground of the Southern Plateau is more marked than the Ganga alluvium. In year 2011, the production of jute was 15,20,000 metric tons, which was 42.5 percent of the asian production.

China : China is the third largest producer of the jute and in 2011 its production was 40,000 metric tons which was 1.1 percent of the asian production. Other countries are the minor jute-producing countries

Apart from the above, the other jute-producing countries of the world are China, Thailand, Myanmar, Brazil, Uzbekistan, Nepal and Vietnam.

CHECK YOUR PROGRESS

Note (a) Write your answers in the space given below

(b) Check your answers with those given at the end of the lesson

1. Write a short note on jute fibre.

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2. Name the various countries producing jute in Asia with production?

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7.9 CONDITIONS FOR THE GROWTH, PRODUCTION & DISTRIBUTION OF TEA

Tea is the manufactured drink most consumed in the world. Discovered about 2700 BC, it is one of the oldest beverages in the world. The tea crop has rather specific agro-climatic requirements that are only available in tropical and subtropical climates, while some varieties can tolerate marine climates of British mainland and Washington area of the Unites States.

Geographical Conditions of Growth:

Climate- Tea bush is a tropical and sub-tropical plant and thrives well in hot and humid climate. The ideal temperature for its growth is 20°-30°C and temperatures above 35°C and below 10°C are harmful for the bush.

Rainfall- It requires 150-300 cm annual rainfall which should be well distributed throughout the year. While prolonged dry spell is harmful for tea, high humidity, heavy dew and morning fog favour rapid development of young leaves. Alternate waves of warm and cool winds are very helpful for tea leaves.

Soils- Tea bush grows well in well drained, deep, friable loams. However, virgin forest soils rich in humus and iron content are considered to be the best soils for tea plantations.

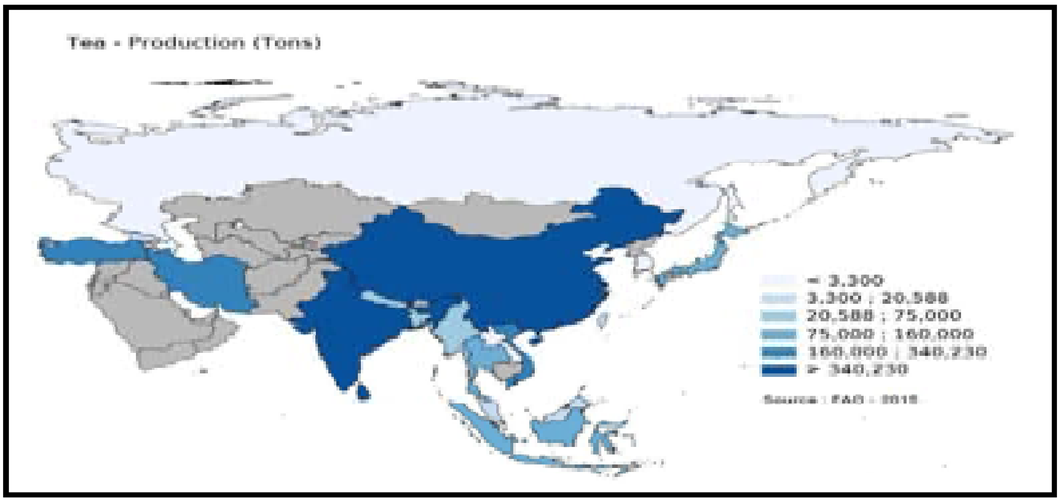
Fertilizers- In order to increase the yield, proper dose of nitrogenous fertilizers such as ammonium sulphate should be given to soil.

Topography- Although tea requires heavy rainfall for its growth, stagnant water is injurious to its roots. It is, therefore, grown on hill slopes where water drains away easily and water-logging does not take place.

Labour- Tea is a labour intensive crop and requires abundant supply of cheap and skilled labour, especially at the time of plucking the tea leaves. For this purpose, women labourers are employed in large numbers. Women constitute over 50 per cent of the total workforce.

Production of Tea: In the world thirty countries are producing more than 2.50 billion kilograms of tea annually from 2.56 million hectares of plantation. After meeting their domestic consumption, 28 countries export around 1.02 billion kilograms of tea annually. World production of all types of tea has increased from 4.69 million tonnes in 2013 to 5.19 million tonnes in 2015 with great regional variations. Asia is the leading continent in the production of tea. The production in Asia was 420 million tonnes in 2015 which accounts for 81 percent of the world production.

Map 7.2 - Distribution of Tea in Asia



Distribution of Tea: There are many factors which determine the production of tea, hence spatial variations can be seen in the distribution of tea producing areas throughout Asia.

Table 7.4 - Major Tea Producing Countries in Asia

S. No.	Country	Tea Production (metric tonnes)	% of World Production
1	China	1,924,457 mt	36.0
2	India	1,208,780 mt	22.6
3	Sri Lanka	340,230 mt	6.3
4	Vietnam	214,300 mt	4
5	Turkey	212,300 mt	4
6	Iran	160,000 mt	3.2
7	Indonesia	148,100 mt	3

Source: FAO, 2015

China : China is indisputably the largest producer of tea in the world, producing 1,924,457 metric tonnes in 2015 alone almost 36 percent of the total amount produced in the world year. It has been consumed as everything from a beverage to a medicine, and is at the center of countless cultural rituals in the nation. Several varieties are produced in China including green, oolong, white, puerh, yellow, and jasmine teas to name a few. Tea is grows mainly in highland areas especially in the Yang-tze valley and in Szechwan Basin green tea is produced.

India : India is the second largest producer of tea in the world, producing an average 1,208,000 metric tonnes in the year 2015. The production of tea on commercial lines began only after Britishers introduced it in India from China. India, besides a major producer, is also a major consumer of tea in the world and nearly 70 percent of its production is consumed locally. The three mains regions of tea production in India are- Assam Valley, Himachal Pradesh and Southern India.

Sri Lanka : In 1867, British planter James Taylor started a tea plantation in the Sri Lankan city of Kandy. The industry grew from the original small plots of tea to over over 188,175 hectares today, and tea production is now one of the island nation's largest industries, employing over a million Sri Lankan workers. In the year 2015 Sri Lankan has produced tea around 3,40,230 metric tonnes. Sri Lanka, the nation formerly known as Ceylon, produces three main varieties: Ceylon black, Ceylon green, and Ceylon white tea.

Turkey : In 2015, Turkey produced 225,000 tonnes of tea leaf. Surprisingly, nearly all the crop grown in Turkey is produced within a small region located near the city of Rize. The wet climate, topography, and proximity to the Black Sea make for ideal growing conditions. Turkey mainly produces black tea, also known as Turkish tea, as well as Rize tea. While Turkish coffee is world famous, tea culture in Turkey is also strong, and there is a very specific way of brewing it. Traditionally, Turkish tea is brewed in a samovar (self boiler), creating a concentrated brew, which is them diluted with water when served.

Indonesia : Indonesians began tea production in the 1700, having been introduced to the crop via Dutch colonialism. The tea culture didn't take off with the locales the same way it did with other colonial producers; In 2013, Indonesia produced 150,100 tonnes, however, 65% of that was exported from the country. Indonesian production focuses predominantly on black tea, though small amounts of green are also produced. Additionally, many varieties grown here aren't well known globally, as much of the Indonesian crop is used in blends; mixed with other teas. Besides, tea production is also carried out in the countries like Vietnam, Japan, Iran, Argentina etc.

CHECK YOUR PROGRESS

Note (a) Write your answers in the space given below

(b) Check your answers with those given at the end of the lesson

1. Write a short note on tea crop.

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2. Name the various countries producing tea in Asia with production?

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7.10 LET US SUM UP

This chapter deals with the agricultural scenario prevailing in the continent of Asia. The various factors affecting agriculture in Asia were analyzed. Conditions of growth production as well as distribution of crops like Rice, Wheat, Jute & Tea were analyzed. We learned that Asia is the leading producer of Rice, Jute & Tea in the world. Jute cultivation being concentrated in the S.W. Asia especially the Gangas delta . Rice forms the staple diet of majority of popluation in Asia.

7.11 GLOSSARY

Agriculture – It is the cultivation of land and breeding of animals and plants to provide food, fiber cereal and other products to sustain and enhance life.

Climate – climate is the average of various attributes of weather such as temperature, wind speed, humidity, pressure, sunlight, cloud cover etc. at a place. The data about these variables is generally observed for 36 years.

Green Revolution – A phase in Indian agriculture concerned with the great increase in production of food grains (such as rice and wheat) due to the introduction of high-yielding varieties, use of pesticides, and better management techniques.

Fertilizers – Natural or artificial substance containing the chemical elements that improve growth and productiveness of plants. Fertilizers increase the natural fertility of the soil or replace the chemical elements taken from the soil by previous crops.

Humidity – *The amount of moisture available in per unit mass of air is known as humidity.*

Relief – Relief means the altitudinal variations in a landscape, generally from the mean sea level.

Rainforest - A luxuriant, dense forest rich in biodiversity, found typically in tropical areas with consistently heavy rainfall..

Temperature – The degree of hotness or coldness of a body is referred to as temperature. It is measured in ^{O}C or ^{O}F.

7.12 LESSON END EXERCISE

1. Define agriculture. Discuss the etymological meaning of agriculture.
2. Enlist the factors influencing agriculture.
3. Discuss the problems being faced by Asian agriculture.
4. Give the production and distribution of rice in Asia.
5. Give the production and distribution of wheat in Asia.
6. Give the production and distribution of tea in Asia.
7. Give the production and distribution of jute in Asia.

7.13 SUGGESTED FURTHER READINGS

1. Tirtha, R. (2001) Geography of Asia; Rawat Publications, New Delhi.
2. Drevitch, G. (2009) Asia; Scholastic Publications Pvt. Ltd; New Delhi.
3. Mamoria, C.B. (2018) Geography of Asia; Sahitya Bhawan Publications, Agra.
4. Khalid, R. (2008) Geography of Asia; Saksham Books International, Jammu.

5. Stamp, L.D. (1967) Asia: Regional & Economic Geography; Methuen Young Books.

7.14 ANSWERS TO CHECK YOUR PROGRESS

EXERCISE – 1

(i) "*Agriculture* can be defined as the cultivation and/or production of crop plants or livestock products." It is the cultivation of land and breeding of animals and plants to provide food, fiber cereal and other products to sustain and enhance life.

(ii) Physical factors affecting agriculture includes: (i) climate (ii) soil and (iii) topography. The most important economic factors affecting agriculture are: (a) market (b) transport facilities (c) labour (d) capital (e) Government policies (f) The level of scientific and technological development has a great bearing on agriculture (g) The system of land tenure also plays a significant role in the patterns and productivity of agriculture crops.

EXERCISE – 2

(i) Asian agriculture has been tradition bound in majority of the regions and is reeling with the problems of declining productivity, fragmented landholdings, less use of fertilizers and poor post harvest technologies and diminishing returns etc. Following are some of the problems being faced by the agriculture in Asia.

EXERCISE – 3

(i) The seed of rice had its origin from China some 5000 years ago. Today, the majority of all rice produced comes from China, India, Indonesia, Bangladesh, Vietnam, Thailand, Myanmar, Pakistan, Philippines, Korea and Japan.

(ii) The tropical region of Asia or Monsoon Asia is the largest rice-producing area. The countries of this region together produce 90 percent of the global output of rice. The total production of paddy in Asia was 447 mmt in 2014. China has been a leading producer with a share of around 32 percent in Asian output, followed by India with a share of 23 percent, Indonesia is ranked third in rice output in Asia.

Bangladesh, Vietnam, Thailand and Philippines are ranked fourth, fifth and sixth in Asia in the production of rice.

EXERCISE – 4

(i) The temperature required for wheat during growing season is around 15.5°C. A frost-free period of 100 days is usually required. The amount of rainfall required for wheat cultivation varies between 30 cm and 100 cm. The soil suitable for wheat is either light clay or heavy loam. The world's best wheat comes from the chernozem soils in the 'Black Earth' region of the Ukrainian Steppes, the dark brown soil of South and Central Asia and also the grey brown podzolic soils of the deciduous forest region. Wheat is grown in plain as well as in rolling topography, which provides adequate drainage and at the same time facilities of the use of machinery.

(ii) Depending upon the season of sowing the wheat have been classified into the following two types- Winter wheat & Spring wheat. Wheat is called **winter wheat** when sown in the late autumn or early winter season and harvested with the onset of summer. In the areas at or below 40^{O} latitudes, Winter wheat is grown as it requires low temperatures at the sowing time whereas winter is mild and cool in these regions. Almost three-fourth world requirement of wheat is met by winter sowing of wheat. When wheat is grown during the summer season is referred to as **spring wheat**. It is generally grown in the colder areas above 60^{O} latitudes, where the summers are cool, such as the Siberian plains, the Canadian prairies, the Scandinavian region etc. In these areas winter temperature may drops below freezing point and cultivation is not possible.

(iii) By the year 2015 wheat production in the world increased to 717 million metric tonnes. China produces highest quantity of wheat in the Asia as well as world, i.e., 130 million metric tonnes, followed by India at 89 million metric tonnes. Pakistan and Uzbekistan are at third and fourth position in wheat production in the Asia. The other leading countries in wheat production are Afghanistan, Nepal, Bangladesh, Tajikistan, Japan etc. All these countries together used to produce more than 10 million metric tonnes of wheat annually. About 35 percent of the world's wheat is grown in China, India, Pakistan and Uzbekistan.

EXERCISE – 5

(i) Jute is a natural fiber popularly known as the golden fiber. It is one of the cheapest and the strongest of all natural fibers and considered as fiber of the future. Jute is second only to cotton in world's production of textile fibers. It is also produced in southwest Asia and Brazil. The jute fiber is also known as Pat, Kosta, Nalita, Bimli or Mesta. The two main types of jute, white jute and dark jute or tossa are grown in India, Bangladesh, Thailand, China, south Asian countries.

(ii) The world production of jute was 35.7 lakh tonnes in 2011 out of which Asia's contribution was 34 lakh tonnes. Continent of Asia is undisputed leader in jute production. In Asia as well, it is concentrated mainly in the two countries of India and Bangladesh which produces more than 90 percent of the world production. The other countries in the production of jute are China, Uzbekistan, Nepal, Vietnam, Myanmar etc.

EXERCISE – 6

(i) Tea is the manufactured drink most consumed in the world. Discovered about 2700 BC, it is one of the oldest beverages in the world. The tea crop has rather specific agro-climatic requirements that are only available in tropical and subtropical climates, while some varieties can tolerate marine climates of British mainland and Washington area of the Unites States.

(ii) In the world thirty countries are producing more than 2.50 billion kilograms of tea annually from 2.56 million hectares of plantation. After meeting their domestic consumption, 28 countries export around 1.02 billion kilograms of tea annually. Asia is the leading continent in the production of tea. The production in Asia was 420 million tonnes in 2015 which accounts for 81 percent of the world production. China is the leading producer with 36 percent, India 22.6 percent, Sri Lanka 6.3 percent, Vietnam 4 percent, Turkey 4 percent, Iran 3.2 percent etc.

LESSON NO. 8	UNIT - II

ASIA - DISTRIBUTION AND DENSITY OF POPULATION AND URBANIZATION

8.0 STRUCTURE

8.1 INTRODUCTION

The previous lesson was devoted to the study of various attributes of agriculture in Asia. As we know, Asia assumes a significant position in agricultural production, which is sufficient enough only to support its huge population base. It becomes imperative to study the population resource of Asia. In this lesson, we shall be studying about the population of Asia, its distribution, density and the process of urbanization in Asia.

8.2 OBJECTIVES

Main objective of this lesson is to make you aware of the population resource of Asia. Its arrangement on land, its density and the process of growth of urban population in Asia and after going through the lesson you will be able to –

1. Discuss the concept of density, distribution and urbanization.
2. Factors affecting population attributes.
3. Distribution of population in Asia.
4. Density of population in Asia.
5. Process of urbanization in Asia.

8.3 CONCEPT OF DENSITY, DISTRIBUTION OF POPULATION & URBANIZATION IN ASIA

Density of population :

One of the important indices of population concentration is the density of population. It is defined as the number of persons per sq. km. The absolute or total population figure may also give an inadequate picture of population pressure. A better idea of population pressure is provided by a measurement, known as population density, which indicates population pressure in terms of the number of people per unit of land (e.g., per sq. mile or per sq. km). ‘It is a quantitative aspect of population. The statistical density for the land area of the world is about 42 persons per sq km. The figure for Asia rises to 104 persons per sq. km, making the overall Asian density, the highest among all the continents.

Distribution of population

Population distribution refers to the arrangement of people on the land. It is the spatial arrangement of population. It is the proportion of population located at different locations in an area or region. it is a qualitative aspect of population.

Urbanization of population

Urbanization refers to the increase in the urban population to the total population in an area. It deals with the study of growth in urban people in comparison to rural people. It is an indicator of rapid industrialization in the area.

CHECK YOUR PROGRESS

Note (a) Write your answers in the space given below
(b) Check your answers with those given at the end of the lesson

1. Differentiate between density, distribution and urbanization.

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8.4 FACTORS AFFECTING DENSITY, DISTRIBUTION & URBANIZATION OfPOPULATION

The main factors affecting the density, distribution and urbanization of population are listed under:

In many parts of the Asia, population attributes are too high in some areas while in others it is very low because of -

1. **Fertile Land:** Human settlements on large scale are at places which are more fertile and where with less efforts the agricultural yield is more. On the other hand, places which are less fertile have less density of population. As such, hilly and rocky regions are less densely populated where as riverine plains are densely populated.

2. **Availability of Mineral Wealth:** Every nation possesses some type of mineral wealth. The regions of mineral wealth become a major source of industrialization and employment of a country. They attract people from far and near. At such places, the density of population

is high due to centralization of industries.

3. Availability of Water Supply: Water is essential for life. The places which have abundant water for daily consumption and for agricultural purposes are moderately to densely populated. In the present era, even industries are established at places which have sufficient supply of water.

4. Increased facility of Transportation and Communication: Since ancient times areas with proper transportation and communication facilities have enjoyed large population. Means of transportation and communication increase the exchange of commodities between peoples and regions. Thus, the density of population increases in area well connected.

5. Availability of Electricity: Ready and sufficient supply of electricity is an essential feature in development of areas. The density of population increases where the social amenities are available.

6. Favourable Climate: From the beginning of human civilization, favourable climate is considered as an important factor responsible for human habitation. The density is nearly zero in places which are extremely hot or extremely cold. The parts which have moderate climate are inhabited on a large scale.

7. Social Factors: Social factors also affect the distribution and concentration of population. Where social customs and taboos are extreme, people tend to migrate to another place, so the density of population of that area changes.

8. Migration of Population: Every time migration of population takes place, it has an important effect on the distribution of population. The places with more opportunities of employment or possibilities of high income generation attract people from different areas.

9. Political Factors: For changes in the world's population distribution, political factors are also responsible. In modern times, these factors have become more important. If the people feel that their expectations are not fulfilled by the government, or if the public is dissatisfied with the political system, then they leave that country and settle in another. Thus alters the population attributes of a region.

10. Historical Factors: People like to settle at places where their ancestors have lived in the past. Sons and grandsons from generation to generation live at a place which they do not leave so easily.

11. Economic Factors: This has been considered an important factor affecting the distribution and concentration of population at one place. The places which have good opportunities for employment and possibilities of trade in industrial products attract migrants from different areas.

CHECK YOUR PROGRESS

Note (a) Write your answers in the space given below

(b) Check your answers with those given at the end of the lesson

1. Discuss the main physical factors influencing population location.

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2. Discuss social factors influencing population location.

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8.5 DISTRIBUTION OF POPULATION IN ASIA

Asia is the largest and most populous of earth's continents and it's located in both the northern and eastern hemispheres. Asia comprises a full 30 percent of the world's land area with sixty percent of the world's current population. It also has the highest growth rate, and its population almost quadrupled during the 20^{th} century. The estimated population for Asia in 2016 is 4.4 billion. Asia comprises the eastern 4/5 of Eurasia, bounded by the Pacific Ocean on the east, the Indian Ocean on the south and the Arctic Ocean on the north. There are a total of 50 countries in Asia.

In 2016, the population of Asia is estimated at 4.4 billion. Russia is excluded from Asia's population, although there are about 40 million Russians who live in Asia, or east of the Ural Mountains. Asia has the two most populous countries in its borders: China and India. China is currently the most populous country on earth with an estimated population in 2016 of 1,377,124,512. It accounts for 31.6 percent of Asia's total population and over 18 percent of the world's population. India is not too far behind with an estimated population of 1,285,800,000, accounting for 29.36 percent of the continent's population and 17.5 percent of the world's population. It's estimated that India's population will surpass China's by 2022, when each country will have a population of about 1.45 billion people.

Characteristics of Asia's Population

- The current population of Asia is 4,456,030,996 as of December, 2016, based on the latest United Nations estimates.
- Asian population is equivalent to 59.78 percent of the total world population.
- Asia ranks number 1 among all regions of the world by population.
- The population density in Asia is 143 per Km^2 (370 people per mi^2).
- The total land area is 31,022,549 Km2 (11,977,868 sq. miles)
- 48.1 percent of the population is urban (2,161,443,094 people in 2016)
- The median age in Asia is 30.7 years.

The highest population in Asia is found in the Southern Asia, which accounts for 41 percent of the Asian population in the countries of India, Pakistan, Indonesia etc. Eastern Asia comprising of the countries of China, Japan, Taiwan, North & South Korea accounts for 36 percent of the total population of Asia. South East Asia inhibits the 14 percent of the Asia's population and is ranked three. Western and Central Asian regions accounts for around 6 percent and 1 percent of the population respectively, inhospitable terrain and climatic conditions are responsible for sparse population in these regions.

Table 8.1 - Regional Distribution of Population in Asia, 2016

Area	Population
Southern Asia	1,846,767,481 (41.3%)
Eastern Asia	1,618,777,725 (36%)
South-Eastern Asia	640,619,303 (14.4%)
Western Asia	261,762,231 (5.8%)
Central Asia	68,297,733 (1.5%)

Within Asia there are significant variations in population distribution. The largest two of the Asian nations—China and India—account for three-fifths of Asia's total population, and the remaining two-fifths shared by forty six countries in Asia. Six of the Asian countries have populations greater than 100 million (Bangladesh, China, India, Indonesia, Japan and Pakistan) making each one of them larger than any European country. Twenty one Asian countries have small populations, less than 10 million inhabitants. With a few exceptions (Cambodia, Kyrgyzstan, Mongolia, and Turkmenistan) these nations are small in area as well.

The distribution of population in various countries of the Asia depicts that China has the largest population base in the world as well as in Asia. The percent share of china in world population is around 19 percent where as in reference to Asia it contributes 36 percent population. India holds the second spot in the population base with a share of 30 percent in Asia's total population. Indonesia is ranked third in Asia in terms of population with a contribution of 5.9 percent. Pakistan follows Indonesia at fourth rank with a population of 4.3 percent and Bangladesh at fifth rank having 3.6 percent of population. The lowest populous countries in Asia includes those of Maldives- 345,000; Brunei- 421,000; Macau- 641,000; Bhutan- 760,000; Timor-Leste- 1.24 million etc.

CHECK YOUR PROGRESS

Note (a) Write your answers in the space given below

(b) Check your answers with those given at the end of the lesson

1. Write a short note on the population of Asia.

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2. Enlist the countries of Asia according to their population.

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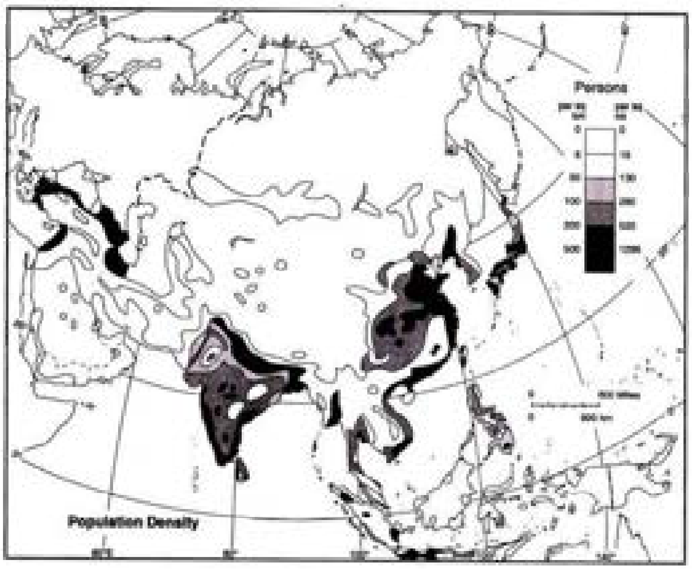
8.6 DENSITY OF POPULATION IN ASIA

The concept of average density of population did not hold good for Asia as a whole, as a large part of the continent consists of land that discourages settlement—hot deserts, high plateaus and rugged mountains. A more significant measurement that describes the relationship between population and development of areas relates people to the cultivated area or growth of capital and industrial production, technology and other economic and social indicators.

Table 8.2 - Population Density of Asia (2016)

S. No.	Country	Population	Density (P/Km^2)
1	China	1,382,323,332	147
2	India	1,326,801,576	446
3	Indonesia	260,581,100	144
4	Pakistan	192,826,502	250
5	Bangladesh	162,910,864	1252

Map 8.1 - Density of Population in Asia



Map shows the pattern of popula-tion density within the continent river plains in South Asia, Southeast Asia and East Asia contain among the highest densities in the world, often exceeding 2,000 persons per sq mile. The notable examples are: the Indus Ganga Plains in north India, the lower Irrawaddy basin in Myanmar, the lower basin of Chao Phraya River in Thailand, the lower Mekong basin, and the lower basins of Huanghe, Chang Jiang, and Xijiang rivers in China. In these fertile river basins, large populations can be supported under conditions of perennial irrigation and double cropping. Elsewhere, high densities exist in the accessible coastal plains of central and southern Japan, most of South Korea, the islands of Java and Bali in Indonesia, and the coastal plains of Vietnam and Taiwan.

As a sharp contrast, large parts of Asia's interior and of Southwest Asia are too cold, too rugged, or too dry to be attractive for settlement. Densities are as low as 5 persons per sq mile in such areas. Significantly, an important factor to note is that population densities have been, in general, on the increase everywhere in the continent, as elsewhere in the world.

a. **Countries with very high density of more than 800p/sq. km-** this category includes the smaller countries as well as those having high urban population and includes Macau, Singapore, Bahrain, Hongkong and Bangladesh.

b. **Countries with high density between 500 – 800p/sq. km-** the countries of Taiwan and Lebanon falls in this category.

c. **Countries with moderate density between 200-500p/sq. km-** many of the Asian nations fall in this category like South Korea, Israel, India, Philippines, Japan etc.

d. **Countries with low density between 50 – 200p/sq. km-** the less hospitable parts of the continent in terms of terrain and climate are included in this category such as China, Indonesia, Thailand, Qatar, Turkey, Malaysia etc.

e. **Countries of very low density of less than 50p/sq. km-** the most un-favourable conditions for the settlement of population have resulted in the very low density of population of these countries. It includes Yemen, Iran, Afghanistan, Bhutan, Saudi Arabia etc.

CHECK YOUR PROGRESS

Note (a) Write your answers in the space given below

(b) Check your answers with those given at the end of the lesson

1. What do you understand by the term 'population density'?

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2, Name the countries of Asia in the very low density group.

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8.7 URBANIZATION IN ASIA

Urbanization refers to the steady increase in urban population in comparison to rural population prominently due to town ward migration, high birth rates in urban areas and growth of potential urban centres. Asia is moving into an era of unprecedented urbanization, a change bringing prosperity and problems.

In 2010, Asia's urban population amounted to 754 million people, which is more than the combined population of the United States of America and the European Union. Now, almost half of the population, namely 45.5 percent in the region, is living in urban areas.

Trends of Urbanization

Following table reveals the growth pattern of urban population in Asia since 1960s. During 60's the total urban population was just 21 percent in comparison to 79 percent of rural population. The urban population increased to 32 percent in the year 1990 registering an increase of 10 percent over a period of 30 years. But the urban population soon reached 45 percent in the year 2010 and by 2016, it has doubled from 1970 to reach at 49 percent. The major reason behind this tremendous increase is the rural to urban migration.

Table 8.3 - Asia : Growth of Urban Population (1960-2016)

Year	Urban Population Growth (%)
1960	21.2
1970	23.8
1980	27.2
1990	32.4
2000	37.5
2010	44.7
2016	48.7

Urbanization rates in Asia vary widely by sub-region. In South and South-West Asia only 34 percent of the population lives in urban areas. Overall it is expected that the urbanization rate in the whole region will reach 50 percent in 2026. Almost half of the world's mega-cities (11 out of 22) are now found in Asia. Seven of the 10 most populous cities of the world are in the Asian region, namely Tokyo, Delhi, Shanghai, Mumbai, Beijing, Dhaka and Kolkata. Overall, mega cities (with population over 10 million) and metropolitan areas (with populations between one million and 10 million) are home to 11 and 29 percent of Asia's urban population, respectively. Mega cities may account for only 11 percent of Asia's urban population but they are driving force of regional and global economies.

Urbanization in countries of Asia

The growth of urban population in the countries of Asia has been uneven, there are certain countries having cent-percent urban population whereas many other countries are having majority of rural population.

Table 8.4 : Asia Urban Population of Major Countires of Asia

S. No.	Country	Urban Pop (in %)
1	China	57.9
2	Indonesia	54
3	Pakistan	38.9
4	Bangladesh	34.9
5	India	32.4

Countries with very high urbanization 100 percent - Some of the countries in Asia are having whole of their population living in the urban areas and are totally urbanized. These are highly industralised economies and include countries of Singapore, Macau, Hongkong etc.

Countries with high urbanization of 70-100 percent - in this category the Asian countries of Qatar, Kuwait, South Korea, Japan, Bahrein and U.A.E. is included.

Countries with medium urbanization of 40-70 percent - Oman, Malaysia, Turkey, Iran, Iraq, North Korea, China, Thailand etc are included in this category.

Countries with low urbanization of less than 40 percent- Indonesia, Philippines, Maldives, Uzbekistan, Pakistan, Burma, India, Bangladesh etc. are included in this category.

CHECK YOUR PROGRESS

Note (a) Write your answers in the space given below

(b) Check your answers with those given at the end of the lesson

1. Discuss the concept of urbanization?

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2. Discuss the trends of urbanization in Asia.

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8.8 LET US SUM UP

While reading this lesson, you have learnt about the forest and the basic concept of the forest. You came to know that a forest is a natural resource comprising of collection of plants, wood, herbs and shrubs. Forests are essential for the survival of all the living organisms and for maintaining the ecological balance while some forests are specially valued by man to satisfy his material needs and desires such as soft wood forests. There has been great variability in the types and distribution of forest throughout the Asia, because of the climatic, soil, physiographic variations of the landscape. Climate is the single most important factor influencing the forest in an area. Thus, climatic classification of forest in Asia has been studied with their characteristics and distribution over space. Further, forest plays an important part in the existence of life on the surface of earth, but due to ruthless exploitation of forest have resulted in the global warming and ecological imbalance causing threat to the survival of life. Hence, it becomes imperative to study the methods for the conservations of forests, with which we have dealt in the later part of the lesson.

8.9 GLOSSARY

Growth Rate of Population – *Growth rates* of population refer to the percentage change in population in an area over the previous referred period.

Migration – It is the change of residence of a person for a substantial period of time.

Mineral – Mineral is a composite matter of elements found in the rocks of the earth. When two or more elements join together, they form mineral.

Population Density – It is the total number of people residing in per unit area i.e, generally measured in kilometer or mile and represented as persons per sq. km. The absolute or total population figure give a picture of population pressure on land resources.

Rural Area – A rural area is also referred to as country side, which consists of more than 75 percent engaged in primary activity; low density; not governed by notified area committee (NAC) is a rural area. .

Urban Centre – A city region comprising of population more than 5000; population density more than 400 persons per sq. km; have a notified area committee; have more than 75 percent population engaged in non-primary activity is designated as an urban centre.

Urbanization – The process of growth in urban population in comparison to rural population which causes growth of cities is known as urbanization.

8.10 LESSON END EXERCISE

1. Elaborate the concept of density of population.
2. Enlist the factors affecting the distribution of population.

3. Write a note on the distribution of population in Asia.
4. Give the trends of urbanization in Asia.
5. Divide the countries of Asia into different density groups.

8.11 SUGGESTED READINGS

1. Tirtha, R. (2001) Geography of Asia; Rawat Publications, New Delhi.
2. Drevitch, G. (2009) Asia; Scholastic Publications Pvt. Ltd; New Delhi.
3. Mamoria, C.B. (2018) Geography of Asia; Sahitya Bhawan Publications, Agra.
4. Khalid, R. (2008) Geography of Asia; Saksham Books International, Jammu.
5. Stamp, L.D. (1967) Asia: Regional & Economic Geography; Methuen Young Books.

8.12 ANSWERS TO CHECK YOUR PROGRESS

EXERCISE – 1

(i) **Density:** It is defined as the number of persons per sq. km. The absolute or total population figure may also give an inadequate picture of population pressure. It indicates population pressure in terms of the number of people per unit of land (e.g., per sq. mile or per sq. km). It is a quantitative aspect of population. **Distribution:** Population distribution refers to the arrangement of people on the land. It is the spatial arrangement of population. It is the proportion of population located at different locations in an area or region. It is a qualitative aspect of population. **Urbanization:** Urbanization refers to the increase in the urban population to the total population in an area. It deals with the study of growth in urban people in comparison to rural people. It is an indicator of rapid industrialization in an area.

EXERCISE – 2

(i) The main physical factors affecting the location of population includes - Fertile land, Availability of mineral wealth, Availability of water supply, Increased facility of transportation and communication, Availability of electricity, Favourable climate.

(ii) Social factors affecting the distribution and concentration of population includes social customs, taboos, religious, linguistic and historical factors.

EXERCISE – 3

(i) Asia comprises a full 30 percent of the world's land area with sixty percent of the world's current population. The largest two of the Asian na-tions China and India account for three-fifths of Asia's total population, and the remaining two-fifths shared by forty six countries in Asia. Six of the Asian countries have populations greater than 100 million (Bangladesh, China, India, Indonesia, Japan and Pakistan) making each one of them larger than any European country. Twenty one Asian countries have small populations, less than 10 million in-habitants. With a few exceptions (Cambodia, Kyrgyzstan, Mongolia, and Turkmenistan) these nations are small in area as well.

(ii) China contributes 36 percent to the total population of Asia. India holds the second spot in the population base with a share of 30 percent. Indonesia is ranked third in Asia in terms of population with a contribution of 5.9 percent. Pakistan follows Indonesia at fourth rank with a population of 4.3 percent and Bangladesh at fifth rank having 3.6 percent of population. The lowest populous countries in Asia includes those of Maldives (345,000); Brunei (421,000) ; Macau (641,000); Bhutan (760,000) ; Timor - Leste (1.24 million) etc.

EXERCISE – 4

(i) One of the important indices of population concentration is the density of population. It is defined as the number of persons per sq. km. The absolute or total population figure may also give an inadequate picture of population pressure. A better idea of population pressure is provided by a measurement, known as population density, which indicates population pressure in terms of the number of people per unit of land (e.g., per sq. mile or per sq. km).

(ii) Countries of very low density of less than 50p/sq. km are the areas with most un-favourable conditions for the settlement of population, have resulted in the very low density of population of these countries. It includes Yemen, Iran, Afghanistan, Bhutan, Saudi Arabia etc.

EXERCISE – 5

(i) Urbanization refers to the steady increase in urban population in comparison to rural population prominently due to town ward migration, high birth rates in urban areas and growth of potential urban centers. Asia is moving into an era of unprecedented urbanization.

(ii) The growth pattern of urban population in Asia since 1960s has witnessed unprecedented progress. During 60's the total urban population was just 21 percent in comparison to 79 percent of rural population. The urban population increased to 32 percent in the year 1990 registering an increase of 10 percent over a period of 30 years. But the urban population soon reached 45 percent in the year 2010 and by 2016, it has doubled from 1970 to reach at 49 percent. The major reason behind this tremendous increase is the rural to urban migration.

JAPAN : PHYSIOGRAPHY, CLIMATE, DISTRIBUTION AND DENSITY OF POPULATION

9.0 STRUCTURE

9.1 INTRODUCTION

Japan the Island nation in East Asia is a fairly sizeable archipelago of 6,852 islands. The four largest islands, Honshu, Hokkaido, Kyushu, Shitoku accounts for 97percent of its population. The structure of Japan since its inception has been controlled by the successive folding of the mountains. The stress and strains within the land mass ultimately gave rise to ruptures and faults. At present the entire Japanese land mass is situated in the midest of four mountain arch's, namely Honshu arc, Ryukhu arc, Kurile arc and Bonin arc. The presence of innumerable volcanoes and their out pouring of lava resulted in permanent instability in the Japanese Geology. Due to the lack of extensive plain land, all the rivers are very short and discontinues. Out of 24 rivers in Japan only two are important by dint of length. Ocean currents Sea location and presence of high mountains exerts considerable influence on climatic variations. One of the important characteristic of Japan is that 65% of Japan is covered by dense forest.

The 2018 estimated census figure shows 127.19 Million people which make Japan the 10th largest populated country in the world. Some estimates shows that Japan's Population could fall by as much as 30 percent to around 87 million by 2050 the reasons, quite simply, point to a disparity in the birth and death rates. In addition it is impossible to rule out the part that the March 2011 tsunami and earthquake played. 19,000 people lost their lives at the time.

Slowing population growth and ageing population are creating more than a head ache for the island nation, as this problem is shrinking its pool of taxable citizens, causing the social welfare costs to skyrocket, and has led to Japan becoming the most indebted industrial nation with public debt that is double its economy. Japan possess at least 7 million 'plus cities and half million population the leading cities are Tokyo, Osaka, Nagoya, Fukuoka, Hiroshima, Kitakyushu and Sapporo the other important cities are Kobe, Kyoto, Hokodate etc.

9.2 OBJECTIVES

After going through this lesson, you will be able to know about :

1. The land and people of Japan.

2. The process and reasons how Japan become a developed nation.

3. The growth and development of human resources in Japan.

4. The process and growth of urbanisation in Japan.

9.3 ORIGIN AND PHYSICAL FRAMEWORK OF JAPAN:

According to Japanese legend a number of gods were born in the "Plain of High Heaven," whose lives were very uneventful until the advent of Izanagi and Izanami, who eventually became man and wife and gave birth to many offspring. Among his numerous heroic gestures Izanagi on one occasion thrust his heavenly jewelled spear into the deep, and as he withdrew it the shower of drops that fell from the spear were transformed into the dragon-shaped island group of Japan.

Actually the origin of the archipelago was not much less dramatic. Only instead of showering down from above, the islands were thrust upward from mighty ocean deeps, for they are the rugged crests of submarine mountains. Some geologists regard Japan's mountainous islands as essentially Alpine in type; others contend that they represent summits of one of the outermost series of tilted blocks forming the Pacific margins of the Asiatic land mass, from which they are separated by subsidence areas occupied by the intervening seas. Willis' believes the islands to be submarine ridges which over a period of sixty million years have risen through the floor of the Pacific Ocean. The great variety of igneous rocks comprising the archipelago suggests that multiple centers and multiple periods of volcanic activity were involved in the long period of mountain building.

Only a few square miles of the eastern side of Japan is one of the greatest series of submarine trenches known to exist in any ocean basin, with depths below sea level of 20,000 to 30,000 feet. Not far to the southeast of the mouth of Tokyo Bay a depth of 10,550 meters (34,600 feet) has been recorded. Thus on the east the Japanese islands rise sharply from an ocean bottom five to six miles below sea level to heights of more than two miles above. In other words, the difference in elevation between the greatest depths of the Japan Submarine Trench and the high mountain peaks of Japan must be at least seven or eight miles.

This immense range of elevation within lateral distances of a few score miles inevitably develops enormous strains and stresses, with the result that this becomes a weak and unstable portion of the earth's crust in which readjustments of the rock masses are constantly occurring. Like the rest of the unstable circum Pacific region, the Japanese islands are an area of numerous volcanoes and frequent earthquakes. There are well over five hundred volcanoes within Japan (including the Kurile and Ryukyu Islands to north and south), and there are historic records for eruptions of exactly sixty. Japan has on the average about fifteen hundred earthquakes annually, or approximately four shocks a day. In the Tokyo area there is a sensible shock on the average of once every three days. Since 1596 there have been twenty one major earthquakes, each of which has cost the lives of more than a thousand persons.'

The seas to the west of the Japan Arc are not nearly so deep, yet the Japan Sea has a depth of more than 10,000 feet, indicating that it is a genuine ocean basin, not merely a submerged portion of the Asiatic continental platform. The China Sea, on the other hand, which in most places is no more than 125-150 feet deep, is only an inundated portion of the continent itself.' But between this shallow basin and the northwest side of Kyushu is a submarine trough having a maximum depth of nearly 9,000 feet. The considerable ocean depths on the continental side of Japan as well as the mighty deeps to the east support the hypothesis that the islands are the crests of heroic mountains rising through the ocean floor.

The arc form of mountain ranges, which is characteristic of many other parts of the globe, is particularly conspicuous in the island groups and associated submarine ridges of the western Pacific. The meeting of two arcs is usually marked by a massive irregular bunch or knot of mountainous terrain, which may be termed a node In Japan the following arcs and nodes may be distinguished:

The Hokkaido Node, where the Karafuto and Kurile arcs join, and in turn connect with the Honshu Arc.

The Honshu Arc, extending from the Hokkaido Node to the Gifu Node, the central and broadest part of the main island.

The Gifu Node at the junction of three arcs: the Honshu on the north, the Tsushima and Shikoku arcs forming southwestern Japan, and the Bonin Arc entering as a submarine ridge from the southeast. The Tsushima and Shikoku arcs, convex in opposite directions. The Kyushu Node, at the junctions of the Tsushima and Shikoku arcs with the Ryukyu Arc. The Ryukyu Arc, extending to Formosa.

9.4 THE ZONES OR REGIONS OF JAPAN

Along the whole length of Japan Proper from Hokkaido to Kyushu two zones of contrasting geological and morphological structure lie parallel to each other. The one on the Pacific side is known as the Outer Zone and that on the Asiatic side as the Inner Zone. Fault scarps and tectonic depressions mark the contact between the two except in the great Gifu Node of central Honshu, where the arrangement of the principal features is confused and complex. In the Outer Zone the geological formations tend to have a more regular arrangement than in the InnerZone, where the structure is more complex, and the rock strata less regular in arrangement, and eruptive rock abundant.

The Honshu Arc may be still further subdivided into dissimilar northern and southern halves by a great depressed zone, the Fossa Magna of Nau-ann, which traverses the mid-part of the main island from the Pacific Ocean to the Sea of Japan. It appears as though the mountain arc had been bent backward along this fracture and the resulting rift subsequently filled, in part at least, by younger strata and great volcanic piles. A series of local structural basins occupy positions at the bases of the fault scarps. Along this depressed zone runs the Fuji Volcanic Chain, whose magnificent cones, among them Fujiyama, stand as boundary posts between the two morphologically unlike districts of northern and southern Japan.

On the basis of geologic and morphologic contrasts, therefore, Japan may be subdivided into four zones: North Inner, North Outer, South Inner, and South outer. The arrangement may be likened to a bent capital *H* convex to the east, the crossbar of which is the Gifu Node separating the unlike northern and southern halves of japan, and the two longer parallel bars are the Inner and Outer zones.

9.4.1 The Outer Zone of southwest Japan :

The Outer Zone of southwest Japan, designated the Pacific Folded Mountains, is separated from the Inner Zone by a line of great dislocation, with which are associated several graben valleys and a conspicuous fault-scarp extending from central Honshu through Kii Peninsula and northern Shikoku to western Kyushu. These mountains are characterized by well-developed longitudinal dislocation lines. They are for the most part high and rugged and contain few sizeable plains, the predominant rocks are crystalline schists and older sedimentaries greatly folded and contorted. Granites and younger volcanics are rare. The mineral wealth is in the form of precious and semi-precious ores, chiefly copper, gold, and silver. In central Honshu this Outer Zone is represented by the high Akaishi Mountains (Akaishi Sphenoid), which terminate on the east in a bold fault-scarp overlooking the Fossa Magna. Declining gradually in elevation, the Pacific Folded Mountains continue westward in the south-ern of Kii Peninsula, Shikoku, and Kyushu; local subsidence in the vicinity of Kii Channel and Bungo Strait divides them into separate mountain masses. In southern Kyushu the Outer Zone is intersected by the Ryukvu Arc; this results in a southern appendage- of volcanic materials consisting of an ash plateau, volcanic cones, and lava flows.

9.4.2 The Inner Zone of southwest Japan:

In contrast to the Outer Zone, the Inner Zone of southwest Japan is a series of dissected block plateaus. Slope prevails throughout, and some parts are genuinely mountainous, though more of the area is rugged hill country. Granite is abundant, hence rounded forms and slopes covered with a whitish crust of weathered rock are more prevalent here than in any other subdivision of Japan. The geological structure and physioraphic history of the area are extremely complex. Ancient sedimentary rocks, pierced by granitic intrusive, have been pen planed and cut by a complicated system of faults, some of the resulting blocks suffering upheaval, others depression. Throughout most of the area fault block structures with associated tectonic valleys and basins are common. Volcanic activity is widespread. Elevations are highest in central Honshu, where the Hida Range (Japanese Alps), some of whose peaks exceed 3,000 meters, terminates abruptly at the tremendous fault scarp overlooking the Fossa Magna. Farther west in Chugoku Peninsula, northern Shikoku, and northern Kyushu, elevations are lower, relief less, and the landscape hilly rather than mountainous. The Inland Sea, enclosed by Chugoku, Shikoku, and Kyushu, and its channel outlets to the open ocean occupy depressed zones. The western end of the

Inland Sea subsidence area has been filled with volcanic material forming the ash and lava plateaus of North Kyushu.

9.4.3 The Outer Zone (east) of North Japan:

The northern half of Japan, the area north of the Fossa Magna is composed of three parallel chains of North-South mountains or hills separated from one another by structural depressions. This distinctive linear and parallel arrangement of ranges and basins is lost toward the south, where they all coalesce to form the Gifu Node of central Honshu.

The Outer Zone (east) of North Japan is separated from the Inner Zone by a line of structural depressions extending southward from the Ishikari Vufutsu Lowland in Hokkaido through the Mabechi, Kitakami, and Abukuma valleys, to the bay head plain of Kwanto. In some places this series of depressions has fault scarp margins, in others flexure-scarps: Gneisses, crystalline schists, older sedimentaries and notable amounts of intrusives are important characteristic. It is composed of five separate segments of highland: the Kwanto and Ashio blocks, forming the western margins of the Kwanto Plain and not conspicuously separated from the Inner Zone; the two spindle haped highlands of Abukuma and Kitakami farther north in Honshu; and the Hidaka Mountains of central Hokkaido. In general they all have the appearance of uplifted, tilted, and dissected peneplains developed upon complicated structures. In the central and eastern part of Hokkaido, where the Outer Zone is intersected by the Kurile Arc.

9.4.4 The Inner Zone (west) of North Japan:

The Inner Zone (west) of North japan comprises two parallel ranges of hills and mountains, separated by a series of detritus floored fault basins. The mountains are elongated domes with flexure scarps along their margin. The central range, which is the backbone and watershed of northern japan, is composed chiefly of recent sedimentary strata overlying a core of gneiss and granite. It is capped with volcanic cones which have greatly altered the original features of the mountain. The range extends continuously through northern Honshu and forms the northernmost knob of Mutsu Peninsula (Honshu) and the eastern volcanic portions of peninsular Hokkaido. The western range is geologically similar to the central one. Several streams draining the western basins cross it in antecedent valleys, their deltas forming various sized plains along the Sea of Japan, some of them in cauldron-shaped depressions partially occupied by volcanoes.

9.5 CHARACTERISTIC OF THE TERRAIN

Complexity and fineness of pattern are characteristic not only of the lithic features of Nippon but also of its terrain. Broad generalization is therefore difficult. Even within small areas the earth materials, their structures, and the resulting landforms are often of the greatest diversity. The lofty folded ranges that form the axis of the archipelago have been altered by block movements, hence faulted and folded forms are much intermingled. Remnants of flattish erosion surfaces at relatively high altitudes are widespread throughout the mountain country, contrasting curiously with the steep slopes and great relief. Repeated volcanic eruptions and intrusions, extensive and widespread, have added further to the complexity of the terrain. Moreover, these tectonic forces are still active, as is manifest in the recurring showers of volcanic ash, outpourings of lava, earthquakes, and changing strand lines. Short, vigorous, steep gradient streams, acting upon these complex structures and materials have sculptured a land surface whose lineaments are varied and intricate.

9.5.1 Hill and Mountain Lands:

A core of moderately rugged hill land and mountain containing a number of debris-choked depressions, with small discontinuous fragments of river and wave deposited plains fringing the sea margins of the mountain land such as the gross geomorphic pattern of Japan. Along great stretches of the coast, plains are absent and the hill lands reach down to tidewater. Seventy five per cent of the country is rugged hill and mountain land whose average slopes exceed 15° and are hence unfit for normal cultivation. Although nearly 65 percent of the land with a gradient of 15° or less is tilled, the total area under cultivation amounts to less than 16 percent of the country's total area. The highest elevations and the most mountainous terrain of Japan is to be found in the Gifu Node of central Honshu, where a dozen or more peaks rise to about 10,000 feet. These highlands are known as the Japanese Alps. In this area Mt. Fuji, Japan's highest peak, which attains an altitude of 12,461 feet. Just to the south of the Gifu Node, along the line of the Biwa Depression is the most complete break in the Honshu highland barrier separating the Pacific and japan Sea coasts. Except for relatively low ridges at the northern and southern ends of Lake

Biwa there is a water route across the narrow highlands from Wakasa Bay on the northwest to the eastern end of the Inland Sea, where great industrial cities of Osaka, Kobe, and Kyoto are located.

In humid forest climates, especially where temperatures are subtropical, one expects to find rounded landforms mantled with a deep layer of weathered rock material. Throughout the rugged interior of Japan, how ever, it is not this type of terrain but sharp angular forms that prevail; concave slopes with narrow knife-edge ridge tops are characteristic. This inconsistency is probably the result of the recent and rapid uplift of many of Japan's mountain areas and the associated vigorous down cutting and removal by streams. The mantle of weathered rock material is consequently thin, with the result' that the rugged outlines of the terrain have been little softened. Youthful and imposing fault and flexure scarps are conspicuous features, and commonly serve as the boundary zones between geomorphic subdivisions. It may also be that the frequent landslides caused by earthquake tremors have appreciably sharpened the contours of the landforms. The field geographer is much impressed by the evidence of recent slides in Japan: the numerous ruddy scars on the mountain flanks where the mantle of vegetation and a mass of regolith have recently been removed, exposing the raw bedrock be-neath. Contrasting strangely with these features in some places, even in areas of steep slopes and sharp divides, there are still preserved fairly extensive upland erosion surfaces. This, too, is evidence of relatively recent uplift. Especially where granite is the predominant rock type, rounded cupola features, covered with a thin mantle of weathered rock materials, are common. Southwestern most Honshu (Chugoku), north of the Inland Sea, is representative of this latter type of terrain.

9.5.2 Volcanic Cones:

Another element giving variety and contrast to the terrain are the scores of volcanic cones, with their associated lava and ash plateaus, in various stages of activity as well as dissection.' These cones provide some of the highest elevations of the archipelago. The symmetrical concave slopes of the young cones, and the radial patterns of drainage lines and divides, make these highland areas easy to distinguish both in the field and on the topographic maps. Although they occur throughout the entire length of Japan, volcanoes are distributed according to a pattern, being numerous in some areas and almost lacking in others. Highest con -centrations are at the intersections of the several arcs. The specific regions of concentration are as follows':

1. Eastern Hokkaido and the Kurile (Chishima) Islands. Thirteen active volcanoes are located within this area of concentration.

2. Western Hokkaido and the central and western parts of North Honshu. Here there is a distinctly linear arrangement of the cones, beginning in the tail like peninsular appendage of western Hokkaido and extending southward along the central range of northern Honshu. The volcanoes exist in the form of small compact agglomerations more or less equally spaced. Recent volcanic features are lacking on the Pacific side of North Honshu, although there are several splendid cones along the Japan Sea margins. Eighteen active volcanoes are present in this region.

3. Central Honshu and the islands of the Bonin Arc to the southeast. Here the volcanoes are arranged in a northwest-southeast line along the great depressed zone known as the Fossa Magna:' Fujisan, one of the earth's most perfectly symmetrical ash cones, is located within this zone of concentration. For fifteen of the volcanoes there are records of erup-tions during historic times, three in Honshu and twelve in the islands of the Bonin Arc.

   In southwestern Honshu and Shikoku there are no volcanoes excellenc in the Inner zone or Tsushima Arc.

4. Kyushu and the islands of the Ryukyu Arc southward to Formosa. Fourteen volcanoes are classed as active. These too are arranged in a series of compact groups.

(a) *Tertiary Area :* *As* has been said, the Tertiary rock areas, which are widely distributed throughout Japan, also have a distinctive terrain. Being weak and often poorly consolidated strata, they tend to form a low and thoroughly dissected hill country of moderate relief and slopes, and their drainage basins have a considerable valley-floor area.

(b) *Mountain Streams. :* *The* mountain streams are short, swift, and shallow, and hence usually unnavigable; their drainage basins are small and their valleys narrow, with restricted floodplains. The headwaters and usually the greater part of the drainage basins of all Japanese rivers lie in the highlands. This fact, together with the abundant precipitation, results in swift rivers capable of vigorous erosion and in a close network of drainage channels over the country. Because of Japan's small size none of its rivers is long or has an extensive drainage basin. Of the twenty four principal rivers listed in the *Japan-Manchukuo Year Book* for 1940, eight are less than 100 miles in length, fourteen are between 100 and 200 miles long, and only two are over 200 miles. These two rivers are the Ishikari in Hokkaido (227 miles) and the Shinano in central Honshu (229 miles), having drainage basins of only 5,401 and 4,734 square miles respectively.

Of necessity the volume of such a stream is small. The restricted areas and steep slopes of their drainage basins cause the rivers to respond quickly to local rains and hence to vary greatly in regimen; they often flood seriously after heavy rains. Of small use for transport, except for rafting logs , the mountain streams are important chiefly as sources of hydroelectric power and of irrigation water for the rice fields on the plains. In many sections the narrow floors of the river valleys are the principal sites of mountain agriculture. River terraces in multiple steps are striking features of the mountain valleys.

9.5.3 Lowlands:

Nippon lacks extensive lowlands, and the diminutive ones that lie within her borders are almost exclusively surfaces of deposition. There are no extensive structural plains underlain by relatively horizontal stratas in central and eastern North America and in northern and western Europe. Hardrock areas in Japan are practically coextensive with hill and mountain land, almost the only exceptions being the fragments of wave planed terrace along the coast: The typical plain of japan is a small isolated patch of river and wave worked sediments developed in a coastal indentation or in a mountain basin. Even the largest of these, the Kwanto or Tokyo Plain in east-central Honshu, has an area of only about 13,000 square kilometers or 5,000 square miles. Being predominantly peripheral, most of the plains have frontage upon saltwater. Seldom are they continuous along the coast for any considerable distance because of the frequent interruptions by spurs and larger masses of hardrock hill land that extend down to the sea. The main railway line between Tokyo and Shimonoseki at the western extremity of Honshu, which roughly parallels the coast, goes in and out of smoky tunnels with a frequency that almost spoils one's enjoyment of the journey, so often are attractive views of plains and sea blacked out.

9.5.4 The Japanese plains:

Origin: Most of the Japanese plains are the result of river deposition. They are here designated as delta-fans. This is not to suggest that portions of the lowlands were not at one time below sea level, and their sediments reworked by waves and currents:[1] Technically speaking, therefore, those portions of the plains which were submarine in origin are coastal plains, but in general no distinction will be made here between subaerial and submarine origin The fact that almost every Japanese plain is associated with a river, and that most rivers have plains at their sea ends, clearly indicates the riverine origin of most of the sediments comprising the Japanese lowlands.Many plains in Nippon also contain considerable additions of volcanic ash and hence their fields of orchards, vegetables, cereals, and other Unirrigated crops are another feature that distinguishes them from the plain proper to the rear, where paddy rice is usually the chief crop.

Rivers on the plains are shallow and braided. They flow in broad gravel-choked beds, the several channels, except in flood periods, occupying only a small part of the total width of the bed. Characteristically, the rivers are on the plains rather than in them, for their channels and levees are the most elevated portions of the plains; that is the land slopes downward away from the rivers, When bicycling in connection with my field work in Japan, I could usually tell when I was approaching a river because the pedaling became harder by reason of the upgrade. After crossing the bridge over the stream, it was possible to coast or pedal leisurely for a short distance. In a number of places in Japan the streams are so much higher than the adjacent country that roads and even railroads pass under their channels in tunnels instead of surmounting them on. The topographic maps contours usually bend downstream in the vicinity of river channels, indicating that they are above the general country leve. Natural and man made *levees* and dikes, often more than a single series of the artificial variety, hold the lowland stream within its raised channel. Such elevated streams are both asset and liability an asset in that a simple gravity system ordinarily serves to distribute their waters for irrigation purposes over the rice fields on the plain; a liability in that they often break their levees in time of flood and do an inordinate amount of damage.

9.5.5 Dihwial Terraces:

The inner margins of the delta plains frequently terminate abruptly, with no marked increase in slope, at the bases of the encircling hard lock foothills. At the points where rivers debouch upon a plain the transition is made less abrupt by the presence of steeply inclined, coarse textured alluvial fans or cones, which in certain areas are continuous enough to form piedmont belts. It is very common also for the descent from Interior Mountain to new alluvial plain to be broken by one or more intermediate steps in the form of sand and gravel terraces. These terraces are of unconsolidated materials deposited by rivers and probably reworked by waves and currents. They are alluvium in part at least, but it is alluvium whose fertility has been sapped by long continued leaching without being replenished by additions of new sediments. This older alluvium, as it is commonly called in this country, the Japanese geologists and geographers call *dittivium.* Most of the Diluviat terraces are the result of uplift associated with mountain building, which is raised to their present positions coastal plains and delta fans that were once near sea level. With the uplift the streams were rejuvenated and a portion of the elevated alluvium. Tokaido Railroad carried by tunnels under was cut away and carried an elevated stream channel in Biwa Basin. Seaward to form the newer alluvial plains. The presence of diluvial terraces in almost all parts of the country from Hokkaido to Kyushu has led one group of geomorphologists to conclude that rather general and con-temporaneous uplift of the Japanese island group has taken place. In some places there arc multiple terraces, indicating several periods of relatively rapid uplift. In certain coastal areas there are conspicuous ter-races of considerable extent which are chiefly the result of wave planation. These benches are composed largely of hard rock with only a veneer of gravel and sand covering the erosion surface. The Kushiro and Nemuro plains of southeastern Hokkaido are of this origin.

The usual form of the diluvial terrace in Japan is that of a low, flat-crested upland rising in fairly abrupt slopes above the adjacent surfaces of new alluvium. They vary markedly in elevation; some are so low as to be almost indistinguishable from the new alluvium, whereas others rise by precipitous slopes to a height of several hundred feet. Vertical down cutting by streams is rapid in these elevated unconsolidated sediments, creating a ter-rain of shallow, canyon-like valleys with fiat to gently sloping interfluves.

This latter feature is a remnant of an earlier depositional (or erosional) surface; its preservation indicates how short a, uplift. Within a relatively brief time, measured geologically, these diluvial crests are bound to disappear. As it is, the relatively even skylines of the diluvial uplands are one of the distinctive characteristics of their profiles as seen from a distance, distinguishing them from hardrock hills.

Less common are certaro diluvial terraces, Ordinarily older and higher, Region has been reduced to a bad-land condition in which slopes predominate, thus much resembling the Tertiary rock areas. The Tama terraces of the Kwanto or Tokyo Plain are of this type, as are certain others in the southern part of the Lake Biwa Basin north of Kyoto, and along the mar-gins of the Osaka and Nagoya plains.

Throughout Japan the terraces are much less in-tensively utilized than are the lower plains of new alluvium. Rice is not a common crop on the diluvial uplands, unirrigated crops being more characteristic wheat, barley, vegetables, mulberry, tea, and or-chard fruits. Large areas are in planted forest and parts would be classed as virtual wasteland. This less intensive use of the diluvial terraces it partly a reflection of the difficulty of raising irrigation water from the deeply incised valleys to the upland levels. And to the Japanese any land that cannot be inundated and therefore planted to paddy rice is, *ipso facto,* inferior land. In any case, much diluvial terrace land is composed of such coarse materials that water would not remain long on its surface. Moreover, much of it has become infertile. Leached of the soluble minerals and shy of humus, the diluvium is low in plant foods and inferior in structure. The addition of acidic volcanic ash in some parts of Japan has done little to improve the condition of the soil. Where the veneer of ash is not present the soil may be quite sandy or even gravelly.

9.5.6 The Larger Plains:

Among Japan's largest and most important plains are the three on the Pacific side of southwestern Honshu, each at the head of a large and deep indentation formed by sub-sidence:

(1) the Kwanto Plain (13,000 sq. km.) at the head of Tokyo Bay, containing the two great urban centers of Tokyo and Yokohama and boasting a total population of over 15 million.

(2) The Nobi Plain (1,800 sq. km.) at the head of Ise Bay with the reat industrial city of Nagoya and a total population of over 5 I million.

(3) The Kinai or dlr70 percent Settsu Plain (1,250 sq. km.) at the head of Osaka Bay, on which are located the three great cities of Kyoto, Osaka, and Kobe: and which is coextensive with a population cluster of over 9 million people.

(4) A similar fourth bay, Suruga, between Tokyo and Ise bays, has no comparable bay-head plain with a large cluster of population, for the head of Suruga Bay marks the southern end of the Fossa Magna, from which rises the immense volcanic cone of Fujisan and its satellite Ashitaka. On the three plains named are located all six of Japan's great cities of nearly a million or more population, her three chief foreign trade ports, and three of her four great nodes of industrial development. Other large and important plains in Japan are the Ishikari (2,100 sq. km.) in southwestern Hokkaido, the Echigo (1,800 sq. km.) in western North Honshu, where the city of Niigata is situated; the Sendai (1,500 sq. km.) in eastern North Honshu, which supports the city of Sendai and the sukushi (1,200 sq. km.) in northwestern Kyushu, of which Kurume is the Metropolis.

9.5.7 Interior Lowlands:

Although the greater number of Japanese plains, including the most important ones, front upon the sea, a considerable number of isolated basins, a few fairly large but most of them small, are located in the mountainous interior. These are striking in the small amount f genuinely level land characteristic of their alluvial and diluvial deposits. From the enclosing hill and mountain ramparts numerous torrential streams debouch into the basins, building a series of converging and coalescing alluvial cones and fans. The resulting terrain is one of smooth, moderately inclined slopes with a very conspicuous cone pattern. Coarse materials predominate. Characteristically these interior basins are arranged in lines or rows, following important zones of crustal fracture and subsidence. Illustrating this linear arrange-ment are

(1) the series of north-south basins in central Hokkaido; (2) the two parallel north-south rows of basins on either side of the central range in northern Honshu; (3) the northwest-southeast chain of basins across central Honshu, coinciding with the Fossa Magna; and (4) the series of northeast-southwest basins corresponding with the great medial disloca-tion line in Kii Peninsula and northern Shikoku.

9.5.8 The Coastline:

Few regions of the earth have so great a variety of interesting coastal features as does Japan. Nippon Proper has a remarkably long coastline, approximately 17,000 miles, or one linear mile of coast for each 8.5 square miles of area. The influence of this unusually long line of contact with the sea is increased by the fact that most of the lowlands, the only areas capable of large-scale production and consequently the areas of large population, have sea frontage to an unusual degree, therefore, the people of Japan have a maritime outlook.

Coastal features of first magnitude in Nippon are due principally to faulting and warping; broad regional contrasts represent differences in fault patterns and in the crustal movements that have occurred along the fault lines. Thus the coastline of the Japan Sea littoral is relatively smooth because it roughly parallels a fault system. Only occasionally, as at Wakasa Bay, does a fault system which has developed at an angle to the coast produce major irregularities. Along the east coast of North Honshu of exactly sixty. Japan has on the average about fifteen hundred earthquakes annually or approximately four shocks a day. In the Tokyo area there is a sensible shock on the average of once every three days. Since 1596 there have been twenty one major earthquakes, each of which has cost the lives of more than a thousand persons.'

The seas to the west of the Japan Arc are not nearly so deep, yet the Japan Sea has a depth of more than 10,000 feet, indicating that it is a genuine ocean basin, not merely a submerged portion of the Asiatic continental platform. The China Sea, on the other hand, which in most places is no more than 125-150 feet deep, is only an inundated portion of the continent itself. But between this shallow basin and the northwest side of Kyushu is a submarine trough having a maximum depth of nearly 9,000 feet. The considerable ocean depths on the continental side of Japan as well as the mighty deeps to the east support the hypothesis that the islands are the crests of heroic mountains rising through the ocean floor.

The arc form of mountain ranges, which is characteristic of many other parts of the globe, is particularly conspicuous in the island groups and associated submarine ridges of the western Pacific. The meeting of two arcs is usually marked by a massive irregular bunch or knot of mountainous terrain, which may be termed a nodeIn Japan the following arcs and nodes may be distinguished.

The Hokkaido Node, where the Karafuto and Kurile arcs join, and in turn connect with the Honshu Arc.

The Honshu Arc, extending from the Hokkaido Node to the Gifu Node, the central and broadest part of the main island.

The Gifu Node at the junction of three arcs the Honshu on the north, the Tsushima and Shikoku arcs forming southwestern Japan, and the Bonin Arc entering as a submarine ridge from the southeast. The Tsushima and Shikoku arcs, convex in opposite directions

9.6 THE CLIMATE OF JAPAN

The climate of Japan is a mixture of continental and marine elements. In some respects the climate of island are very similar to those of North America Atlantic seaboard between Maine and southern Georgia. Japan has a range of latitude between 31 degree - 45 degree North Latitude which itself tends to produce marked climatic contrast between the northern and southern parts. The Latitudinal differences in winter temperature and in length of frost free season are striking one. Fortunately a large part of Japan lies in the sub-tropical latitudes, where the climatic energy is abundant and the climatic potentialities for plant growth is high.

Intricacy of surface configuration and differences in altitude of 10000ft and more are other factors that make for local differences in climate.

The greatest of all the factors operating to produce the climate of Japan are the Monsoonal air masses that so dominate the weather conditions throughout South Eastern Asia in Winter the cold Asiatic continent develops an immense thermal anti Cyclone whose centre is in the Lake Baikal area of Siberia from this region great surges of dry, cold, Polar Continental air stream centrifugally ocean ward. This is the North West Winter Monsoon of China and Japan. In summer on the other hand when the continent is warm a thermally induced low pressure centre of action replaces the winter anti Cyclones over Asia. The Pressure Gradient is consequently the reverse of that which prevails in winter and moist Tropical and Sub-Tropical maritime air masses originating over the warmer parts of the Pacific Ocean converge upon Eastern Asia. This is the weaker and more intermittent south east summer monsoons. The winter Monsoon is stronger than that of summer. The maximum difference between the January and July wind velocity is greatest at Akita, which receives the full force of the winter winds from Asiatic Continent. Osaka on the Pacific side the difference in strength between the summer and winter winds is less marked.

9.6.1 The Important Climatic Elements of Japan:

1. TEMPERATURE :

The temperature is more continental than marine because of its east coast location in a region of well developed Monsoon. Japan has distinctly a colder winter climate then in normal for its latitude. Actually the Japanese area has a negative January Temperature anomaly amounting to 15 degree. Summer in Japan although more for the latitude, are for the most part hot and sultry.

a) Winter Temperature:

January temperatures range from about 10° or 15° in northern and central Hokkaido to 3 5° or 40° on the lowlands of central Japan, and 45° in the extreme south of Kyushu.

Thus the latitudinal temperature gradient, or rate of change of temperature, is very steep in Japan approximately 2.6° for each degree of latitude, which is almost the same as on the American Atlantic seaboard. The freezing isotherm for January is at about latitude 38°, in the general vicinity of Sendai. The January isotherms tend to, loop far southward over the Islands, roughly parallel to the coasts, showing the effects both of altitude ‘and of the colder land. Thus the January isotherm of 38°, which skirts the southern part of the. To-kyo Plain, follows the coastal low lands southwestward to about the mid Inland Sea region.

Despite the fact that the west coast faces the cold Asiatic continent, from which the polar air masses arrive in winter, there is little 'difference between the winter air temperatures of the Japan Sea side than those of the Pacific coast at a given latitude. Actually the Japan sea side north of 86° (northern 15F Vishnu and Pi·Okkaido) is slightly wet than Inner, Pacific side. This is due to the rather constant cloudi-ness and heavy precipitation along 'the japan Sea coast in winter, which mitigate the cold.

b) *Summer Temperature*:

Summer temperature combined with high humidity make the summer weather of much of Japan extremely sultry and oppressive. Most foreign residents and many Japanese as well trek to high altitudes or to seacoast resorts in summer just as whites do in tropical locations. July temperatures in central and southern Japan range from 77° to 80°, and August is slightly warmer than July at most Japanese

Stations. The rate of change in temperature from north to south is much less in summer than in winter, the latitudinal temperature gradient being only 1.3° for each degree of latitude, or approximately half that of January. Northern Japan largely escapes the uncomfortable heat. The July isotherm of 61° skirts the eastern and southeastern lowlands of Hokkaido, which are paralleled by a cool current; most of central and western Hokkaido has July temperatures of about 65° to 68°. These are much the same as the midsummer temperatures of northern New England. The cool *Oyashio* Current parallelie east coast of Honshu down to about latitude 35° or 36° makes the Pacific coast of northern Japan definitely cooler and also somewhat foggier in summer than the Japan Sea lowlands in similar latitudes. Interior basins at considerable elevation are also somewhat cooler.

c) Growing Season:

The length of the frost-free, or growing, period ranges from about 120 or 130 days in central and eastern Hokkaido to 250 days or more along the extreme southern and eastern littoral. To be sure, these data apply to the period between the first and last hoarfrosts, but in humid Japan any temperature drop below 32° is almost invariably accompanied by a white deposit of frost. A deposit of hoar frost is usually associated with temperatures destructive to vegetation. In the United States northern New England and North Dakota are comparable to Hokkaido in length of frost free season. Thus St. Johnsbury, Vermont, has a frost-free period of 127 days, which is identical with that of Asahigawa in central Hokkaido; Grand Forks, North Dakota, is without frost for 132 days. The 250-day frost-free season in the extreme south of Japan is duplicated in 'southern -Georgia Alabama, and Mississippi. Tokyo in the middle latitudes of Nippon has a growing season of about 215 days and Nagoya 207, which is comparable to the northern part of the American Cotton Belt. The fact that the isotherms connecting places Nvitla the same number of frost-free clays tend to parallel the coasts shows that land and water and altitude controls operate quite as much as latitude in frost distribution. In northern Japan, especially in Hokkaido, 'early autumn frosts often do serious damage to rice fields and in the northern part of subtropical Japan late spring frosts not infrequently damage vegetables, mulberry, and tea.

d) *Precipitation*:

Unlike sub humid North China and Manchuria in about the same latitude Japan is a humid land no section of which suffers from a yearly or seasonal deficiency of rainfall. There are no winter dry climates as in the very circuitous courses of others. In general there are three areas of heavier than normal precipitation (80 to 120 inches):

(1) the Pacific side of japan Proper from Kyushu to Izu Peninsula south of Fuji (35° N.);

(2) the Japan Sea coast north of latitude 35° or 36° to about Akita (40° N.); and

(3) the Hida Highlands of central Honshu west to the Fossa Magna. In many localities in these areas the precipitation ,'exceeds 120 inches, and here and there it approaches 160 inches. There are at least four areas of less than normal rainfall, where the annual Temperature in the neighborhood of 40 inches: (1) a large part of Hokkaido, especially its eastern portions; (2) the basins of the Fossa Magna in central Honshu; (3) the Inland Sea borderlands; and (4) the eastern and north-eastern sections of North Honshu. Over much of the country precipitation is heaviest in the warm months of the year, and lightest in the winter. This is what one would expect in a region where monsoon wind systems are highly developed. The surprising thing is that the difference between winter and summer precipitation is

not greater. Even in the driest cool season months there is normally from two to three inches of precipitation, and several times this amount in the warm months. Often there are two secondary maxima in the precipitation curves of stations in eastern subtropical Japan, the first in early summer associated with the *baiu* rains, and the second in late summer and early fall, at the time of the typhoons. The secondary minimum in midsummer is perhaps associated with a westward extension of the Pacific subtropical high, for the same phenomenon is observable in the precipitation curves of many West Indies stations.

The most marked exception to a warm season maximum of precipitation in Nippon is an area on the Japan Sea side of the islands, from Hokkaido nearly to the southwestern tip of Honshu. There the cP air masses, warmed and humidified in their lower strata, come onshore in winter as conditionally and convectively unstable air masses. As they are forced to ascend the orographic barriers, or perhaps surmount local masses of colder air lying over the western plains and mountains, they yield heavy precipitation, much of it in the form of snow. Farther to the east, where these same air masses are descending, the winter weather is clearer and precipitation lighter. Summers too are wet along the Japan Sea side there being no marked difference in warm season precipitation between the northwestern and southeastern coasts. The weaker summer monsoon produces less distinct windward and leeward coasts than does the stronger winter monsoon.

Snow falls over the whole of Japan Proper and remains on the ground all winter in Hokkaido, on the Pacific side of Honshu down to about latitude 37° or 38°, and on the Japan Sea side almost down to Kyushu. In many places in the mountainous western parts of northern Japan the snow reaches a depth of six or seven feet in January, and at a number of stations snow lies on the ground for more than 100 days in the year, and there may be as many as 25 days with snowfall in the midwinter months.

9.7 CLIMATIC TYPES AND REGIONS :

Two of the most detailed schemes of climatic subdivision that have been devised for Japan unfortunately do not fit into any recognized world scheme of climatic classification. Okada's and Fukui's maps, therefore; show only regional subdivisions, and no relationship to world patterns of climate are suggested. Actually Okada calls his map one of geographical, not climatic, subdivisions, although his discussion of regional climates follows the subdivisions shown on the map. Fukui's map which is more detailed, is designated a map of "climatic divisions." It bears some re-semblance to the Thornthwaite map of climatic subdivisions of Japan.

In the modified. Koppen system' of climates here employed ,rather 32° cold-month isotherm is adopted as the boundary between the relatively mild or meso thermal, and the more severe, or microthermal, groups of climate called, respectively, the C and D groups. Northern • Honshu and Hokkaido are shown in the D group, the rest of Japan in the C group all the C climates are of the Caf variety, which may be described as humid subtropical. North of about latitude 38° Honshu has a Da or humid continental warm summer climate, as does also the elevated interior farther south . Hokkaido with its cooler and shorter summers has the Dbf or humid continental cool summer climate. On the map of climatic sub division, some subdivisions of the principal Koppen types have been added.

The Dbf Climates of Hokkaido. *" Hokkaido,* in the general latitude of the northern tier of American states, resembles climatically the north-eastern part of New England and the Maritime Provinces of Canada. Summers tend to be short and also cool, the average for the warmest month usually being below 70° (Asahigawa, 68.5° , Sapporo, 69,4°; Okada.

Nemuno a, 62.4°; Obihiro, 67.1°). These are delightful temperatures for human comfort but less desirable for the growing of crops. The eastern and south-eastern littorals, washed by the cool Okhotsk Current, are particularly cool in summer, warm-month averages being below 65°. Summer fog is prevalent along these cool water coasts. At Sapporo the mean maximum temperature of the air in August is only 80°, hence summer are not oppressive and east sultry as they are farther south.

The normal frost free season is between four and five months. Winters, on the other hand, are long, cold, and snowy. Except in the south-western peninsula of Hok-kaido average temperatures in the four winter months are below freezing point. Average January temperatures in most of Hokkai do ranges between 14° and 23°; mean January minimum temperatures at interior stations range from 3° to 12°. at Asahigawa 42° below zero has been recorded.

Winter weather is likely to be changeable, but numerous overcast days and boisterous winds are characteristic. The first snowfall usually occurs in late October or early November and the last snow of the year late April or early May. Snow lies on the ground ten to twenty inches deep for several months, being much deeper on the wind ward west side than to the east of the central mountain chain. On the Ishikari Plain in western Hokkaido the snow in midwinter is two to three feet deep on the level; at Kutchan it may reach a depth of six to seven feet.

The transition Season of spring and fall are short. Hokkaido is one the driest parts of Japan at most of the stations precipitation totals only about 40 inches. There is no distinctly dry season in Hokkaido, although are seasonal differences in precipitation. Stations close to the west coast have more in the winter half year than in the summer half year, whereas the converse is true of stations on the eastern side. September is likely to be the wettest month. One of the principal defects of Hokaido's Climate is the deficiency of bright sunshine in western Hokkaido. This deficiency is most marked in winter when the strong winter this monsoon blow from the off Sea of Japan. Eastern Hokkaido has the least sun shine in summer, when dense sunshine prevail along the coasts washed by the cool Okhotsk Current.

Sub provinces The precipitation of the winter half year exceed 30 inches and in many parts exceeds that of the summer half year. Further evidence for the location of the boundary was obtained from the detailed seasonal rainfall maps. Winters are dark and gloomy, and bright sunshine is infrequent. Winds are strong and boisterous. Annual precipitation is relatively heavy, and since half or more of the continental air is raw and penetrating, although the actual temperature is no lower than in the eastern subprovince, if quite as low. Relatively high summer temperatures and high humidity make for sultry heat.

Sub province has sunnier winter weather, cloudy days being only a third or a fourth as numerous as in subprovince 1, and clear days 10 to 30 times as menereus. Snow falls on a majority of the winter days, but the total fall is much less and the snow cover much shallower than on the Japan Sea side. Winter temperatures are about the same as to the west, but the cold is less penetrating. Summers are cooler than in subprovince. Rainfall is between 40 and 60 inches and there is a definite summer maxinurn, although winters are by no means dry.

Sub province is the southward extension of the relatively severe D climates following the central highlands. Marked altitudinal differences result in a variety of climates. Elevated interior basins, such as the Nagar o, Matsumoto, and Suwa basins, have local continental climates. Winters are relatively severe, the January average temperature at Matsumoto reing 28.2° and at Nagano 29.1°, about the same as in northern Iionslei. In these mountainenclosed interior basins, August temperatures are relatively high, usually between. Outside the basins, altitude makes for cool summers. There are great local variations in amount of precipitation. During the winter the mountains are covered by a deep snow mantle. Cool summers and snowy winters, plus the attractive mountain scenery have made famous a number of summer resort and skiing centers. In contrast to the mountains, the enclosed basins have considerably less precipitation. The summer monsoon is warm and relatively drier, thereby rendered less capable of producing precipitation sone basins the rainfall is less- than 40 inches, but in more of them it is between 40 and 50 inches (Ueda, 37.9; Nagano, 40.1; Matsumoto; 44.3; ·4.1;.araisuwa, 52.6): With eastern Hokkaido and the Inland Sea district, these in basins of central Honshu are the driest parts of Japan in all of them. summer is the period of maximum precipitation, for the summer rnonsoon is the dominant control. Normally the wettest summer month has three to five times as much precipitation as the driest whiter month.

The Caps Climates of Subtropical **Japan** This is the part of Japan best known to Occidentals, who are likely to assume that it is typical of the entire country. Summer temperatures are high, the average for the warmest month being between. At a majority of weather stations midsummer temperatures approximate those of the wet tropics. And since rainfall is abundant and humidity high, sensible temperatures as well as air temperatures are veritably Amazonian. This sultry, humid heat, virtually unrelieved by air movements, makes the summer season very uncomfortable and enervating, much like that of the American Atlantic seaboard from about Washington D.C. to southern Georgia The growing season is long from 180 days in the northern part to 260 days along coastal locations on the Pacific side. Winters are relatively mild, the coldest winter months having a mean temperature above freezing. During January Tokyo has an average temperature of 37.4°, Osaka 40°, Kagoshima 45°. On sunny winter days mid day temperatures are very pleasant, but when it is overcast and a strong wind is blowing, the humid'. Cold is raw and penetrating.

Japanese homes are so ineffectively heated, that, indoor winter temperatures are distinctly uncomfortable; indeed, the foreigner in Japan is likely to have as unpleasant recollections of the winter cold as of the summer heat. Because the winter chilliness is much less prolonged than the summer heat, Japanese houses, clothes, and ways of living are much better adjusted to heat than to cold. The number of days with a mean temperature below freezing is small only 3.2 a year at Tokyo; 0.7 at Osaka; 2.7 at Hiroshima; and 19.2 at Niigata. Frosts are widespread throughout sub-tropical Japan in midwinter. Thus at Kumamoto, far to the south in central-western Kyushu, night temperatures drop below freezing on an average of 64 days a year, of which 15 occur in December, 20 in January and 17 in February. Thus it is obvious that despite its insular location subtropical Japan has relatively severe winter weather for its latitude. Precipitation varies in amount. Heavy average annual rainfalls of over 100 inches are recorded at stations along the mountainous Pacific coast, facing the inflowing summer monsoon, and also along the Japan Sea coast, which is windward during the winter monsoon. By contrast many section of the borderlands of the Inland Sea depression have only 40 to 50 inches of rainfall. Over the larger part of the Caff region summer rainfall greatly predominates, but the Japan Sea side of Honshu receives an excess of winter precipitation. Snow falls on occasion over the whole of subtropical Japan; even Kagoshima in the extreme south of Kyushu records an annual average of 6 to 7 days with snowfall, Tokyo 1 3 days, the American Atlantic seaboard from Maryland to North Carolina. Strong winds, often of gale strength, accompanied by driving snow, and a heavy cover make the winter raw and penetrating even though the air temperatures are not low. There is less winter sunshine than in any other part of Japan; Niigata has only 18 per cent of the amount possible in December and January. Snow falls on one to two thirds of the days in midwinter, the total for the year ranging from 70 at Niigata, the station farthest north, to 30 at Hamada at the extreme southwest. The total amount of precipitation is greater in winter than in summer. Although Warm season rainfall is also heavy and there is a secondary maximum in late slimmer. So heavy is the winter snowfall that special forms of house construction are required and farmers often leave their snowbound villages for several months to find employment elsewhere, It is not unusual for rail traffic to be suspended for days because of snow blockades, and frame snow sheds protect the rail lines for long distances. West of Wakasa Bay the snow cover is much less deep than to the north and east.

9.8 POPULATION OF JAPAN

Reliable statistics for natality, mortality, and rate of population increases in Japan date from 1920, the year of the first census. Earlier vital statistics are so inadequate and contain so many inconsistencies that they must he used with great care and with many more qualifications. From the best information available it would appear that the Japanese population remained nearly constant at twenty eight to thirty millions in the century and a half prior to the Restoration in 1868. Considering how small the area of arable land was, thirty million was a large population for the time. The density per unit of arable land being higher than it is in Italy and Germany today. In view of the inefficient and exploitative feudal agricultural economy prevailing in Japan under the Toikugawas, which required the farmers to support a large parasitic leisure class of nobles, samurai, and their subordinates, it was probably as large a population as the country could maintain. The static population was therefore largely of economic origin. The wretched life of the peasant farmers led some of them to epidemics, and natural disasters took a large toll of human life, and abortion and infanticide were practiced in all social classes. The Tokugawa period gave to modern Japan the tradition of population control and the small family system, plus folk memories of abortion and infanticide as acceptable controls of family size. Even more, it consolidated the political - economic system and unified the cultural values that have been the major barriers to the diffusion of Western patterns of fertility and mortality control."

The Meiji Restoration in 1868 inaugurated a steady and spectacular growth in population which has continued almost to the present day. By 1872, when the first estimate for Japan Proper was made, the population had increased to almost thirty five million, and by 1918 to almost fifty-five million. The census of 1920, the first reasonably accurate count, gives the population as 55,963,000, that of 1910 as 73, 111, 00. The two outstanding features of Japan's population are (1) the rapid increase in total numbers and (2) the continuous migration, particularly of young people, from rural areas to the cities. In the decade 1925-35 the average annual increase in the population of Japan Proper was not far from a nillion, which is greater than that for the United States, or for all of northern and western Europe, where the population is from two to three times as great. This is a rapid rate of increase, but it is not abnormal, for it corresponds to that in the Western world fifty to seventy five years ago. The present high fertility of Japan was matched by an equally high fertility in Occidental countries over a large part of the nineteenth century, during the first three quarters of which Nippon's population was nearly static. It required sixty years for japan to double its nearly static Tokugawa population, but this same feat was accomplished by the United States in about half the time during the expansionist period after the Civil War. In the sixty year period 1811-71 the population of England and Wales increased 125 percent. With a time lag of about half a century, Japan is duplicating the population history of Western Europe and the United States. The only reason that its large numerical increases are so conspicuous is that they come at a time when population growth in many Western countries has begun to level off. The inter census increase in population was some official publications give the population of Japan as 2 and 3 million 'higher than the census figures. This results from the fact that a number of government agencies collect and publish statistics independently of one another. Thus the General Statistical Bureau of the Imperial Cabinet gave the population in 1935 as 71,968,416. On this basis the population of 1940. Males would probably be about 75 million, 81 percent in 1920-25, 7.9 per cent in 1925-30, 7.5 percent in 1930-35, and 5.6 percent in 1935-40. The period 1930-35 saw a maximum absolute increase of 4.8 million, which declined to 3.9 million in the next five year inter census period.

The large annual increment to Japan's already very large and dense population, together with such impedimenta to trade as high tariff, empire preference, quotas, and exchange restrictions, which became increasingly prevalent during the past decade, made it more and more difficult for resource poor Japan to exchange her manufactures for raw materials on the world markets. In the face of this situation the military and nationalist elements in Japan found it easy to convince themselves that economic and strategic security required control of south-eastern Asia, which could be developed both as a market for manufactures and as a source of raw materials and food. This was the theme of the propaganda disseminated to prepare the country for the present war.

The crude birth rate for Japan for about forty years prior to 1935 was between 30 and 36 per 1,000 population. This is about double the crude birth rate of northern and western Europe and of the United States during the past decade. Since 1930 when the rate reached its all time high of 36.2, it has declined steadily; in 1935 it was 31.6, and in 1938, 27.0. More relined measurements clearly establish the fact that fertility in Japan began a definite downward trend as early as about 1920. The number of births per 1,000 women in the reproductive period of life decreased from 169.4 in 1920 to 142.6 in 1935. Penrose attributes this partly to the increasingly widespread practice of birth control by the rapidly expanding urban population, which recognized the handicap of large families in city living.

But despite this decline in reproduction rates for nearly all ages of mothers, there has been no commensurate reduction in the annual increase of population; on the contrary, it actually increased somewhat between 1920 and 1935. The reason is that mortality rates have declined more rapidly than the birth rate. Thus the crude death rate in Japan declined from 26.8 in 1918 and 25.4 in 1920 to 16.7 in 1935. Infant mortality especially showed a rapid decline: from 166 deaths under age one per 1,000 live births in 1920 to 106 in 1937. Nevertheless the mortality figures of Japan are still 4 to 6 per 1,000 Higher than in northern and western Europe.

It is, then, Japan's Oriental birth rate and Occidental death rate that produced, until about 1935 or a little later, an annual net increase in population of almost a million despite a falling reproduction rate. Until 1935 the annual rate of population increase actually mounted; in the period 1930-35 it rose to 1.5 per cent. During, the next five years, however, it declined to 1.1 per cent. Thus the problem created by a rapid increase in population would slowly have disappeared. Nevertheless the age distribution of the Japanese population, characterized by a large proportion of young people, indicates that rapid growth is possible for some time to come. In this respect Japan resemble

Eastern Europe and Soviet Russia more than western and northern Europe, where the percentages of mature and older people are greater. In 1935 almost 40 percent of Nippon's population was under fifteen years of age, as compared with 22 percent in the British Isles, 24 percent in western and central Europe, and about 25 percent in the United States. Only 7.8 percent of Japan's population is between the ages of fifty and fifty-nine, as compared with nearly 10 percent in the United States and over 11 percent in France. With such an age distribution Japan may not feel the full effects of declining fertility for several decades. Before the outbreak of the Sino-Japanese War in 1937 it was estimated that the population of Nippon would reach 80 million by 1950 and 105 million by 1970.

Dr. Ueda, however, concluded that it could never reach 100 million. Under present conditions all such prophecies are of course meaningless, for no one knows what the conditions will be in Japan after this war.

Since the outbreak of the Sino-Japanese War in 1937 population growth has been abnormal. Statistics on births, deaths, and marriages have not been published since 1939, but the figures for 1938 reveal that certain trends had begun to accelerate. In that year as compared with 1937 there was an increase in total deaths and a sharp decline in births, and hence a sharp decline in the excess of births over deaths. In 1938 the crude birth rate (26.7 per 1,000) was the lowest it had been in many decades, and the population increase (9.3 per 1,000) was about 33 percent less than in the previous year. In the fourth quarter of 1938 there were 20 percent fewer births than in the same period of 1937. Even if the rate declined no further, the total births in 1939 would have fallen to about 1,750,000, the lowest figure since 1920. As reckoned from October to October the net population growth of 970,000 in the 1937-38 period would have declined to 653,000 in 1938-39 and to 239,000 in 1939-40." It may have become nearly static by 1940. All this of course reflects the military mobilization for the Sino-Japanese conflict and the emigration of civilian war workers to the industrial centres of Manchuria, Korea, and China, which is at-tended by increasing separation of the sexes. The rise in mortality in 1938 seems to indicate a *decline* in Japan's national health as a result of the war in China and the exertion being made for the more serious conflict to follow. In January, 1941, the Japanese Cabinet approved a plan for increasing Japan's population to a hundred million by 1960. The stated objectives of the plan are:

(1) To maintain a perpetual increase; (2) to outrank other nations in the quality and rate of the natural increase; (3) to supply the military and industrial manpower required by the State; and (4) so to distribute the population as to maintain Japan's leadership in Asia. To make it easier for young people to marry early and have large families the plan provides for (1) preferential rights of large families with respect to daily necessities; (2) marriage loans, the principal of which shall be reduced 20 percent upon the birth of each child; (3) reduction of taxes for large families; (4) health measures to reduce infant mortality; (5) honors and rewards to parents of large families, to be paid from funds created by (6) the

taxation of bachelors; (7) establishment of marriage agencies; and (8) the restriction or prohibition of birth control.'

It seems somewhat incongruous for a nation which proclaims its need for more room because of its large population, and which justifies its territorial robberies in eastern Asia on that ground, to encourage reproduction by offering bonuses and bribes. Obviously Japanese leaders are more impressed with the military handicap of a numerically inferior population than with the probable benefits of a *reduced* population. At one time the Japanese government cited the country's population density as reason for her economic dilemma, hoping to gain sympathy for the solutions she contemplated. But as a greatly expanded empire began to take form in south-eastern Asia, the increasingly army dominated government saw the need for greater manpower and likewise the opportunities for migration into the tropical lands to the south. "Recent Japanese literature tends to identify declining fertility with national *decadence* and to urge the bearing of babies in terms of duty to race and State, stressing the his-toric destiny of the Japanese nation rather than the economic and social welfare of the individual."

A second striking feature of Japan's population growth since 1920, which has in it the seeds of a declining birth rate, is the differential rate of increase between the rural and the urban population (53). In the two decades 1920-40 the number of people residing in communities of more than 10,000 doubled, whereas the rural population declined. By about 1,400,000. In general both the farm population per se and the rural population as a whole (those living in communities of less than 10,000) have remained nearly stationary. But whereas two decades ago the rural population constituted 68 percent of the total population and the urban population 32 percent, the respective proportions are now about 50 and 50 per cent. In the five years 1930-35 the total increase in Japan's population was 4,804,000, of which 3,217,000 or 67 percent took place in the cities; in the three years 1935-38 the estimated increase in total population was 2'369,000, but with an increase of 3,291,000 in the cities." Since the total population living outside of incorporated communities of 30,000 or more has remained at about 45 million from 1920 to 1940, the entire national increase of 17,200,000 was absorbed by the cities, chiefly cities of over 100,000. All this reflects the increasing importance of industry and trade in Japans economy, and suggests that agricultural expansion and intensifica-tion has reached a ceiling. A number of studies of population movement in Japan and the growth ratios of various parts of the country have been made.

Despite the high birth rates of the peoples in these districts of rugged terrain. Emigration exceeds births because the opportunities for earning a livelihood are *so* limited. In only two large non-urban regions, northern Honshu and Hokkaido, did population increase during the fifteen-year period at a rate higher than that for the country as a whole (23.8 per cent), although there are numerous isolated patches in other districts, particularly central Honshu and southern Shikoku, of which the same may be said. Exclusive of the districts with great cities, it is southwestern Japan that has had the slowest rates of increase; for the part of the country north of the latitude of Tokyo they have been somewhat higher (54).

Much the larger part of the higher than average rate of population in-crease, however, was localized in the four important industrial nodes of southwestern Japan, the *Keihin* or Tokyo-Yokohama centre, the *Ilan-shin* or Osaka-Kobe-Kyoto center, the head of Ise Bay around Nagoya, and the North Kyushu node of heavy industry. Between 1920 and 1940 only ten prefectures" grew at a rate higher than the national average.

"Hokkaido; Aomori and Miyagi prefectures in northern Honshu; Tokyo and ten accounted for more than two-thirds of the nation's total increase; two prefectures alone, Tokyo and Osaka, were credited with more than one-third. The prefectures containing the six great cities with a million or more population had 13.3 million people in 1920 or 24 per cent of the nation's population and 22.5 million or 31 percent in 1940. The prefectures of Tokyo and Osaka alone gained 6 million during the two decades, which increased their percentage of the total population from 11 to 17. By 1940 nearly one-fifth (19.67 per cent) of the Japanese were concentrated in the six largest cities, all situated within the three important industrial nodes. Here in an Oriental country there has been in progress a migration of the younger people from the farm areas into the industrial cities that duplicates the population changes that accompanied industrialization in the United States and Western Europe; only in Nippon the movement has been more rapid. The rapidity of the rural-urban migration is revealed in the fact that in the single decade 1930-40 the proportion of people living in Japan's large cities increased as much as it did in the United States in the four decades after 1900.1 This gravitation toward the urban centres seems natural in view of the rate expansion of industry and foreign trade. The greater than average rate of increase in Hokkaido's population also seems warranted in view of the opportunities offered by that semi-frontier island. More difficult to justify is the higher than average increase in north-eastern Honshu, a region largely without industry and one of the most impoverished sections of Japan. The largest migration to the cities has *been* from the more prosperous agricultural districts of commercial agriculture in southwestern Japan, which themselves offer the greatest economic opportunities, while population continues to pile up on the poor areas characterized by subsistence agriculture. This parallels the situation in the United States.'

Significant as is the internal migration and the resulting redistribution of population which has been analysed above, it should not be inferred that the population of Japan is a constantly or widely shifting one, for that is not the case. In 1930, for example, 83 per cent of the people were living in the prefecture of birth, a larger proportion than anywhere in the United States except a few states in the Old South." Only in Hokkaido and the industrialized prefectures of Tokyo, Kanagawa, Kyoto, and Osaka were more than 30 per cent of the inhabitant's natives of other prefectures. Even the fact that in four-fifths of the prefectures emigration has exceeded immigration does not invalidate the statement that in general the Japanese population has been a stable one, for the loss has been due largely to a one-way migration, chiefly of younger people from the agricultural areas to the great industrial centres; there has been little compensating in-migration from other prefectures.

In general the internal migration after 1935 was similar to that which took place in the fifteen years preceding. Of greatest significance are the absolute population declines which 14 of the 47 prefectures suffered. This represents an accelerated movement away from the agricultural areas. But there is evidence also that the trend toward concentration of population in the great cities was losing momentum, and that the cities of less than 300,000 were receiving a greater share of the total urban increase." This may have been a result of the war rather than a normal trend, however. Many satellite towns and cities of the great metropolises grew at a relatively faster rate than the mother city itself, and there was also a proliferation of new industrial towns. For example, Kawasaki, a shipbuilding centre near. Tokyo grew from 104,000 to 301,000 in the five-year period, and Yokosuka, a naval base, from 110,000 to 193,000. The Kwanto cluster of cities numbered thirteen in 1930; in 1940 there were twenty-eight whose population exceeded 25,000. Those industrial urban areas in which there was a marked concentration of new war industries, such as North Kyushu, the Kwanto district, and the Nagoya area at the head of Ise Bay, grew much more rapidly than those not so stimulated by war preparations. The great Kinki urban area, for example, lagged well behind Kwanto in popu-lation increase during the decade of the thirties, whereas the eight principal cities of Fukuoka Prefecture in northern Kyushu, the nation's principal focus of heavy industry, expanded 46 percent. This transformation has fareaching effects, economic and political, on the Japanese population." Not the least of these are the effects upon health and sanitation conditions and upon birth and mortality rates.

9.9 POPULATION DENSITY AND DISTRIBUTION PATTERNS

9.9.1 Density of Population:

The latest figures pertaining to Japan's population were released in 2015 shows 1, 27,094,745 people, which make Japan the tenth largest populated country in the world. The most recent estimates places the number lower at 126.71 Million, still the world's 10th largest populated country. Though it decline in 2018 it still holds that position with an estimated 127.19 Million people, out of which 48.82 percent are males and 51.18 percent are females. The density of population is 336.53 Km^2 and the growth rate in 2018 is -0.23 percent.

In 1940 Japan had a population density of about 500 per square mile. This was more than eleven times the density of the United States (56). In only two European countries, Belgium and Holland, does population density markedly exceed Japan's, and in Great Britain it is slightly higher than in Japan, but none of these depend upon agriculture to the same extent as Nippon. Of the Asiatic countries only Java has a greater population density.

But even this high figure of about 500 per square mile is an under-statement of real density because so little of the country is closely settled, owing to the prevalence of hill land and mountain. Only 20 per cent of the total area is classed as potentially cultivable, and only 16 per cent is actually under cultivation. This does not mean that the hill and mountain land is without resource value and incapable of supporting human life: merely that its potentialities are much less than those of the lowlands. If we substitute cultivated area for total area in the denominator of flit: ratio, we arrive at the almost unbelievable figure of about 1.200 per square kilometer or more than 3,000 per square mile (56). In no other country are human beings crowded together so thickly on the cultivated land. Even in Great Britain, a highly industrialized country, the arable land density is much lower. In Japan about 42 per cent of the population is still engaged in agriculture. Even if the agricultural population alone is considered, the density is still 1,200 to 1,300 per square mile, which is one of the highest anywhere on earth.

There is no question that Japan's chief national problem is that of sup-porting this unusually dense and rapidly increasing population in a small territory poor in essential resources. Still one hesitates to say that Japan is actually overpopulated. The fact that, until recently at least, the per capita income has been slowly rising would suggest that she has not yet reached that point. On the other hand, if there were fewer people in Japan, more of them could live better, provided the national income were well distributed. Population density is not an absolute, but a relative measure; the ratio of people per square mile of gross area or even of cultivated land must be considered in the light of other factors. Thus in Japan much of the rough non-arable land must be regarded as productive, since it yields timber and other forest products, and more of it could doubtless be used for growing tree crops of nuts and fruits. Another source of great wealth are the extensive and very productive fishing grounds in the vicinity of Nippon. And one cannot refrain from remarking that the country's limited resources were well known to the Japanese long before they had in-creased to seventy-three million. Yet the government has taken pride in the high birth rate and lately has adopted measures to halt its decline. That decline may presage a return to the population stability which characterized the pre-Meiji period; in any case the dangers of overpopulation seemed less serious in 1940 than a decade earlier.

The population problem of Japan has of course been greatly aggravated by the maintenance of national policies inconsistent with the country's scarcity of resources. A nation that spends so much of its national income on armaments will naturally have less capital to spend on developing its resources; yet Japan insists she must rob her neighbours to obtain new resources. Clearly it is an anomaly that it should be the fascist military nations which urge high birth rates and large families. The whole economy of Japan is designed to benefit a few already wealthy groups and to build an invincible military power." Few of the benefits of modern capitalism have filtered down to the large mass of the population. Industrialization has been promoted for the purpose of producing certain goods that could be exchanged abroad for oil, steel, armaments, etc. The market at home for manufactured goods has remained small because of the low income of the working people. The poverty so prevalent in Japan, then, is not wholly attributable to overpopulation of the land, but partly also to the fact that industrialization has been fostered to a mass strength for the preservation of the State rather than to improve the lot of the people. Japan as a small, resource-poor country, lacking a large and profitable colonial empire, is dubiously equipped by nature for a place among the first-class powers, and it is doubtful whether she can afford both military pre eminence and a high standard of living for her population.

9.9.2 Distribution Patterns:

Almost any map showing population distribu-tion in Japan, but especially Ishibashi's, which expresses density ratios for small political subdivisions (gun) by means of colours, reveals that for the county as a whole—disregarding for the moment the local variations between hill land and lowlands—population density decreases progres-sively north of about latitude 37^0. Thus, whereas most of the prefecture in central and south western Japan averaged 150 400 persons per square kilometre in 1940, Hokkaido had an average of only 37, and the three northern provinces of Honshu (Aomori, Akita, Iwate) only 89 persons per square kilometre. These differences are associated with differences in the proportions of rough land and plain, and with the presence or absence of large cities. In all of northern Honshu and Hokkaido the average population density was well below that for the whole country, which in 1940 was 194 per square kilometre or 501 per square mile.

If cultivated land is substituted for total area, in order to eliminate the effects of relief in the several prefectures, the same decrease of density northward is evident. If the population 'density per unit of cultivated land in the south western prefectures (lacking large cities) is taken as 100, southern Tohoku in latitudes 37° or 38° has an index of 65-80, northern Tohoku 45-65, and Hokkaido 25-35. This progressive decrease of population north of about latitude 37° reflects, for one thing, increasing remoteness from the economic and political heart of japan. Even more it reflects the increasing severity of climate, which makes living conditions harder and land less productive, particularly for a people strongly bound to subtropical agriculture and housing llice declines in yield, winter cropping becomes much more precarious and is entirely absent over large parts of Japan's northland, and such commercial crops as tea, citrus, and mulberry are either absent or less important. Table 59, which shows farm production and farm population per tan (1 tan = 0.245 acres) in large regional sub-divisions, reveals that it is in Hokkaido that ratios are lowest and most out of line with the normal for Old japan, and that Tohoku, comprising the northernmost six prefectures of Honshu, is next lowest. The most important boundary separation South of latitude 37° population is markedly concentrated along the Pacific side of the country in an irregular zone extending south from the Tokyo Plain along the Pacific coast (excluding Kii Peninsula) to Osaka and including both shores of the Inland Sea and north-western Kyushu . This was one of the first sections settled, and is the most urban and industrial part of modern Japan. It contains both the nation's ancient and modern capitals and the modern centres of business and commerce. Here large alluvial plains face on the quiet waters of spacious bays, where great industrial port cities have developed. The whole region is easily accessible, for its deeply indented coastline borders protected waters that offer numerous havens for boats. At its western end is the nation's most utilized coal field, one of the largest in the country. All six of Nippon's great metropolitan centres of more than 950,000 population. Five of them occupying tidewater locations, are included within this populous belt, as are twenty-six of the other thirty-eight cities of more than 100,000 inhabitants.

In a region as complicated in relief as Japan it is almost inevitable that the population pattern should be a very discontinuous, fragmented, or clotted one (back end paper). The compact settlement clusters are almost coincident in both size and shape with alluvium-floored lowlands." Very sharp, almost knife-edge boundaries frequently separate densely populated areas from almost uninhabited ones. Indeed, it is almost possible to reconstruct the relief pattern of Japan from a detailed population map. Here and there smooth ash uplands and low, much-dissected Tertiary areas are also fairly well settled. This coincidence of the plains of river aggradation with areas of settlement makes for a decided peripheral or seaboard concentration of population, since most of Nippon's lowlands are delta-plains (back end paper). Hence it is not surprising that the Japanese are closely bound to the sea. The coincidence of alluvial areas with popu-lation is perhaps more pronounced in Nippon than in most parts of the world because of the Japanese farmers' determination to grow irrigated rice. In the hill lands it results in a close correspondence between population and drainage lines.

Like the Chinese, the Japanese tend to overcrowd the best lands and neglect the possibilities of the less fertile and more isolated upland areas. In part this may reflect their gregarious nature and their dislike for frontier isolation. A more important factor is the inability of a fanner. Under conditions of spade agriculture, to obtain a living from any bug*le* be' land. The United States Department of Agriculture has estimated that takes about fifteen man- takes about fifteen 311:1I1- days to spade an acre of land by hand; hence the farmer who lacks draft animals and machinery and thus must depend altogether on his own labour can cultivate no more than an acre or two of ground. Even those more fortunate Japanese who own an ox or a horse can plow only a few acres at most. In as much as it takes just as long to spade, plant, and cultivate poor land as good land, the Oriental farmer must apply his labour on the most productive soil if he is to keep his family from starvation. In the United States the farm area is in-creased as the productivity of the land declines; increasingly extensive methods are possible through the use of more animal or motor power and labour-saving machinery. But this adaptation the Japanese peasant farmer, almost devoid of capital, cannot make.

9.9.3 Japanese Migration and Colonization:

Among the proposals for meeting Japan's population problem which *were* noted above was that of emigration. Between 1638 and 1868, the two centuries that witnessed the establishment of the empires of the European powers and the migration overseas of large streams of Japan was a nation bent upon preventing not only the outside influence but the eco of its own subjects. In recent Years, however, the Japanese government has sponsored and' subsidized emigration, either to Japanese colonies or to foreign lands where Japanese immigrants are welcome. In doing so it has had two objectives: to ease the mounting pressure of population, and to promote its imperialistic policies by extending and consolidating the military and economic strength of Japan.

The first Japanese emigrants were contract labourers who, beginning in 1885, settled in Hawaii, the United States, and Canada. After immigration into the United States was limited, about the turn of the century, and eventually stopped entirely by 1924, the Japanese began to migrate to South America, more especially to Brazil, and to the mainland of Asia and the tropical islands off its south-eastern shores. From 1918 to 1936 the number of Japanese authorized to emigrate annually ranged from a low of 8.825 in 1923 to a high of 28,087 in 1934. In at least six of these years the number of returning emigrants exceeded the number leaving. Thus Japanese emigration has been at best a feeble movement. One main cause is that the Japanese are poor colonizers and do not like to emigrate, especially to a severe continental climate. Dr. Ishii believes that the long period of isolation in the Tokugawa era, during which overseas activity was suppressed, had a devitalizing effect upon Japanese colonizing ambi-tions. Then, too, many of the areas they would regard as attractive have been closed to them. The few colonies they established during the last three or four decades had become densely populated by peoples of lower standards of living." Some writers stress the southern origins of the Japanese as a factor impairing their capacity to colonize cold climates. Certainly many elements of their culture—their dwellings, clothing, diet, agricultural crops, etc. are so acclimated to the subtropics that they must make serious readjustments when they move into regions with so severe a climate as Manchuria, Hokkaido, and Karafuto. The Japanese farmer offers much less resistance to southward migration, though at best he is unenthusiastic.

Within the Japanese Empire itself and its "sphere of influence" the possibilities for colonization have not been great. In 1940 Hokkaido had a population of about 3.3 million, a large part of which represented migra-tion from Old Japan. But virtually all the valuable agricultural and has now been settled; all that remains is a modest amount of the poorer land.' Hence further migration to Hokkaido will be slow. Karafuto or southern Sakhalin is even less suitable for Japanese agriculturists, for its 300,000 inhabitants are largely engaged in such extractive occupations as fishing. Mining, and logging. Korea, or Chosen, is already thickly populated (24.3 million in 1940), having a density of 286 per square mile. And I, 451. Per square mile of crop area. Moreover, since the. Koreans have a lower standard of living, the Japanese agriculturist cannot compete in the same area. The business and professional occupations offer somewhat better opportunities, so most of the few hundred thousand Japanese in Korea are in the cities and towns. In Formosa the density of population, higher than in Korea, has discouraged agricultural settlement by the Japanese. In the Pacific Mandated Islands Japanese population has increased rapidly. From 3,671 in 1920 to 70,141 in 1938; many of these are tenant farmers working sugar-cane plantations. Japanese authorities estimate that a total of 100,000 farmers and a considerable number of tradesmen and fisher-men can be accommodated in the islands.

Manchuria, more than any other region within Japan's "sphere" has been regarded as a promising field for agricultural colonization. But as late as 1930, despite the ambitious schemes which authorities and organizations had been fostering for nearly a quarter century, there were only 743 Japanese farm families in Manchuria. After the creation of the puppet state of Manchukuo, when it was made legal for the Japanese to own land in Manchuria outside the Kwantung Leased Territory and the South Manchurian Railway Zone, immigration increased. Between 1932 and the spring of 1937, 2,367 Japanese families (4,245 individuals) were settled on the land in Manchuria and continued to remain there. This movement was subsidized by cash and services. In addition there was a free non-subsidized immigration of 2,150 people." Most of the settlers were young army reservists between the ages of twenty-two and thirty, and many were unmarried. Obviously the plan was to create military farm colonies along the northern and eastern frontier of Manchuria.

Manchuria is one of the few areas in eastern and southern Asia in which much good agricultural land is still unsettled; it is estimated that from 40 to 50 million acres are still available. But the climate of this region, where the frost-free season is only 120 days or less and where average January temperatures are below zero, is more severe than most Japanese farmers care to endure, and many discouraged colonists have returned to the homeland. Beginning in 1937 the government put into operation a project for settling a million Japanese farm families or 5 million persons in Manchuria during a twenty-year period." Part of this im-migration was to be subsidized, the rest was free. As a result of the Sino-Japanese War the project was somewhat reduced in the second year. But by early 1939 some 50,000 Japanese had already migrated to 'Manchuria."

After 1934 Japanese emigration to foreign countries dropped off sharply; in 1935 and 1936 it was less than half as great as it had been in the two years preceding (Table 61). By far the largest exodus was to Brazil, though the Philippines, Soviet Russia, Peru, the Malay States, the Dutch East Indies, and Argentina also received substantial numbers. The migration to Brazil reached a maximum of 23,299 in 1933, and in 1934 it was almost as large. Thereafter, as a result of restrictions imposed by the Brazilian government, the numbers were greatly reduced. In 1937 there were 197,733 Japanese residents in Brazil.

Despite the government's encouragement to emigration, the number of Japanese in foreign countries is still less than a million, and the total number of Japanese outside of Japan Proper is only from 1.8 to 1.9 million. If Japan could retain and consolidate as a part of her empire the regions of tropical South Asia recently acquired by conquest, she would have at her disposal large areas and extensive resources still virtually undeveloped: in Burma, Thailand, French Indo-China, Malaya, the Dutch East Indies outside of Java, New Guinea, and other islands in its general neighbourhood. It is these tropical regions that Japan hoped to conquer and make available to her people. Even after Japan is defeated and stripped of the fruits of conquest, there are good arguments for per-mitting Japanese farmers to settle in these undeveloped lands of tropical South Asia, provided of course they come purely as home seekers and not with the backing of an imperialistic government.

9.10 THE GROWTH AND PROCESS OF URBANIZATION

One of the most dramatic developments of the post-war era, and one with profound consequences for Japan, has been the rapid increase in urbanization and its concentration in a small fraction of the country. In 1950 there were 6.2 million farm households, almost the same number that existed during the early Meiji era. By 1986 that number had declined to 4.3 million. Farm population as a percentage of the total population declined from 85 percent early in the Meiji period to about 50 percent in 1945. In the late 1980s it fell to barely 11 percent. Urban population, in turn, increased. Even as late as 1960, the urban population accounted for less than half of the population; today that figure is around 80 percent. Thus, Japan's transformation to a predominantly urbanized nation has taken place relatively recently.

A striking characteristic of the urbanization in Japan is the concentration of that urban population in a small portion of the country, in cities scattered through the core area from Kitakyushu/Shimonoseki at the western end to Tokyo in the east. In between are scores of smaller cities, such as Hiroshima, Okayama, Oita, Takamatsu, Tsu, and Shizuoka.

The urban concentration is most intense in three huge urban nodes, which are gradually coalescing into what is called the Tokaido megalopolis, named after an old post road that ran through the region in pre-Meiji times. The three nodes are Tokyo-Yokohama, Nagoya, and Osaka-Kobe-Kyoto. Today, approximately 52 million people, or about 43 percent of Japan's total population, live in these three nodes. The Tokyo metropolitan region has 27.8 million; the Nagoya region, 8 million; and the Osaka region, 15.9 million. Thus, well over half of Japan's urban population is located in this megalopolis. If migration and natural population growth rates continue, 80 million Japanese will live in the Tokaido megalopolis by the year 2000, making it one of the largest urban concentrations in the world.

The remaining 69 million Japanese are found predominantly in other cities scattered throughout the core region. The few significant cities outside the core region include Sapporo and Hakodate on Hokkaido; Sendai and Niigata in northern Honshu; and Toyama, Fukui, and Maizuru on the Sea of Japan side of Honshu. All of these cities are relatively small. Southern Shikoku and southern Kyushu have no major cities, at least in terms of industrial activity.

Fortunately, the growth rate in the central cities of the Tokaido megalopolis has slowed almost to a standstill. In the past two decades the trend has been for the fastest growth to occur in the suburbs and satellite cities of the major metropolitan centres, a pattern analogous to the urbanization in the United States in recent years. Of course, this trend further contributes to urban sprawl, which raises major problems for a land-shy nation.

In Japan, as in most developed countries, industrialization and the declining need for farm labour provided the major stimulus for urbanization. In Japan's case, however, an important additional factor was the desire of Japan's business interests and government to concentrate industry, especially heavy industry, in a few areas, most of them near the coast. Concentration was useful to take advantage of economies of scale, and location near the seashore made it cheaper to handle large quantities of imported raw materials, such as iron ore, coal, and oil. Much of the post-war development of industry occurred on reclaimed land built along the shoreline of the Inland Sea and the Pacific coast of the core region.

In addition, the Japanese developed kombinats, or groups of closely interrelated and integrated factories clustered around one or more large-scale core factories. These complexes are designed so that the products of one factory can be easily and efficiently used by the others. Most of the kombinats produce chemicals and petrochemicals and typically include a petroleum refinery; others specialize in iron and steel or other products. The kombinats allow huge amounts of bulky raw materials to move directly from ships into the production.

CHECK YOUR PROGRESS

Note (a) Write your answers in the space given below

(b) Check your answers with the above subsection

1. Write a short note on the climate of Japan

____

____

2. The economic development of Japan is related to Sea and water. Comment

____

____

3. Give an account of Population growth in Japan.

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4. Write a short account on Urbanization in Japan.

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9.11 LET US SUM UP

In this chapter the relief and physiography of Japan is analysed in detail the existing situation and the processes that have been at work in the past. Physio graphically, Japan is divided in to four zones, north inner zone, south inner zone, north outer zones and south outer zones. The island nation contain 6852 islands out of which four largest islands (Honshu, Hokkaido, Kyushu and Shitoku) accounts for 97 % of its population. These islands are densely populated. The diversity in relief has definitely its impact on the climate, drainage system, Natural vegetation, population and Urbanization. The present number put the people at 127.19 million and rank 11^{th} largest populated country in the world. The total urban population of Japan is 91.6% and rank 8^{th} in the World.

9.12 GLOSSARY

Archipelago: A chain or group of Islands.

Climate: The average temperature, precipitation and wind condition expressed for an extended period of airs prevailing condition over time.

Climatic Classification: Temperature and precipitation conditions reduced to meaningful generalisation for segment of the earth.

Death Rate: The number of deaths occurring per thousand persons in a given area.

Natural Vegetation: The plant life that can be expected in a particular environment if free of human impact.

Population Density: The number of people per unit area.

Population Distribution: The placement or arrangement of people within a region.

Region: The portion of the earth surface that have some internal features of uniformity.

9.13 LESSON END EXERCISE

1) Divide Japan into Physiographic zones and write a detail account on each of them.

2) Write a detailed account on the drainage system of Japan.

3) What is Climate? Classify Japan into different climatic regions and discuss them in detail.

4) Discuss the soils of Japan and classify the soils into different types.

5) Discuss the various elements which control the climate of Japan.

6) What is natural Vegetation? Classify Japan into natural vegetation regions.

7) What is population growth? Discuss population growth from 1920 to 2018 of Japan.

8) The Population of Japan is unevenly distributed. Discuss.

9) Write a detailed account on Urbanization in Japan.

10) Urbanization is a powerful indicator of development. Discuss.

9.14 SUGGESTED READINGS

- Geography and Development: A world regional Approach edited by: James Fisher. (1980) Macmillan Publishing Company.

- Regional Geography of the World By D.S. Manku (2002) 2nd Revised edition Kalayani Publishers. New Delhi.-110002.

9.15 REFERENCES

- Regional Geography of world by Majid Hussain 2005

- Geography and Development: A world regional Approach edited by: James Fisher. (1980) Macmillan Publishing Company.

- Regional Geography of the World By D.S. Manku (2002) 2nd Revised edition Kalayani Publishers. New Delhi.-110002.
- Geography of Asia by. Shiv Kumar Tiwari. (1990)
- Geography of Asia by Sir. Dudlay Stamp.

JAPAN-MAIN FEATURES OF AGRICULTURE, LOCALIZATION OF INDUSTRIES AND INDUSTRIAL REGIONS.

10.0 STRUCTURE

10.1 INTRODUCTION

Intune with several other Industrialised countries of the world, the percent share of agriculture in the gross national product of Japan is gradually decreasing. The relative decline in agriculture output in terms money value suggests that development of secondary and tertiary sectors outpaced the growth of agriculture. Despite the decline relative share of agriculture in the national economy, considerable progress has been made in agricultural sectors. The volume of present agricultural output is surpassed all previous records. The total population engaged in agriculture is 2.028 percent of total population of Japan.

The modern industries that were deemed important by the Japanese government were those on which military power depended. Hence, the government led the way in developing shipbuilding, Iron and steel, and modern communications. The first railroad was built between Tokyo and Yokohama in 1872. At the same time, as the need for importing raw materials grew, export industries were encouraged, particularly silk and textiles.

At the end of the nineteenth century, the country still had a small industrial base. In a quantitative sense Japan's take off period did not begin until after the Russo-Japanese War of 1905. Then industry blossomed. Between 1900 and the late 1930s, the production of manufactured goods increased more than twelve fold. Export trade grew twentyfold in the same period, with manufactured goods accounting for most of the increase. The Japanese excelled at producing inexpensive light industrial and consumer goods more cheaply than many other countries—an approach to production that has continued to serve the Japanese well. Foreign markets, however, played a less important role in this export strategy than is commonly believed. Japan's economic growth in the early twentieth century was largely self-generated.

Two decisive events that shaped the course of Japan's development in the twentieth century were its victories over China in 1895 and over Russia in 1905. These two wars had a number of consequences. For one thing, they started Japan on a course of imperial conquest that ended in the disaster of World War II. This course was partly an imitation of the colonial practices of modern Western nations. It was also partly a quest for secure sources of raw materials and markets for industrial goods. As a result of the two wars, Japan's territory was greatly expanded: it controlled Taiwan, Korea, and parts of China, including Manchuria. By the end of World War I, Japan was a fully accepted imperial world power. In 2018 the total population engaged in industrial sector is 97.972 percent which confirmed its strong industrial base.

10.2 OBJECTIVES

After studying this lesson, you will be able to learn about :-

1. To highlight the present position of Japanese Agriculture.

2. To study the land reforms and distribution of land to the active cultivators.

3. To analyse the meteoric growth of Japan in the field of industry which is really brilliant achievement.

4. To study their locational and regional distribution of industries.

10.3 THE MAIN FEATURES OF AGRICULTURAL GROWTH

A significant change that accompanied the modernization of Japan after 1868 was an upsurge in population growth. During the latter half of Tokugawa rule, Japan's population had stabilized at about 33 million. Between 1868 and 1940, however, Japan provided a classic illustration of the interaction of economic and demographic factors, the demographic transformation. As industrialization and urbanization proceeded, both birth-rates and death rates declined. Population began to increase, but the rate averaged only about 1.5 percent per year up to 1940. Nonetheless, that growth rate was sufficient to more than double the population, to just over 73 million, by 1940.

At the close of the Tokugawa era in 1868, about four-fifths of the labour force was engaged in agriculture, forestry, or fishing. From 1868 to the present, the rural population has declined steadily in proportion to the urban population, even though it did not start declining in absolute terms until just before World War II. Today, agricultural workers constitute only about 10 percent of the total labour force.

Several important trends marked Japanese agriculture in the last century. First, production increased rapidly up to World War I, the result of improved farming methods that included more efficient irrigation, better crop strains, pest control, and, above all, the lavish application of fertilizers. Agriculture succeeded in supplying all but a small part of the increased demand for rice that accompanied the population growth and the rise in per capita consumption. As Japan's population continued to expand, however, the country's ability to feed itself declined steadily. As a result, reliance on the colonies of Taiwan and Korea for rice and other foodstuffs increased.

The declining self-sufficiency in rice stimulated considerable spatial expansion of agriculture. Much of the agricultural land that is now farmed in northern Honshu and Hokkaido—including the terraced hillsides so common in these regions—was brought into cultivation during this period. The influence of the United States on agricultural expansion is still evident today in the north: farms in Hokkaido often specialize in dairying and are ten times the national average in size.

A second trend was that the gap between urban and rural standards of living increased as industrialization progressed. Even at the turn of the twentieth century, the average Japanese farm was extremely small. Productivity depended on heavy labour input on tiny, fragmented fields. Moreover, the number of tenant farmers increased greatly after 1868 and was not substantially reduced until after World War II, when a compulsory land-reform program was initiated during the American occupation.

Another important development arising from the pre–World War I period was a growing tendency for rural people to seek part-time employment in secondary economic activities. Rice alone could not sustain an acceptable standard of living. Consequently, many farmers raised silkworms, and large numbers of rural people, especially young girls, worked in silk mills. This movement out of agriculture into industry was hastened by the depression of the 1930s. The transfer of workers from agriculture to industry and from rural to urban trades kept industrial wages down. And low wages, combined with technical improvements during this period, enabled Japanese industry to remain competitive in world markets. From World War I to the late 1930s, Japan went through the drive-to-maturity stage of development. Agriculture receded in relative importance as secondary and tertiary activities expanded dramatically. Textile and food-processing industries gradually gave way to heavy industry, especially as Japan militarized in the 1930s. The war years, between 1937 and 1945, saw a reversal of sorts, as Japan's economy was geared to the war effort and austerity and shortages characterized personal consumption. Japan's extreme vulnerability its lack of domestic raw materials— doomed the nation to eventual defeat.

10.4 MANUFACTURING

JAPAN was a latecomer into the field of capitalistic industry, but once she had been forced to open her doors to the Western world, shedeveloped industrially at a rate that has been little short of phenomenal. Having been drawn into the maelstrom of world economic competition, she was primarily concerned with protecting herself against the humiliating fate that China had suffered at the hands of the Western nations. She was bent on making herself a military power capable of repelling economic encroachment from the outside and insurrection at home. Hence she directed her plans and her energies toward modernizing the country along Western lines at the greatest possible speed. The task that confronted the Meiji Government when it assumed control in 1868 was a formidable one—that of bridging the wide gap between the feudalism of Japan and the technologically advanced economy of the Western powers. No ordinary procedures would suffice.

The most notable features of industrial development in early Meiji Japan were, first, the government's participation in the development of model n industry and, secondly, the unusual concentration of capital, and hence of economic power, in the hands of a small group of wealthy men who financed the Stated For more than a decade after the Restoration, plans for the wholesale application of Western industrial methods were implemented by the establishment of government-managed enterprises which served both as models and as schools of experience. Government protection and subsidy were also granted to new private enterprises, with the result that early Japanese capitalism was of a distinctly hothouse variety. Ultimately many of the government enterprises were turned over to private firms, but the policy of strong protection and subsidy has continued to the present day.

At the time the Meiji Government undertook to telescope centuries of Western evolution into a few decades, only a few rich merchants and money lenders had accumulated enough capital to finance large-scale industry. These few, naturally enough, were wary of investing their wealth in such untried ventures. Thus the State itself had to develop those industries that were considered essential weapons against the penetration of foreign power, political and economic. Not only the industries that were strategic for military purposes were fostered, but also those in which Japan could hope to compete with foreign products. Arsenals, foundries, shipyards, and mines were brought under State control, and such other essential industries as cotton mills, chemical works, and glass and cement factories were established. Industries producing distinctly Japanese style goods, such as silk, lacquer, and porcelain, were not westernized but remained essentially handicraft enterprises.

The early dependence of the Meiji Government upon a small financial oligarchy for the funds needed to develop new industries forced it to take a number of wealthy families into virtual partnership. At first they served merely as bankers for the government, but later they took over the enterprises established by the State and eventually became the owners and operators of much of Japan's industry, commerce, and banking resources. The result has been a much closer association of government and big business than in most Western countries.

Still another feature of early Japanese industrialization was its great dependence upon foreign markets, since the bulk of the Japanese population—the agriculturalists—remained too poor to buy the products of the new industries. The Meiji Government's resources were devoted so exclusively to the development of manufacturing, banking, and communications that agriculture was largely neglected, despite the fact that the agricultural population comprised nearly eighty per cent of Japan's total. As a result agriculture lagged far behind the other industries in technical progress. Moreover, it was the tax on agriculture that furnished the funds for the wholesale subsidization of the government's adventures into Western capitalism. Thus Japan, lacking many of the raw materials needed by inrush and having only a restricted home market, was forced to develop a foreign trade to acquire the needed raw materials and to dispose of her manufactured goods. Cheap lab; was supplied by the rural districts, but few of the benefits of the new capitalism filtered down to the mass of the people.

World War I ushered in for Japan an era of unprecedented industrial and commercial expansion and prosperity, which lasted well into the post- War period. The factors that contributed to this prosperity were the cessation of imports from the Western powers, the increase of Japanese exports. Including munitions, to the Allied Powers, and the expansion of Japanese, spinning and shipbuilding. After the middle of the twenties, however, the recovery of the Western powers and the increasing trend. Toward economic nationalism or monopoly capitalism tended to restrict Japan's markets and curtail her industrial expansion.

10.4.1 Status of Manufacturing in 1930:

Judged by Western standards, Japan, although she possessed some highly developed modern industry, was not yet in 1930 a highly industrialized nation. Agriculture supported half her population, whereas manufacturing supported less than a fifth and commerce about 17 per cent. Light industries greatly predominated, particularly textiles and clothing, which in 1930 employed nearly one-third of the wage earners in Japanese industry (124).

The heavy metal and machine industries were much less developed, employing only 13 per cent of the gainfully employed. This predominance of textiles is shown even more strikingly hi the Factory Statistics issued by the Japanese Ministry of Commerce and Industry, which includes only establishments employing five or more workers" According to this report, more than 50 per cent of the workers of industry were in the textile trades, which represented 40 per cent of the total factory employment,' Silk and cotton industries greatly predominated 1929, silk reeling alone providing about two-fifths of the total factory employment in textiles, and cotton spinning and weaving about one-third. Taken together, all branches of the silk and cotton textile industries (including silk spinning and the bleaching, dyeing, and finishing trades), representing nine-tenths of the textile employment.' In 1928-29, some 37 percent of Japan's exports consisted of raw silk and 20 per cent of cotton anti and piece goods; together, all forms of raw and processed silk and of cotton goods represented two-thirds of the total value of exports.'

Control over Japan's modern industries, trade, and banking has been highly concentrated in the hands of a few huge business families known as the Zaibatsu (financial aliquot), the greatest of which operate simultaneously in finance, commerce, insurance, and mining' in 1937 their trust companies held some 70 percent of all trust deposits, and their trading companies conducted a third of Japan's foreign trade. Three of the Zaibatsu alone controlled half of the coal output and owned nearly half of the merchant ship tonnage registered in Japan. Factory-scale manufacturing is largely controlled by them. A large part of the chemical industry was controlled by four great concerns, as was the heavy-machine industry. Their interests in shipbuilding, warehousing, colonial enterprises, engineering, sugar refining, flour milling, and textile manufacturing have been extensive. Two of the Zaibatm, Mitsu and Mitsubishi, which controlled two of the manor political parties, were able, by exerting political and financial pressure, to influence government policies, secure subsidies, and obtain government contracts. Their ownership of banks and trust companies enabled them to exercise indirect control over many enterprises not owned by them directly.

For a much larger extent than in other industrial countries, Japanese manufacturing in 1930 was still carried on in a multitude of pygmy factories. This was true not only of Japanese-style goods, but of many export commodities as well. Today the Japanese industrial structure is a combination of large modern factories and multitudes of small factories and workshops and 1930 about half the workers in industry (excluding the building industry) were in establishments employing fewer than five workers, and about 70 percent in factories employing fewer than fifty.' Opinion differs as to the efficiency of such small units. It must not be forgotten, however, that from an administrative and financial point of view the many small units are often parts of a larger, highly integrated organization which coordinates their activities.

In 1930 Japan's industrial structure was very dependent upon foreign raw materials as well as upon foreign markets. As has been said, the bulk of the country's population was too poverty-stricken to provide a large home market, although it was a reservoir of cheap labour, one of Japan's chief advantages in competition with other countries. Not only is the low-income market of Japan a small one, but many of the goods it consumes are very different from those it exports. Thus Nippon's industry differentiates between Japan-style and foreign-style goods.

10.4.2 Japan's Manufactural Development, 1931-37

In the interval between the outbreak of the Manchurian Incident in 1931, which marks the beginning of a quickened imperialistic policy, and the opening of the Sino-Japanese War in 1937 Nippon's industrial structure underwent some remarkable changes. Without these changes, which involved both a major expansion of industry and fundamental changes in its structure, the present war in the Far East would have been impossible (124). Between 1931 and 1937 the number of factories employing five or more workers increased 66 per cent, the number of workers in industry nearly doubled, and the value of manufactural output more than tripled. This rapid expansion was the result of a complex of interrelated causes, the relative weight of which experts have not agreed upon.' The increasing power of the military in the government resulted in a speed-up of war preparations during the decade of the thirties; large expenditures were made for armaments and increased subsidies to such strategic industries as chemicals, oil relining, shipbuilding, and munity Ions. In a measure, then, the boom was State-financed. Abandonment of the gold standard and the depreciation of the yen created an export boom for Japanese goods. At the same time the collapse of the American silk market dealt a hard blow to the rural population. The resulting agricultural depression caused a shift of population from the impoverished farming areas to the cities, making available an abundance of low-cost labour. The competitive superiority of Japan is also manifest in her homo-geneous, highly integrated and beautifully adapted social organization permitting a unification of national effort not possible in any other country. The nation is conceived as a large clan whose chief is the Emperor and whose complete unification rests upon the strength of family tradition. The family is the prototype of the nation.

This national unity has permitted the absorption of foreign cultural influences without serious disturbances. Whereas European countries achieved the industrial revolution only at the cost of a disintegrgtion of their closely knit feudal organization, Japan was able to fit the revolution into her regimented feudalism with no serious disruption of its structure. In the United States and much of Europe production costs are high. Modern Japan achieves low-cost production without capitalistic exploitation of the worker. For low wages, national habits of frugality, and the capacity to sacrifice all but the minimum essentials are as characteristic of the people today as they were in the feudal era. From the great reservoir of the agricultural population, which is inured to an existence of extreme frugality, has come a never-ending supply of eager workers willing to accept subsistence-plus wages.

A second feature of industrial development in the period 1931-37 was the changing composition of Japanese industry, with emphasis upon greater diversification of manufactures (124). The earlier overwhelming importance of the lighter industries, particularly textiles and other consumers' goods, was reduced as a result of the expansion of the heavy industries, although this was of course a relative, not an absolute decline. Thus while metal manufactures accounted for only 5 per cent of inclusion; production in 1919 and 8.4 per cent in 1931, by 1935 it had sivrockete, to 23.8 per cent. In the same period the value of machinery and tools changed from 9.6 to 19.4 per cent, and chemicals from 11.7 to 17.3 percent. At the same time the value of textiles declined from 45.9 per cent of the total value of manufactures in 1919 to 37.3 percent in 19.31, and to 20.3 percent in 1938. This relative decline also took place in the face of an absolute increase. The volume of textile production was much higher in 1937 than in 1931, cotton cloth production being 31 per cent greater in that year than six years before. Foodstuffs declined from 16.2 percent to 9.1 percent.

Employment figures tell the same story. Thus in 1931 textiles employe. 50.4 per cent of the people in industry as against 37.8 percent in 1936. The metal industries workers increased from 6.0 to 9.7 percent of industrial workers, in machinery and tools from 13.2 to 18.3 percent, and in chemicals from 6.6 to 11.1 percent.' These figures are an indication of the extensive changes that Japan's industrial structure underwent within the span of a few short years during the early thirties.

Third area in which the Japanese industrial structure changed in the period 1931-37 was in the technical efficiency of factory industries. Factory managers learned to make more efficient use of labour, power, materials and improved equipment and manufacturing processes we introduced. The results were increased output and lower production costs. In the lighter industries this increase in technological efficiency were effected most rapidly during the depression years 1927-31, but in ravel, chemicals, metals, and machine manufacturing the speed-up came large' after 1931 again it must be said that this progress was all relative. Sine Japan's level of industrial technique and organization, judged by Western standards, was very low in 1920, the advance she made thereafter is being assured from a low base. Despite the rapid strides she has made, her productive efficiency does not equal that of the industrial countries of the Occident. In most modern industries she still lags behind western-Europe and the United States, although the gap has been appreciably narrowed.

A fourth and significant feature of Japan's industrial change between 1931 and 1937 was the increasing intervention and control of the State over industry. This was not a complete innovation, for ever since the early Meiji period the State had played an important role in industrial and commercial development. But beginning in 1930 and 1931, when severe depression occasioned great suffering. This policy of State control was greatly quickened and expanded. During the early thirties political power shifted, at least in part, from the great financiers and industrialists the military factions. With the adoption of an expansionist foreign policy in Asia, these factions insisted that all economic activities connected with national preparedness for war and with the execution of the expansion program in Asia be strictly regulated and controlled. The will not opposed to the policy of expansion, were inclined and less dangerous means of attaining the goal; they favoured a threat only if and when necessary. Despite their reservations, however, trend during the early thirties was toward a quasi-wartime economy. Such strategic industries as iron and steel, petroleum refining, and shipbuilding were brought under strict control of the government, with the result that by 1937 the way was open for the State to take over when they broke out.

10.4.3 Developments in Manufacturing since 1937

With the outbreak of the Sino-Japanese War many of the industrial standards conspicuous in the earlier part of the decade were intensified. In competition there were certain distinct changes in the composition of industry, chief of which was the absolute decline in textiles and most other, consumer's goods destined both for home consumption and the export market. In the preceding years these lighter industries, although they didn't kept pace with the rapidly expanding heavy industries, had continued to increase also; after 1937 they suffered an absolute decline, as capital and labour were diverted to the essential war industries. The unparalleled acceleration of production in the heavy metals, machinery, chemicals, and engineering to meet the demands of the armed forces necessitated greatly enlarged purchases abroad of raw materials for metal and munitions manufacture, petroleum products, high-grade machine tools, motor vehicles, etc., and inevitably resulted in a tightening of State control over peacetime industries. Japan's goal was so to expand the strategically important heavy industries that the country would be less dependent on imported raw materials. In 1938 this ambition was crystallized in the concept of the "New Order in East Asia" or "the Yen-Bloc," which was based on a Japanese organization of Japan, Manchuria and China into an economic defence bloc. By mid-1940 this earlier organization had become only the nucleus of a greatly expanded "Greater East Asia Co-Prosperity Sphere," which was to be an independent and self - sufficient economic bloc comprising large but unspecified areas of eastern and southeastern Asia. Within this sphere Japan was to the dominant from its resources she planned to draw the raw materials she needed, and to its market sell the products of her industry. Between 1936 and 1939 the number of manufactural enterprises increased 52 percent, the number of workers in industry 45 percent.

The Gross value of industrial production 99 per cent, the number of hour, worked by industrial employees 40 percent, and expenditures for wages and salaries 98 percent. The increase of almost 100 percent in Bros, value of production is partly accounted for by the rapid rise in prices 1939. In terms of 1936 prices the increase was in the neighbourhood of 3; percent. Individually and collectively these several criteria denote very substantial growth in Japan's industrial machine after the outbreak of the war with China.

The industrial spurt that occurred in the late thirties resulted in an increase of 13.5 percent in the total volume of manufactural production between 1937 and 1939, and 32 percent between 1936 and 1939. The increase after 1937 comprised a 41.8 per cent increase in the volume of producers' goods and a 15.1 percent decrease in the volume of consumers' goods. The contrast in changing volume of production since 1937 between heavy war industries and lighter peacetime industries is shown in Table 9.4, in which the base is August, 1937. It is significant that Despite the increasing demands of the war, both metals and machinery and chemicals declined in the year ending August, 1940. This is attribute able in part to shortages of raw materials, coal, and electric power; in part it is due to other circumstances, notably the failure of some of the large financial interests to cooperate in the militarists totalitarian Production and the declining efficiency in labour with a declining standard of living.

10.4.4 Distribution of Manufacturing

Manufacturing in Nippon is concentrated largely in a thin belt nearly 500 miles long which extends from the Kwanto region on the northeast, along the Pacific coast to the Nagoya area and thence through the Kinki along the shores of the Inland Sea, to Nagasaki in north-western Kyushu. By any measure of manufacture importance value of product, number of factory workers, variety of industries, etc.

This region outranks all others. It is also the most populous and urbanized belt of Japan, 53 per cent of the country's cities of over 25,000 population being located here. In this belt are employed 75-80 per cent of the total value of Japanese manufactured goods. About three quarters of the pig iron of Japan Proper and probably 90 per cent of the steel originate here. The specific advantages of this belt as a location for industry are not too striking. Certainly no single factor explains its growth. Perhaps its most important advantage, one which is common to all parts of it, is readily accessibility. No other part of Japan is equally accessible, either to countries or to other parts of japan. The whole belt is coastal in location and the numerous bays and the inland Sea offer excellent protection for shipping. Here are located the five ports that together handle 90 percent of Japan's foreign trade. Numerous smaller ports, most of them engaged chiefly in domestic trade, supplement the services of the larger ones.

Even during Japan's feudal period of isolation this Tokyo-to-Nagasaki strip was very much at the centre of activities. It included the old capital of Kyoto, the residence of the Emperors, and Yedo (now Tokyo). Capital of the Shogunate. Osaka and Nagasaki, two other important cities of feudal Japan, were also in this belt. Of the famous highways in Tokugawa Japan the Tokaido, connecting Yedo with Imperial Kyoto, was the greatest. The Sanyodo Highway followed the northern shore of the inland sea from Kyoto to northern Kyushu, and another important feudal road paralleled the coast of northern Shikoku. It is not strange, therefore, in view of these historical antecedents, that when japan was opened to Western influence, industry and trade should have been concentrated in this: coastal strip, where cities were already present and which was so easily accessible. The old cities of the region grew rapidly, and new ones like Osakobe, Yokohama, and those of North Kyushu came into existence. The accessibility of the Tokyo-to-Nagasaki littoral strip made it the logical region both for the importation of raw materials and for the disposal of industrial products. Some of the earliest railway lines in Japan were built across this region because of the concentration there of population and cities.

Japan's manufacturing is concentrated in four centres: Tokyo-Yokohama in the Kwanto Plain; Nagoya at the head of Ise Bay; Osaka-Kobe in Kinki; and extreme northern Kyushu.

From Tokyo to Kobe ran the Tokaido line, which was continued to Shimonoseki as the Sanyo line. At present this Tokaido-Sanyo route is the only long double-track railroad in Japan, and it has the best service and the fastest trains. The region also has the best modern motor highways.

The power resources of the region are not extraordinary. At its extreme southern end are Japan's most important coal fields, which supply coal to a large part of the belt. The lignite fields near Nagoya and the Johan coal field north of Tokyo are much less significant sources of power. The northern and central part of the industrial belt are also within reach of Japan's greatest potential and best developed hydroelectric concentration in central Honshu.

The industrial belt comprises four areas of concentration or node, which have advantages superior to those of the belt as a whole. The three northern most of them have extensive plains whose level areas permit development of great cities and the construction of large factories. Two of the nodes, Kwanto and Kinki have modern deer, -water ports, and the other two, though somewhat inferior in this respect are at least better equipped with port facilities than other parts of belt. The northern and southern nodes have easy access to local cch resources. All of Japan's six great metropolises lie within three of the for centres of this industrial concentration.

The Kwanto Node - Northern most of the four manufacturing concentrations is the Kwanto Node, whose principal urban centres are Tokyo and Yokohama. In 1940 the former had a population of nearly 6.8 million and the latter close to a million. Within the node are approximate twenty-five lesser cities, one of which has a population of over 300,000 and another over 200,000. Twelve cities have a population between 50,000 and 100,000. Nearly 30 per cent of the nation's output of industrial products is from the Kwanto or Kei-hin industrial district. Here hydroelectric power, derived from the mountains of central Chubu, is relatively abundant, and adjacent Joban supplies a considerable part of the coal needed. Some coal arrives also by small steamer from North Kyushu and Hokkaido. Yokohama, Japan's first or second port, depending on what, car is being considered, is located on the west side of the extensive pouch-shaped Tokyo Bay, the principal gateway for the area. The extensive Kwanto Plain, the largest in Japan, is in general an ideal site for cities and factories, though Yokohama is bordered on its land side by fairly high diluvial terrace. Excellent rail connection and the most abundant local labour supply in Japan are other favourable factors.

The region is characterized by a great variety of manufacturing industries. Before the great expansion in heavy industries during the thirties these were chiefly industries that could be housed in small or medium-sized establishments; large factories were the exception. The war boom mod fled this situation considerably; by the late thirties the Kwanto centre had really increased in importance, particularly in the heavy industries requiring large factories. Today it ranks high in blast furnaces, steel mills, machines and tools, chemicals, oil refineries, shipbuilding, airplane factories, electrical machinery and textiles. It is estimated that 10-15 per cent of the nation's pig iron and 11-12 per cent of its steel originate in this centre. The principal groups of industries in Tokyo and Kanagawa pre lectures, the two most industrialized prefectures within the Kwanto node, rank as follows :

Table - 10.1

First	Second	Third	Fourth	Fifth
Tokyo Prekcture	Machine and tools	Metals Chemicals	Food	Textiles
Kanagawa Prelecture	Metals and tools	Machines Chemicals	Food	Textiles

The Nagoya Node.-to the south of Kwanto, lying between it and the great Kinki Node, is the industrial centre located on the Mino-Owari Phi n at the head of Ise Bay. Nagoya, a city of 1.3 million, which is its metropolis and chief manufactural focus, lies 140 miles by rail from Osaka and 235 miles from Tokyo. Eight or ten lesser cities are included within the node, two of them in the 100,000-200,000 group, and two of them in the 50,000-100,000 group. This Ise Bay centre accounts for about 10 per cent of the country's factory production. Located as it is one of Japan's larger plains, there is ample room for urban and factory development. Good industrial coal is not available locally, although the adjacent lignite beds are utilized by the ceramics industry and some offers. Coal is brought by boat chiefly from the North Kyushu fields. It is coactively close to the principal hydroelectric developments of central uslni, and the large population cluster of the Mino-Owari Plain provides an adequate supply of local labour. Being on the main Tokaido railway line, its rail service is good, though both rail and water transport the facilities are inferior to those of the Kinki and Kwanto nodes. The improved harbor of Nagoya is not first-class. Although ships of 10,000 Tons can enter, the port is far outdistanced by Kobe; Osaka, and Yokohama. Much of the trade of this industrial node passes through the Kinki or Kwanto ports and consequently involves a rail haul. Because of this handicap in shipping facilities the growth of the Nagoya industrial centre, was slow until the last decade or two, and it is still 'far from the equal' of the Kwanto and Kinki nodes.

Essentially the Nagoya centre is one of light manufactures and small -scale industry, and consequently it has not participated as much as some of the others in the wartime industrial expansion. Nagoya, its primate city and seat of the greater part of the new war industry, has grown most rapidly. Textiles, including silk reeling, cotton spinning, cotton weaving and wool weaving, lead all other industries. In 1938 it was the only one of the four industrial nodes in which textile production held first rank. The Aichi Prefecture, which includes the city of Nagoya and .a large part the Ise Bay industrial node, the principal groups of industries ranked is follows in 1938: (1) textiles; (2) machines and tools; (3) metals; (4) foods; and (5) chemicals.'

The Kinki Node.-The Kinki industrial centre, at the eastern end of the Inland Sea at the head of Osaka Bay, and the Kwanto centre are the two greatest industrial concentrations in Japan. In terms of total industrial output the two nodes are about on a par, each accounting for approximately 30 per cent of the nation's manufactures in 1938. In the Kinki Node are three of the country's six great cities-Osaka, Kobe, and Kyoto, the first two of which are also among the three great deep water ports. In addition, there are ten or eleven smaller cities, four of which have populations between 100,000 and 200,000 and three between 50.000 and 100,000. Excellent shin-ping facilities, both water and rail, are available. Extensive plains around Osaka and Kyoto provide good sites for factories and general urban development. Kobe, on the other hand, is handicapped for space, since the hills in its vicinity come down so close to tidewater that level land is scarce. Power resources are less readily available here than in some of the other nodes; coal must be brought by boat from the North Kyushu and Ube fields 250-300 miles distant. Moreover, the region further removed from the principal hydroelectric centre of Japan than either Nagoya or Tokyo. The power at Osaka-Kobe, based upon a dependable six months' flow, is only one-third that of Nagoya and one-fifth of Tokyo-Yokohama."

The manufacturing structure of the Kinki Node is one of great diversity. Until recently at least, textiles led all other industries, though the recent expansion in metals and machinery has created serious rivals. In 1938 the four principal groups of industries ranked as follows in both Osaka and Hyogo prefectures, the two which are most industrialized: (1) metals; (2) machines and tools; (3) textiles; (4) chemicals. In Hyogo, Prefecture had ranked fifth, in Osaka Prefecture a group of "miscellaneous" industries Cotton, silk, and rayon processing are all represented in the area. The past decade the Kinki or Han-shin Node has developed as one of the nation's principal iron and steel centres. If Himeji, on the shores of the Inland Sea about fifty kilometres west of Kobe, is included, of the area the eastern end of the Inland Sea is estimated to produce 25-30 cent of the country's pig iron, about an equal share of its steel, and proximately 45 per cent of its rolling mill output. Other leading industries of the Kinki Node are iron foundries, machine industries, shipbuilding chemicals, oil refineries, and aircraft factories. Most of these are it's of industry that must be housed in large factories. The Osaka-Kobe, region is as smoky, noisy, and unattractive in appearance as are most regions of heavy industry.

The North Kyushu Industrial Node is located close to the southwestern limit of the general manufacturing belt. It ranks fourth among the manufacturing concentrations, being credited with nearly per cent of the nation's industrial output in 1938. In total value of manufactures it is about on a part with the Ise Bay Node. It differs from the other nodes in several ways. In the first place, being advantage on situated in close proximity to the nation's most productive coal field uses coal power far more than hydroelectric power. Secondly, it is only the one of the four nodes that has no great metropolis, the largest having a population of less than' 350,000. Moreover, it has no important foreign trade port, being served through such secondary ports are Nagasaki, and WaVamatsu. It also has fewer cities than any of the nodes only eight in all. Six of these are strategically located along Straits of Shimonoseki, where they form an almost continuous urban Island. Five on the Kyushu side and one in Honshu. West of this group separated from it is the largest city, Fukuoka (323,000) and the small of Ashiya. Other than Fukuoka there is only one city with a population excess of 200,000, three others over 100,000 and two over 50,000. The small cities with less than 50,000 population in the Chikuho coal field perhaps also a part of this southernmost industrial node, although are not included in the count above.

North Kyushu is the one node in which textiles are not an important element of the industrial structure. Of first importance are the heavy industries, especially iron and steel manufacturing. About a third of the pig iron and 40-50 per cent of the steel manufactured in Japan Proper is probably produced in North Kyushu. It is the chief steel supply centre for other industrial regions of Japan. Cement factories, shipyard flourishing mills, glass factories, and chemical factories are among the other type of industrial plants well represented in North Kyushu. Large factories are Characteristic. The industries are large consumers of fuel and power and so profit by the proximity of coal, to which in large measure they owe their location. The several groups of principal industries in Fukuoto Prefecture, which contains this entire industrial node, rank as follows (1) metals, (2) chemicals, (3) food, (4) machines and tools." unlike the three other nodes the North Kyushu is now, associated with an extensive local plain. The area of greatest industrial, concentration is along a narrow strip of level land bordering the Straits of Shimonoseki in the extreme north of Kyushu.

CHECK YOUR PROGESS

Note (a) Write your answers in the space given below

(b) Check your answers with the above subsection

10.2 OBJECTIVES

After studying this lesson, you will be able to learn about :-

1. To highlight the present position of Japanese Agriculture.

 ____

 ____

2. To study the land reforms and distribution of land to the active cultivators.

 ____

 ____

3. To analyse the meteoric growth of Japan in the field of industry which is really brilliant achievement.

 ____

 ____

4. To study their locational and regional distribution of industries.

 ____

 ____

10.3 THE MAIN FEATURES OF AGRICULTURAL GROWTH

A significant change that accompanied the modernization of Japan after 1868 was an upsurge in population growth. During the latter half of Tokugawa rule, Japan's population had stabilized at about 33 million. Between 1868 and 1940, however, Japan provided a classic illustration of the interaction of economic and demographic factors, the demographic transformation. As industrialization and urbanization proceeded, both birth-rates and death rates declined. Population began to increase, but the rate averaged only about 1.5 percent per year up to 1940. Nonetheless, that growth rate was sufficient to more than double the population, to just over 73 million, by 1940.

At the close of the Tokugawa era in 1868, about four-fifths of the labour force was engaged in agriculture, forestry, or fishing. From 1868 to the present, the rural population has declined steadily in proportion to the urban population, even though it did not start declining in absolute terms until just before World War II. Today, agricultural workers constitute only about 10 percent of the total labour force.

Several important trends marked Japanese agriculture in the last century. First, production increased rapidly up to World War I, the result of improved farming methods that included more efficient irrigation, better crop strains, pest control, and, above all, the lavish application of fertilizers. Agriculture succeeded in supplying all but a small part of the increased demand for rice that accompanied the population growth and the rise in per

1. Write a short note on the agriculture problems in Japan.
2. Discuss briefly the recent development of Japanese agriculture.
3. Write a note on production and distribution of Rice in Japan.
4. Write a note on distribution of Coal.
5. Write a short note on industrial regions of Japan.

10.5 LET US SUM UP

We have charted Japan's economic development through two major economic transformations. The first, the late-nineteenth-century transformation from a feudal state into an industrial one, culminated in the disastrous experience of World War II. The second transformation was Japan's post-war industrial recovery and expansion into a world economic power. The third transformation is now beginning, as a restructuring of the

Japanese economy by sector. These three transformations should be viewed as separate phases of a single, ongoing process of development. The third transformation, in fact, is simply recognition by Japan that its modern economy is maturing and it can no longer be expected to maintain the phenomenal growth rates of past decades. Moreover, as heavy industry assumes a naturally decreased importance, the economy shifts increasingly toward a service orientation, just as it has in the United States. Sentiment is strong within Japan for greater attention to domestic consumption, in order to reduce the drive for exports. The government is also being encouraged to spend more money on social well-fare, improve housing, develop social security, and take other measures that will enhance the quality of life rather than simply increasing the GNP. In other words, some Japanese are questioning the goal of being number one in the world. These processes take time, of course, so Japan's huge trade surplus is not going to turn around overnight. Even when the trend is finally reversed, Japan will remain a formidable economic giant in world affairs. From that is likely to follow a much greater political and possibly military role in the next century.

10.6 GLOSSARY

- **Agrarian Society:** A society in which the majority of the population is based on agriculture.
- **Factory:** A manufacturing unit based on quantity, production, a distinct division of labour and use of machinery driven by inanimate power.
- **Heavy Industry:** A term applied to manufacturing that uses large amount of raw material such as coal iron ore and sand and that has relatively low value per unit of weight.
- **Tokaido Megalopolis:** A large multinucleate urbanized region in Japan extending from Tokyo to Osaka

10.7 LESSON END EXERCISE

1. Give an account of the Kwanto Industrial Region of Japan with reference to its resource basis.
2. Give a brief account of the agricultural resources of Japan and state briefly the major features of the country's agriculture.

3. Give an account of the cotton textile industry of Japan and comment on the locational pattern of the industry.

4. Give a brief account of the iron and steel industry of Japan and comment on the locational pattern of the industry in the country.

5. Give an account of any industrial region of Japan with reference to its resource - basis.

6. What are the principal characteristic features of Japanese Agriculture? Give a short account of the agricultural development of Japan after 'Meiji' Restoration'.

7. Give a detailed account about the new and technology based industry in Japan.

10.8 SUGGESTED READINGS

- Geography and Development: A world regional Approach edited by: James Fisher. (1980) Macmillan Publishing Company.
- Regional Geography of the World By D.S. Manku (2002) 2nd Revised edition Kalayani Publishers. New Delhi.-110002.

10.9 REFERENCES

- Regional Geography of world by Majid Hussain 2005
- Geography and Development: A world regional Approach edited by: James Fisher. (1980) Macmillan Publishing Company.
- Regional Geography of the World By D.S. Manku (2002) 2nd Revised edition Kalayani Publishers. New Delhi.-110002.
- Geography of Asia by. Shiv Kumar Tiwari. (1990)
- Geography of Asia by Sir. Dudlay Stamp

PAKISTAN - PHYSIOGRAPHY, CLIMATE, DISTRIBUTION AND DENSITY OF POPULATION

11.0. STRUCTURE

11.1 INTRODUCTION

Pakistan covers an area of 310,403 sq. miles' out of which 183,840 sq. miles in the north and west form mountainous terrain and tableland. The remaining 126,563 sq. miles comprise a flat gradational surface.

The lofty Himalayan Mountains in the north of Pakistan, which extend eastward to form the northern rampart of India, are the 'girders of Asia's structure. 'In Pre-Himalayan days, the area was occupied by a long, narrow, shallow sea, the Sea of Tethys, lying between two Continents of ancient hard rocks, Angara land to the north, and Gondwana land to the south. (The plateau of Central Siberia and parts of the great plain of western Siberia are remnants of the northern block, and the Deccan and Arabian Plateaux remnants of the southern.) Sedimentary materials were deposited layer upon layer in the Sea of Tethys, the sandy materials forming sandstone, while organic remains, such as shells and the bones of sea animals, became limestone. As the northern and southern continental blocks were drawn toward each other by movements of the earth's crust, the rocks in the sea of Tethys were compressed and contorted in to fold mountains.

The uplift of the mountains continued in several intermittent phases, separated by long periods of time. Some of the upheavals were more pronounced than others. In the first major upheaval, the central axis of ancient sedimentary and crystalline rocks of the Himalayas was formed. The Murree sediments of the Potwar Plateau were formed in the second. In the third phase, the central part of the Himalayan system was further elevated and the outlying zone of the Siwaliks created.

The mountain-building movements were associated with subsidence of the northern part of the Deccan block, creating a deep trough. This trough began to be filled rapidly with sediments as a result of the increased erosive and carrying power of streams descending from the newly elevated mountains. The fracturing of the Fold Mountains still in the process of formation, may also have added to the amount of material to be transported. The weight of the sediments themselves may have depressed the earth's crust, creating the trough. In any case the deposition formed the second great feature of the' sub-continent, the Indo-Gangetic Plain. The thickness of the sediments beneath the Plain has been variously estimated to be between 6,500 and 15,000 feet.

11.2 OBJECTIVES

After going through this lesson, you will be able to learn about:-

1. To make student aware of the Land and Physical environment of Pakistan.
2. To make familiarize students with the achievements made by Pakistan since Independence.
3. To acquaint students about the growth and development of Population.
4. To make aware students about the processes and growth of urbanization in Pakistan.

11.3 MAJOR PHYSCIAL DIVISIONS

On the basis of altitude and physiography Pakistan can be divided into five major physical divisions.

The Himalayas,
The Hindu Kush and the western bordering mountains.
The Baluchistan Plateau.
The Potwar Plateau and the Salt Range.
The Indus Plains.

11.3.1. The Himalayas:

The Himalayas comprise a series of ranges:

(i) the Sub-Himalayas 2,000-3,000 feet.

(ii) The Lesser Himalayas, 12,000-15,000 feet;

(iii) The Central or Great Himalayas, average altitude, 20,000 feet;

(iv) The Inner Himalayas or Ladakh Range;

(v) The Trans-Himalayan or Karakoram Ranges.

Most of the Central, Inner and Trans-Himalayan ranges lie in the state of Jammu and Kashmir, large parts of which are in India.

(i) The Sub-Himalayas or Siwaliks extend over the southern parts of Hazara and Murree which include the hills of Rawalpindi and the thickness of the sediments beneath the Plain has been variously estimated to be between 6,500 and 15,000 feet from the mean sea level.

(ii) The Lesser Himalayas:

The Lesser Himalayas occur in northern Hazara and Murree, where the main range, DungaGali, attains a height of over 15,000 feet in the north. The DungaGali descend into a number of spurs in the Murree Hills. The hill-station of Murree (7,445 feet) is a spectacular one-hour drive from the capital, Islamabad .Zone (iii), (IV) and (V) lie in the state of Jammu and Kashmir, large part of which are in India and hence ignored from the present study.

11.3.2. The Hindus Kush and the Western Mountains:

The Hindu Kush branch off from the Himalayas at the Pamir Knot, where the borders of Pakistan, Afghanistan, U.S.S.R., and China meet. Whereas the strike of the Himalayas is North West to South East, that of the Hindu Kush is North to South. Peaks like SadIstragh (24,170 feet) and Tirich Mir (25,263 feet) are capped with perpetual snow and ice. Several ranges branch south through Chitral, Swat and Dir, with deep narrow valleys along the Chitral-Kunar, Panjkora and Swat rivers. Some passes permit communication. Abbottabad is connected with Gilgit through the Babusar Pass, the Lowari Pass connects Peshawar and Chitral, and the route from Chitral to Gilgit lies through Shandur Pass. Southward the altitude decreases to 5,000-6,000 feet in Mohmand Territory and the Mala-kand Hills.

South of the Kabul River, the strike of the ranges changes from north-south to west-east. The west-east strike is strongly represented by the Koh-i-Sofed Range. The general height of this range is 12,000 feet, with the highest peak, Sakaram, rising to 15,620 feet. Outliers in Kohat District have a height of 3,000-5,000 feet. South of the Koh-i-Sofed are the Waziristan Hills, with the same east-west alignment. These hills are traversed by the Kurram and Tochi rivers, and bounded on the south by the Gomal River.

South of the Gomal River, the Sulaiman Mountains run for a distance of about 300 miles in a north-south direction. Takht-i-Sulaiman (11,295 feet) is the highest peak. At the southern end are the Bugti and Marri Hills, draining westward to the Bolan River.

The low Kirthar Hills run north-south and form the western boundary of the lower Indus Plain. The Hab and Lyari rivers drain into the Arabian Sea.

Passes through the western bordering mountains are of special geographical and historical interest. Comparatively broad passes, which are not difficult to traverse, occur south of the Kabul River. From north to south these are: Khyber, Kurram, Tochi, Gomal, and Bolan. The Khyber is sufficiently wide for the passage of troops, only 3,500 feet high at LandiKotal, its highest point, and leads to the fertile Vale of Peshawar at the head of the Indo-Gangetic Plain. The total length of the Pass is 35 miles of which 25 (Jamrud—Torkham) are in Pakistan, and the remainder in Afghanistan. The Tochi pass connects Ghazni in Afghanistan with Bannu in Pakistan via northern Waziristan. The Goma! Valley provides a route from Afghanistan to Dera Ismail Khan. The Bolan Pass follows the river of the same name and connects the Kachhi¬Sibi Plain with Quetta. From Quetta a route goes to Chaman on the Pak -Afghan border, and thence to Kandahar. The route from Kandahar to Central Asia avoids the Hindu Kush which, after traversing northern Pakistan, continue into Afghanistan.

11.3.3. The Plateau of Baluchistan:

The extensive plateau of Baluchistan has an average altitude of over 2,000 feet, and is sharply divided from the Indus Plain by the Sulaiman, Kirthar, and Pak Ranges. It includes a great variety of physical features .

In the north-east, the Zhob-Loralai Basin forms a lobe surrounded on all sides by mountains. To the east and south lie the Sulaimans, which join the central Brahui Range near Quetta. The small Quetta Basin is surrounded on all sides by mountains, namely Zarghun, Takatu, Khalifat, Chiltan, and Murdar Ghar. In the north and north-west, the lobe is bordered by the Toba Kakar Range, the western extension of which is known as the KhwajaAmran Range.

The general terrain of north-western Baluchistan comprises a series of low-lying plateaux, some of which are separated from one another by mountain ranges. The RasKoh Range in the east runs northeast to southwest. The Chagai Hills form the border with Afghanistan for some distance. This region is a true desert, an area of inland drainage and dry lakes (haniuns), the largest of which is Hamun-i-Mashkel, some 54 miles long and 22 miles wide.

Southern Baluchistan includes the Sarawan area in the north and a vast wilderness of ranges in the south. The backbone of the mountain system of Baluchistan is the Central Brahui Range, which runs in a Northeast to South West direction for a distance of about 225 miles between the Zhob River in the North and the Mula River in the south. The Central and Coastal Makran Ranges lie to the South.

Along the coast are large areas of level mud flats forming the coastal plain or enclosed plains bordered by sandstone ridges. This arid coastal tract provides another route into the sub-continent, connecting the Lower Indus Plain with southern Iran.

11.3.4. The Potwar Plateau and the Salt Range:

The Potwar Plateau is an area of about 7,000 sq. miles with an elevation of 1,000-2,000 feet. It is bounded on the east by the Jhelum, on the west by the Indus, on the north by the Kala Chitta Range and the Margalla Hills, and on the south by the Salt Range. The gradual northern slope of the Salt Range makes the southern boundary of the Potwar ill-defined. The plateau slopes from north-east to south-west and, with the exception of the south eastern portion draining to the Jhelum, belongs to the Soan Basin. It is a typical 'bad-land', cut up by deep-set ravines, known locally as khaderas. Above the broken surface of the Soan Basin rise the limestone and sandstone hills of Khairi Murat, Kheri Mar and Kala Chitta.

The Salt Range is a feature of great geological interest since it presents a complete geological sequence from earliest times. The steep southern face, rising to about 2,000 feet, also evokes interest. It is an example of a 'dislocation mountain'. It's orthoclinal outline suggests that these mountains are the result of a monoclinal uplift combined with vertical dislocation along their southern border which has depressed the other half underneath the plains.

The range begins in the east near the Jhelum in the Jogi and Bakralla Ridges, and comprises parallel ranges of low, flattor hills enclosing small intermontane valleys, basin plains, or plate: and a number of saline lakes. Two of the larger lakes are Khal and Kallar

Kahar. At Kalabagh the range crosses the Indus and it continues south-west into Bannu District.

Between the Indus and the western bordering ranges lie Trans Indus Basins, including the Vale of Peshawar, the KohatVa and the Bannu Plain. The Valley of Peshawar is hill-girt on all sides except in the south-east where the Kabul River makes its way tc Indus. It spreads over the Peshawar and Mardan Districts. The Valley includes most of the District of Kohat, but is bordere. rugged hills. The Bannu Plain is 800-1,500 feet in elevation al surrounded by hills, except in the south-east, where the comt Kurram and Tochi stream provides an opening toward the Iran. A narrow opening also exists towards D. 1. Khan, through the Gap between the Bhittani and Marwat hills.

11.3.5. The Indus Plains:

The Indus Plain forms the western part of the Indo-Gangetic plain of the northern part of the sub-continent. The general slope of the plain towards the sea is gentle, with an average gradient of one foot to the mile. The plain is featureless, but elements of micro relief assume great importance because of their relationship to flooding and irrigation.

11.4 MICRO RELIEF

Five distinct micro relief land forms have been recognised. These are: active flood plain; meander flood plain; cover flood plain; scalloped interfluves; and tidal delta and deltaic plain.

Active flood plain is variously known as *bet* or khaddar land. It lies adjacent to a river, and is inundated almost every rainy season. It is often called 'the summer bed of rivers'. The area is the scene of changing river channels, where erosion and deposition go on simultaneously. During the low water season, the surface of the land can be seen scarred by numerous active or abandoned channels. Embankments or bunds have been built in many places along its outer margins to protect neighbouring areas from floods. The soils of the active flood plain are coarse-textured sand and silt. Active flood plain is found along all the rivers, except the lower half of the Ravi. Along the Indus this belt is quite wide from Kalabagh to the Delta.

Meander flood plain usually adjoins the active flood plain and is somewhat higher. It also occurs away from the present course of the river on the site of old channels. Identifying features are bars, meanders, levees, and ox-bow lakes. Relief is only a few feet, and soils differ because of diversity in materials deposited. The meander flood plain is widespread along the Jhelum, Chenab, and the upper reaches of the Ravi. Along the Indus, it is absent above Muzaffargarh, but widespread in Sind.

Cover flood plain consists of recent alluvium spread over former riverine features. The alluvial deposits have resulted from sheet floodings. The boundary between the meander flood plain and the cover flood plain is not sharp: the two often merge together. Because of the varying speeds of the flood waters at different locations and differences in the time of deposition, frequent changes of soil texture are noticeable. The cover flood plain is the most extensive of the plain areas in Sind, Bahawalpur, Ganji bar and Rechna doab.

Scalloped interfluves or bars are found in the central, higher parts of the Chaj, Rechna and Bari doabs, but in the Sind Sagar doab appear to have been covered by sand. Their boundaries are mostly formed by river-cut scarps, often over 20 feet high. Low sand or earth dunes appear on their southern ends. The soils of the scalloped interfluves are relatively uniform in texture over considerable distances, and the material is old alluvium or aeolian in origin.

Tidal Delta and Deltaic plain. The lower delta area is frequently inundated by tidal floods, creating saline waste-lands and tidal mud-flats. The Deltaic plain extends north to Thatta in an intricate pattern of low features formed by the many distributaries of the Indus. Its soils vary in texture from place to place.

11.4.1. The Upper Indus Plain:

The Upper Indus Plain differs from the Lower Indus Plain in that major tributaries (Jhelum, Chenab, Ravi, and Sutlej) divide the land surface into several interfluves or doabs. In the Lower Indus Plain there is but one large river, the Indus itself. The two plains are separated by a narrow corridor near Mithankot where the Sulaiman Ranges approach the river. The Upper Indus Plain is subdivided into four large doabs, plus the Bahawalpur Plain, and tbeDerajat or Sulaiman Piedmont.

The Sind Sagar Doab or Thal Desert (7.9 million acres) lies between the Indus and the Jhelum-Chenab, south of the Salt Range. About 80 percent of the area is a gently undulating sand plain, with some tibbas or sand-dunes, the number and size of which increases from west to east. Here and there are narrow belts of level land (patti) between the sand hills.

The Chaj Doab (3.2 million acres) has as its central part the Kirana bar, above which rise some low bedrock hills known as the Kirana Hills. These outcrops are composed of old rocks similar to those of the Aravalli Hills in India. Narrow flood plains along the Chenab and Jhelum constitute 25 per cent of the area.

Rechna Doab (7.0 million acres) differs from the Chaj and Bari Doabs in that its northern and central parts are devoid of scalloped interfluves. This occurs only in the south in the Sandal bar. The bedrock hills near Chiniot, Sangla and Shah Kot in central Rechna Doab are similar to those of Chaj Doab.

Bari Doab (7.2 million acres) has extensive areas of cover flood plain and scalloped interfluve. The interfluve between the Ravi and the old course of the Beas is called Ganji Bar, while the high land between the old course of the Beas and the Sutlej is known as Nili Bar. These bars are long and narrow, and have some highly impermeable alkaline soils, locally known as bara soils. The Sutlej cover flood plain has a number of channel ways, the longest and deepest of which is the old abandoned course of the Beas.

The Bahawalpur Plain is grouped with the doabs because the riverine tract, known locally as Sind, is followed by an upland identical with the bars of the doabs. The north-eastern part is a cover and meander flood plain, the central part is a sand hill plain which has been largely levelled and irrigated, and the south¬western portion is the cover flood plain of DerzNawab. The area is a reclaimed part of the Thar Desert.

The Derajat or Sulaiman Piedmont is seamed with numerous streams and torrents, as is also the Himalayan Piedmont on the northern border of the Indus Plain. The land here varies between flat and gently undulating, and the rivers have a comparatively steep gradient. The riverine tract, known locally as Sindhu, is narrow.

11.4.2. The Lower Indus Plain:

The Lower Indus Plain is very flat, sloping to the south with an average gradient of only six inches per mile. Excluding the deltaic area, the predominant landforms are meander and cover flood plains. Meander flood plain is more extensive in the north-east sector of the upper Sind plain, cover and meander plains are equally extensive in the upper and central Sind plains, and more than two-thirds of the lower Sind plain is cover flood plain.

The Kachhi-Sibi Plain is bounded on the north by the Marri-Bugti Ranges and on the west by the Kalat Ranges. Surroun¬ded on three sides by arid mountains, it is a barren, desolate area, in which heat and aridity combined with uniformly textured soils, create ideal conditions for mirages. Its southern edge is its contact line with the Indus alluvium.

The Sind Plain forms the major part of the Lower Indus Plain. The upper Sind plain is agriculturally less developed, and more waterlogged and saline, than areas further south. Lake Manchhar is alternately full or dry according to the level of the Indus. The central part of the plain has a uniform landscape, but one outstanding feature is the Rohri cuesta, a ridge of nummulitic limestone, attaining a height of 250 feet and extending 30 miles south from Sukkur. The lower Sind plain, which starts from Hyderabad, is predominantly a cover flood plain. The GanjoTakkar ridge, a cuesta of Kirthar limestone and an outlier of the Kohistan Ranges, stretches southward from Hyderabad for a distance of about 15 miles.

The Indus Delta has its apex some distance north-east of Thatta, where distributaries fan out to form the deltaic plain. Two of the larger distributaries are the Ochito and the Gungro. Many of the channels perform the dual function of distributaries and estuaries. The channel beds and their levees are higher than the adjacent lands, and the shallow troughs between them are often filled with water, resulting in swamps. The tidal delta is sub¬merged at high tide, and has mangrove swamps and tamarisk groves in its western section. The eastern section is the Rann of Kutch, a saline marshy land. The coast is low and flat except between Karachi and Cape Monze, where the Pab Hills approach the shore.

The Karachi Plain has a thin mantle of soil over weathered bedrock. A few low hills rise to 50 feet. Shallow depressions are known as dhand. One of these, HalejiDhand, is used as a reservoir for Karachi city.

11.4.3. South-Eastern Desert :

The South-Eastern Desert spreads over eastern Bahawalpur, the eastern half of

Khairpur, and the greater part of Tharparkar Districts. In Bahawalpur it is known as Cholistan or Rohi. The desert is separated from the central irrigated zone of the plain by the dry bed of the Ghaggar in Bahawalpur, and the Eastern Nara in Sind. The surface of the desert is a wild maze of sand-dunes and sand-ridges, occasionally rising 500 feet above the general surface. Generally speaking the alignment of the dunes is longitudinal in the south, where southerly winds are strong, be-coming more and more transverse toward the north, where the winds are less strong and less constant in direction. With little rainfall and a low water table, the desert is a barren land of scattered, stunted, thorny bushes, mostly acciea.

11.5 SOILS OF PAKISTAN

11.5.1. Factors in Soil Formation:

Soil is defined as that part of the unconsolidated material covering the surface of the earth which supports plant growth. It has three major constituents, solid particles (salts, minerals and organic matter), air and water. The type of soil formed is a function of topography, climate, vegetation, and the parent rocks from which the soil material is derived. Soil material transported and deposited by running water is termed alluvium, while that transported and deposited by winds forms Aeolian soil. Soils formed in situ are termed residual.

Soil texture varies with the size of the soil particles. Coarse textured soils are sandy, fine textured soils are clayey, and a mixture of sand and clay is called loam. The organic content of the soil also varies, being largely dependent on the extent and type of the vegetative cover. Soils of high organic content are darker in color, and have more nutrients for plant growth than those of low organic content. Since most of Pakistan is arid or semi-arid, the soils contain little organic matter.

Soil-forming processes are complex and continuous. As a result, soils vary in their chemical composition, color, texture, and organic content from place to place, even within small areas.

11.5.2. The Indus Basin Soils:

The Indus Basin comprises a vast area of alluvial plains deposited by the Indus and its tributaries, and a small area of loss plains. Most of the material is sub-recent or recent in origin. calcarious, and low organic content. The soils can be divided into three major categories:

(1) Bangar Soils (old alluvium):

(ii) Khaddar Soils (new alluvium): and (III) Indus Delta Soils.

(i) The Bangar Soils cover a vast area in the Indus Plain, include, most of the Punjab, Peshawar, Mardan, Bannu and Kachhi plains, and the greater part of the Sind Plain. These soils are deep, calcareous, of medium to fine texture, low in organic matter, but very productive when irrigated and fertilized. In some ill-drained areas, these soils have become waterlogged, and capillary action carried salts to the surface. Some areas show a puffy salt layer at the surface, but these can be reclaimed by simple leaching, if supplied with plenty of irrigation water. Over very small areas, strongly alkaline soil patches have developed, and these, being non-porous, are difficult to reclaim.

In the upper Chaj and Rechna Doabs, the sub-mountain area bordering the Peshawar-Mardan Plain, and in the eastern Potwar, the Bangar soils have developed under sub-humid conditions. Because of the higher rainfall, they have been leached of lime and are non-calcareous, medium to fine textured, and have a slightly higher organic content. These soils arc also fertile when supplied with plenty of water and manure.

(ii) The Khaddar soils are formed from recent and present-day deposits along the rivers.

Parts of these soils are flooded each year, adding depositional layers of silt loam and silty clay loam. The organic content of these soils is low, but they are usually free of salts.

(iii) The Indus Delta Soils are formed of sub-recent alluvium and estuarine deposits. They cover the entire area of the Indus Delta from south of Hyderabad to the coast. Clayey soils, developed under flood water conditions, cover about one-third of the area. With irrigation, these soils are used for rice cultivation. Saline loamy soils cover most of the delta. Some with salt crust at the surface, have been reclaimed by simple leaching and better drainage. Extremely saline patches can be used only for poor grazing.

Coastal estuarine deposits form the lower part of the Delta, which is a maze of tidal flats, basins, and sea-water creeks. The soils are extremely saline and barren, except for a weedy vegetation.

11.5.3: Mountain Soils:

Mountain soils occur in the highland areas of the north and west, and are residual as well as transported. Along the steep crests and slopes, and in the broken hill country, shallow residual soils have developed. Under arid and semi-arid conditions, these soils are usually strongly calcareous, with low organic content. Further north, under sub-humid conditions, there is more leaching, and a higher organic content.

In the mountain valleys, soils are formed from the alluvial infills of the streams. These soils are calcareous silt loans and sandy loans of low organic content. They are cultivated in patches only.

In the sub-montane area of the Potwar Plateau, shallow residual soils and silty eroded loss have been formed. In places these soils are massive, susceptible to erosion, and strongly gullied, producing a dissected landscape. Lime content is high, and organic content low, but, with plenty of water, these soils are relatively productive.

In the lowest parts of the inter-montane valleys and interior basins of the arid and semi-arid regions, strongly saline soils develop. Excess of evaporation over precipitation leaves a thick crust of salts at the surface of the intermittent lakes. For the most part, these soils are barren. The margins carry low shrubs and salt bush, used for poor grazing.

11.5.4: Sandy Desert Soils:

The soils extend over some parts of western Baluchistan, and the Cholistan and Thar Deserts. Thar Desert soils occur in large sections of the Sind Sagar Doab. Desert soils include rolling to hilly sandy soils, and clayey flood plain soils. Where the soils are formed of deep sand, as in much of Baluchistan, they are moderately calcareous, and largely aeolian. In places, the windblown material is mixed with old alluvium. The arid and semiarid desert sand areas have few possibilities for improvement, beyond very poor grazing.

11.6 DRANIAGE SYSTEM OF PAKISTAN

The availability of water for agriculture has always been of vital importance to Pakistan. The natural rainfall for crops is adequate only in the Himalayan foothills. Although use of underground waters is increasing, Pakistan may be said to be dependent on its rivers, and all its useful rivers are part of the Indus system. Smaller rivers, principally in Baluchistan, peter out in areas of inland drainage.

11.6.1. The Indus System

The Indus system includes a large number of tributaries, but the principal affluents are the Jhelum, Chenab, Ravi, Beas and Sutlej. Two of these, the Beas and the Sutlej, combine near Harike in India, before entering Pakistan. The Indus and its important tributaries traverse long distances through the Himalayas and have captured most of their flow before debouching into the plains of Pakistan.

TABLE 11.1 : Catchment Areas and Discharge of Major Rivers

Rivers	*Mountainous Catchment Areal* (Sq. miles)	*Av. Annual Discharge 2017/4-65/62* (Million acre ft.)
Indus	103,800	92.0 (at Attock)
Jhelum	I3, 000	22.0 (at Mangla)
Chenab	10,500	26.7 (at Marala)
Ravi	3,100	6.4 (at Balloki)
Sutlej	18.500	16.6 (at Suleimanke)

The volume of water in the rivers is subject to vast seasonal and monthly fluctuations. It is small in winter, and increases gradually with the approach of summer, as the snow in the mountainous catchment areas begin to melt. The volume of water in the rivers in the early summer months varies with their size, altitude, situation with respect to the monsoons, the height of the snow line, and heritage of glaciers from past eras' in the respective catchment areas.

In the Indus, Jhelum, and Chenab, the volume of water increases appreciably after

March, but this increase comes later in the eastern rivers. The Indus, in which an early rise is most marked, draws its supply from two large groups of glaciers, the Hindu Kush and the Karakoram, the glaciers of the Karakoram being larger than those of any other mountains outside the Polar region.

The approach of the rainy season at the end of June or early July is marked by a great increase in flow. The period of high flow terminates in the Indus and Jhelum in September, but continues for another month in the eastern rivers. The decrease in flow after the peak month is as sharp, or even sharper, than the rise before it. Even months with high mean discharges are characterized by wide fluctuations in the daily discharge. Floods generally occur in the early part of the rainy season in the western rivers, and later in the eastern.

Because about 60 per cent of the flow in the Indus system is concentrated in the three rainy months, there is a great need for reservoirs and dams to regulate the flow, reduce floods and loss to the sea, and provide more water for irrigation. Further, the flow of the Ravi, Beas, and Sutlej has been lost to India, and must be replaced from other sources.

11.6.2. Drainage Pattern Of Baluchistan:

In Baluchistan, the main rivers sprawl out in all directions from the axis of high land formed by the Quetta node, the Central Brahui Mountains, and the Central Makran Range. Rivers draining to the north-east and east of the main divide generally join the Indus system. These include the Zhob, with its main tributary the Kundar, the Loralai, and the Kulachi. The Bolan and Mula Rivers, flowing south or south-east from the main divide, dissipate themselves in the Karachi—Sibi Plain. Southward flowing rivers drain to the Arabian Sea. The Hab, Porali, Hingol, with its main tributary the Mashkai, are the chief of these. Rivers flowing west or south-west generally dissipate their water in shallow depressions of varying size called hamuns. The more important of the rivers draining into the inland basins are the Pishin Lora, the Baddo, and the Rakhshan.

The rivers of Baluchistan generally flow only during the rainy season, and some small rivers are dry not only for the greater part of the year, but for many consecutive years. Some of the larger rivers, such as the Zhob, Loralai, Pishin Lora, Hingol, Porali, and flab, are perennial only in their lower reaches, and the volume of water is small except in the rainy season. Some rivers, for example, the Hingol and the Bolan, flow intermittently above and below ground, and disappear underground in limestone regions.

11.7 CLIMATE AND WEATHER

Pakistan lies on the western margin of one of the major climatic regions of the earth, the monsoon region. The winds in winter are north-east to south-west, and the reverse, south-west to north-east, in summer. The causes of the reversal of the wind system, and of the pulsating character of the monsoons, are varied and complex. The summer monsoon brings maritime influences and rain, but there are annual fluctuations or pulsations in the strength of the monsoon current. Cyclones in the monsoons cause rainfall, but their frequency is variable. Similarly, the paths of the cyclones vary with the position and strength of the Inter-tropical Front, and this again results in variable rainfall.

The climate of Pakistan is more 'continental' than that of other parts of the sub-continent, which come under a more typical monsoon regime. The rainfall in most parts of Pakistan is insufficient and its usefulness for agriculture is further reduced by its variable nature. Moreover, the efficiency of the rainfall is reduced because it takes place in the late summer months when, because of the high temperatures, much of it is evaporated.

11.7.1. The Seasons

Pakistan has the same four seasons found in the rest of the sub-continent, but their duration is somewhat differentIn Pakistan, the seasons may be distinguished as follows: Cold Weather Season (mid-December to March); Hot Weather Season (April to June); Monsoon Season (July to September); and Post-Monsoon Season (October to mid-December).

(i) Cold Weather Season:

The cold weather season is characterized by high barometric pressure, somewhat low temperatures, and small precipitation from shallow western disturbances. In the month of January, which typifies the climatic conditions of this season, mean pressure generally decreases from 1035 millibars in the north-west at Drosh to 1015.2 millibars in the south. The mean monthly temperature is below 40°F. in the mountainous areas, and varies from about 50°F. In the north of the plain area to about 65°F. in the south.

The generally fine weather of this season is occasionally affected by disturbances from the west, which form along the Mediterranean Front, and reach Pakistan after travelling across Iraq, Iran and Afghanistan. With the advent of the cool season, the incidence and intensity of these disturbances increase, and they move southward. The winds along the cold fronts of these depressions lower the temperature. The minimum temperature occasionally falls below freezing point even in parts of the plain, to 28°F. in Lahore, for example. It is still lower in the Potwar Plateau, the Indus plains, and the hilly areas.

Rainfall during the months December-March increases north¬wards and westwards. Over the middle and lower Indus Plain it is 1 inch or less, in the upper Indus Plain it ranges from 3-5 inches, and in the north and north-west, it rises to 10 inches or more.

(ii) Hot Weather Season :

High temperature and aridity are the main characteristics of the hot weather season. With the approach of the season, the day temperature begins to rise. in May-June, it reaches its peak when, over large areas, the mean maximum daily temperature varies between 105°F. and 114°F. Southern and south-western parts of Pakistan register higher temperatures than elsewhere. Jacobabad is the hottest place in the sub-continent, with the highest recorded temperatures of 126°F. in May and 127°F. in June. The hill resorts and the Sind-Makran coast are areas of comparatively low temperature, but Karachi experiences short spells of high temperatures (108°F.) when winds from the Rajasthan Desert are drawn to low pressure troughs in the north Arabian Sea.

As the season approaches, pressure falls. A trough of low pressure begins to appear in April, when most of the Indus Plain has a mean pressure of 996 millibars. Relative humidity drops from about 50 per cent in the early morning to 25 percent or less in the afternoon. Rainfall is small, varying from 1 to 3 inches over the plains to 4 to 5 inches in the Himalayan sub-montane areas and parts of the Potwar Plateau. The rainfall is associated with the westerly disturbances, which have by now swung to more northerly latitudes, causing thunderstorms over the hills and widespread dust-storms over the plains.

(iii) The Monsoon Season :

The establishment low pressure over the Indo-Pakistan sub-continent in May and

June attracts winds from the Indian Ocean,which 'burst blowing' over the land about the middle of June as the south-west monsoons. The monsoons gain in strength until July, remain constant to the end of August, and then begin to slacken. The monsoon current reaches Pakistan about the beginning of July and is well established by the middle of that month. In some years, the monsoon remains active even in September.

The tropical cyclones or 'lows' formed along the Inter-tropical Front at the head of the Bay of Bengal move in a north-westerly direction over northern India and enter Pakistan. Their tracks vary with the position of the Inter-tropical Front. Some, after reaching the central parts of India or Rajasthan, re-curve north and north-westward. Others continue westward and bring rains to the lower Indus Plain.

The effect of the Arabian Sea branch of the monsoons over Pakistan is felt from the end of June. However, these mon¬soons penetrate only the coastal areas, and result in the formation of stratus clouds, with very little rain.

During the month of July, the mean monthly temperature exceeds 90°F. over most of the Indus Plain and western Baluchistan. Pressure in the low, centered on Multan—Jacobabad, is 996 millibars. Average rainfall during the monsoon season in the Indus Plain decreases from 25 inches in the north, to 5 inches or less in the south.

(iv) The Post Monsoon Season :

This season is a transitional period between the monsoonal regime and cool-season conditions, and is also known as 'the season of retreating monsoons'. In October, maximum temperatures range from 94° to 99°F., with 60°F. as the normal minimum. There is a further fall of about 10°F. in maximum and minimum in November. The high pressure begins to establish itself over Pakistan in mid-November. The absence of any active wind system results in general dryness, and October and November are the driest months.

11.7.2. The Climatic Elements

(i) Temperature:

Pakistan extends north-south over a considerable expanse of latitude (24°N. to 37°N.). This, together with the diversity of terrain results in a diversity of temperatures at any given time. Seasonal differences in temperature are also substantial, due more to the high temperatures of summer than extreme cold in winter .Temperature in the hottest month are very high, except in mountainous localities. In the plains the hottest month is June, in the hill stations, July. In hilly areas summer temperatures, like winter temperatures, are influenced by altitude and the 'face' of the terrain, and thus vary considerably from place to place. For example, the mean temperature of the hottest month is 97.8°F, at Drosh (4,806 ft.), 78.5°F. at Murree (7,445 ft.), 87.8°F, at Quetta (5,213 ft.) and 100.4°F, at Nushki (3,416 feet.). The difference between the extreme maximum and extreme minimum of the month is great (table 2).

In the plains temperatures in the hottest months are uncomfortably high. The mean monthly temperature for June at most stations in the plains is 100°F or more. The extreme maximum generally rises above 117°F. Jacobabad is the thermal pole, of the sub-continent, where the mean maximum for June is 119.4°F. and the mean minimum 90.7°F. It is probable that nowhere else in the world are there agricultural populations cultivating crops in such intense heat. The day-time heat is sometimes relieved by cooler nights, and the temperature at Jacobabad can fall to 70°F at night in June.

In the coastal areas.the summers are milder. Karachi has a June mean maximum of 95°F and a mean monthly minimum of 85'F. Stratus cloud cover reduces the daily maximam temperatures in January, the coldest month, are low in the Northern and North-Western mountains. Chitral has a mean maximum of 47.7°F and a mean minimum of 29.7°F in January the coldest month. These areas are snowbound until April. Stations in the western mountainous areas experience somewhat similar temperatures in January. January temperatures in the upper Indus plain are moderate and pleasant. At Lahore, for example, the mean maximum is 75.2°F and the mean minimum is 50.7°F. These figures increase in the lower Indus Plain, reaching 87.3°F and 64.8°F in Karachi.

(ii) Pressure and Winds

In summer, the land becomes heated and a low pressure area is created in south-western Pakistan (fig 17). In the month of July,atmospheric pressure (reduced to 32°F. and mean sea-level) is lowest (994.7 millibars.) in the vicinity of Multan, and rises north wards (Lahore, 996.0 millibars.) and southwards (Karachi, 997.7 millibars). This low pressure area attracts winds from the Indian Ocean. As previously explained, some cyclonic storms migrate to this low all the way across northern India from the Bay of Bengal. Although their moisture content decreases as they move westward, it is these storms which bring most of Pakistan's rainfall. Winds sucked in from the Arabian Sea bring fess moisture because these air streams have originated over Arabia, and have a lower moisture content. Nevertheless, they do produce some rain in the western mountains.

In winter, the temperatures over the land are relatively low, and a high pressure area is established (fig 18). The pressure generally decreases from north to south. In January, the pressure is 1022.6 millibars at Peshawar, 1017.4 millibars at Lahore, and 1017.3 millibars at Karachi. Thus, while the prevailing direction of the winter monsoons over the sub-continent as a whole is north-east to south-west, over Pakistan it is almost from north to south. Because these winds blow from the land toward the sea, they are generally dry.

(iii) Rainfall :

The mean annual rainfall of Pakistan is shown in. It is 40 inches or more in the northern mountainous region (Murree, 64.6 inches). Local variations, characteristic of highly differentiated terrain, are recorded in this area. Areas in the extreme north-west, largely sheltered from the monsoonal effect, receive only 20-25 inches (Chitral, 23.1 inches; Drosh, 25.9 inches). The Himalayan Piedmont receives 30-40 inches and the 20-inches isohyet (line joining places receiving the same amount of rainfall) lies somewhat north of Lahore (19.3 inches), veering north-west. The amount of rainfall decreases sharply toward the southern part of the upper Indus Plain. It is less than 5 inches in the Indus corridor, and the northern parts of the lower Indus Plain (Sukkur, 3.6 inches). The Kachhi-Sibi re-entrant is one of the driest areas (Jacobabad, 3.5 inches; Sibi, 5.6 inches). The rainfall again increases southward toward the coast (Hyderabad, 6.1 inches; Karachi, 8.2 inches). On the Makran Coast, it is over 5 inches (Pasni, 5.2 inches; L. bela, 7.7 inches), increasing over the central ranges of Baluchistan (Quetta, 7.7 inches; Fort Sandeman, 15.0 inches). Elsewhere in Baluchistan. it varies from less than 5 inches (Nokkundi, 1.95 inches) to about 10 inches (Panjgur, 4.8 inches, Kalat, 9.2 inches).

With the exception of some areas in the north and north-west, rainfall is concentrated in the three months (July to September) of the summer monsoon (fig 20). Table 4 shows summer monsoon rain as a percentage of total rainfall for selected stations. Winter rainfall (December to March) is much smaller in amount

(iv) Variability of Rainfall:

The rainfall of Pakistan, like that of some other marginal areas of monsoon climate, is markedly variable in the amount and timing of its incidence, and in its areal distribution (fig 22). Over a large area of Pakistan most of the rainfall is associated with monsoon depressions. A secondary source is the passage of western disturbances. In the coastal areas, tropical storms from the Arabian Sea, and thunderstorms associated with thermal instability, produce some rainfall. Each of these sources of rainfall is in itself of a variable character.

The monsoon activity is of a ‘pulsating’ nature. The monsoon blows in ‘intermittent bursts’. Areas of Pakistan receiving 50-75 percent of their rainfall from the monsoon have above normal variability.’ The above-normal variability increases from north-east to south-west over the Indus Plain. Below normal variability is indicative of the comparatively steady influence of the western disturbances, and occurs where winter precipitation is 50-100 per cent of the annual total. The tropical storms from the Arabian Sea area are markedly variable in their incidence, and have erratic paths. They contribute to the high variability of the coastal strip. Jacobabad, the area of greatest extremes in temperature, also registers the greatest fluctuation between average and absolute maximum rainfall.

The mean annual number of rainy days varies from 89 at Murree to less than 10 (Sukkur, 6.5). It is obviously larger at wetter places, and in localities receiving rainfall in both the winter and summer months.

(v) Efficiency of Precipitation :

It has been shown that rainfall over most of Pakistan is low, markedly variable in character, and occurs mainly in the summer months when temperatures are high. High temperatures cause greater evaporation and transpiration (giving out of moisture by the leaves of trees and plants). Thus, the usefulness or efficiency of the rainfall for plant growth is reduced The measure of the efficiency of precipitation, known as the ‘moisture index’, has been devised by Thornthwaite 1 When applied to Pakistan, Thornthwaite’s formula reveals that, with the exception of a narrow strip of land along the North Westen Frontier Province Kashmir border and a small area around Parachinar, Pakistan has a negative moisture index. This indicates that aridity or insufficiency of moisture for plant growth is a basic characteristic of Pakistan's physical environment.

A critical isopleth (line joining, places having the same moisture index, temperature and rainfall) dividing semi-arid from arid areas, runs from south of Lahore to north of Peshawar, and thence to a point north-west of Quetta. To the north of this line, moisture conditions are semi-arid to dry sub-humid. The vast area to the south of this line is arid. Aridity is highest in two distinct areas, the desert lowland of north-western Baluchistan, and the area around Jacobabad.

A more detailed examination of the moisture balance, by months, indicates that only in a few rainy hill areas, such as Murree, is there no month of water deficiency: In the dry areas, water deficiency is commonly experienced for 9 to 10 months and, in some cases, 12 months.

11.7.3 Climatic Divisions:

A detailed scheme of climatic divisions for Pakistan has been classified by Kazi S. Ahmad.1 the four major divisions are:

i. Subtropical Continental Highlands,

ii. Sub-Tropical Continental Plateau,

iii. Sub-Tropical Continental Lowlands,

iv. Tropical Coast lands.

(i) Sub-Tropical Continental Highlands:

Sub-tropical continental highlands include the outer and middle Himalayas, the north-western hills (including Chitral, Swat, Waziristan, Zhob and Loralai), and the Baluchistan hills (Quetta, Sarawan, Central Makran and Jhalawan). They are characterized by cold, snowy winters, cool summers, winter and spring rains, and frequent fogs.

The outer Himalayan area, which includes Murree and Hazara, receives rainfall throughout the year, with two maxima, one in late summer, and the other in spring. In the rain-shadow of the outer Himalayas, precipitation decreases. In Chitral and Swat, the summer rains become scanty, and about two-thirds of the annual total falls from December to April. In the Kohat and Waziristan areas, the rainfall generally decreases toward the south. In the Zhob-Loralai area, both winter-spring and summer rains diminish, producing a total of about 10 inches. Quetta and the Sarawan area have a dry climate, with a mean annual total of 5-10 inches, occurring mostly in winter and spring. North and north-west winds, known as gorich, blow from October to February, and are piercingly cold. In the Makran—Jhalawan area rainfall is still lower, under 5 inches a year. From Kohat south, the annual temperature range is pronounced: the winters are cold and the summers hot.

(ii) Sub-Tropical Continental Plateau:

This embraces north-western Baluchistan and is markedly dry and hot. Hot and dusty winds prevail almost continuously from mid-May to mid-September. Most of the scanty rainfall takes place in January and February (Nokkundi, 1.95 inches). Extreme heat, dryness, and dust are the chief characteristics of this climatic division.

(iii) Sub-Tropical Continental Lowlands:

These include the entire Indus Plain, with the exception of the coastal areas. The climate is characterized by high summer temperatures, aridity, and late summer monsoon rains. The annual range of temperature is high. The northern sub montane area and the Potwar Plateau are wetter than the rest of the Indus Plain and receive more winter rain. The Thar Desert, the Kachhi-Sibi Plain and the south-eastern desert are the driest areas. Thunderstorms are a prominent feature, especially in the Peshawar Plain, and dust storms are frequent during summer.

(iv) Tropical Coast lands:

The tropical coast lands are dominated by sea breezes throughout the summer. The annual and diurnal temperature ranges are low and humidity is high. The mean annual temperature is over 90°F and the rainfall over 7 inches. May and June are the hottest months, with a secondary maximum after the cloud cover dissipates in October. At Karachi, relative humidity exceeds 50 per cent throughout the year, and 80 per cent at night from

April to October. From May to September, it is at least 60 per cent during the day. The Lasbela coastal plain with rainfall maximum in both summer and winter, is the transitional area between the Makran coast and the Karachi-Sind coastal belt. Westward, most of the rain takes place in winter, while from Karachi north-eastward most of the rain occurs in summer.

11.8 NATURAL VEGETATION

Natural vegetation comprises forests, shrubs and grasses, and is determined by climatic conditions and soil types. The climate of Pakistan is too dry for forests, except in the northern hilly and sub-montane belts. Soil formation on the hill slopes is a prerequisite for forest growth, but human practices in these areas have contributed to erosion, rather than to soil formation. Ruthless wood-cutting over-grazing, and the annual removal of grass cover from the slopes are all processes which handicap soil formation and the development of forests. As a result, there is a marked deficiency of tree-cover in Pakistan. It is generally accepted that, for a balanced economy, with an agrarian base, 20-25 percent of the land should be under forest. In Pakistan, only about 3 percent of the total area is forested. Afforestation program increased the acreage under forest from 3.4 million in 1947-48 to 7.41 million by 2011.1 Additional large, areas have been reserved for afforestation in Thal, Ghulam Mohammad Barrage, and Gudu Barrage, and this is likely to improve future acreage to some extent. Of the 6.41 million acres classified as forest in 1971/2, Sind had 1.22 million acres, Baluchistan 2.65acres, the Punjab 1.05acres and N.W.F.P. 1.49 acres. Much of the acreage in Sind and Baluchistan is not true forest and, indeed, two-thirds of the 'forested' area is scrub-land.

Slightly over two-thirds of the forest land is under public ownership, the remainder being privately owned. Forests are classified as 'Reserved', 'Protected', or 'Unclassified'. Reserved and Protected forests are publicly owned. Tree-felling in reserved forests is done only under the strict supervision of the Forest Department. In Protected forests the local population has some traditionally acquired rights of use for example, grazing and collection of dried branches for firewood. This makes the scientific management of such forests difficult. Unclassified forests are under private or communal ownership, and depleted so badly that large areas of such so called 'forests' are devoid of tree cover.

11.8.1. Types of Forest:

(i) Northern and North-Western Mountain Forests

These are mostly evergreen coniferous softwood forests, with some broad leaf species growing on the lower altitudes. The principal coniferous trees include fir, deodar, blue pine and spruce, and they grow generally at altitudes of 3,000-12,500 ft. Above the tree-line (12,500 ft.), there arc stunted alpine forests. Below 3,000 ft. there are some pines but more broad leaf trees, such as oak, maple, birch, walnut, and chestnut.

Coniferous forests constitute the main source of commercial lumber, obtained by felling trees from the more accessible parts of the groves on the lower slopes of the hills. In the future, with the construction of access roads, their economic exploitation will improve. The deodar tree is particularly useful as a source of timber for houses and for railway sleepers. Broad leaf species, like oak, walnut and chestnut, are used in the manufacture of furniture.

(ii) Shrub Forests of the Foothills and Plains:

Shrub forests are found over large areas in the northern and north-western foothills and plains. The principal species are acacia, wild olive, and mesquite. These are found in the Districts of Peshawar, Mardan, Kohat, Campbellpur, Rawalpindi, Jhelum and Gujrat. Their yield in firewood is very small.

(iii) The Baluchistan Hill Forests:

In the Quetta and Kalat divisions of Baluchistan there are some dry hill forests at altitudes between 3,000 and 10,000 ft. The trees include Chilghosa pines and pencil junipers. In 1972-73, a small beginning was made, at a cost of Rupees 4.6 million, to improve the forests of Baluchistan by stabilizing sand-dunes in Pasni and Gawader and planting trees along 150 miles of highway.

(iv) Riverine Bela Forests and Irrigated Plantations:

These are high-yielding commercial units of hardwood species. They contain planted shisham, mulberry and acacia trees. Shisham is a high-quality cabinet wood extensively used for high-quality furniture. Changa Manga Forest near Lahore is the largest of the irrigated forest plantations. First established about 100 years ago, it now covers 12,500 acres and has an annual yield of 10 cubic feet of timber and 250 cubic feet of firewood per acre. This yield is some ten times that of natural forests in Pakistan. Other sizeable irrigated plantations are Wan Bachran in the Thal area, Chichawatni in Sahiwal District, and some parts of Ghulam Mohammad and Gudu Barrages. Linear plantations are found along river banks and irrigation canals, roads and railways.

The planted acreage is still relatively small. In Punjab Province, of a total forested area of 1.05 million acres in 1971-72, only 256,000 acres were in irrigated, and 30,000 in linear plantations.

(v) The Rakhs:

The Rakhs are dry scrub forests grown in small patches on the arid plain. They provide insignificantly small quantities of fuel wood. Species include farash, bakain, jand, and karil.

(vi) Tidal Forest:

These occur in the coastal wastelands from Karachi to Kutch, covering an area of approximately, 750,000 acres. These forests are of the mangrove type, with trees of stunted growth, and produce some fuel wood for use in Karachi.

The average annual demand for timber in Pakistan has been estimated at 6.5 million cubic feet.2 the gap between supply and demand results in high prices for timber. Similarly, the estimated annual requirement for firewood is 450 million cubic feet, on the basis of a per capita need of about 10 cubic feet. Supply amounts only to about 17 million cubic feet. The deficiency is met by burning cow dung and anything else that grows above soil level. Such a practice is clearly harmful to the regeneration of trees and shrubs.

11.9 POPULATION

The latest population count of Pakistan was held in 2017. The population of the country in 2017 was 207,774,520, comprising 106,443,520 males and 101,331,000 females. Of the total population, the province of Punjab contained 110,012,442 (52.95 per cent of the total), Sind 47,886,051 (23.04 percent), N.W.F.P. 30,523,371 (14.69 percent), Baluchistan only 12,344,408 (5.95 percent), centrally administered Tribal Areas and the

Federal Capital Territory of Islamabad respectively 5,001,676 (2.41 percent) and 2,006,572 (0.97 percent).

(i) DENSITY:

The density of population in Pakistan in 2017 was 260 persons per square mile. It was 209 persons per square miles in 1972,138 persons per sq. mile in 1961 and 109 persons per sq. mile in 1951. The District wise analysis reveals a very uneven distribution. The most densely peopled district is that of Karachi, with 2,506 persons per square mile, for that district contains the most populous urban centre of Pakistan. The density of population is high, over 950 persons per square mile, in a large block of districts in north-eastern Punjab. The block comprises the districts of Sialkot (1260 persons per sq. mile), Gujranwala (1100), Gujrat (1206), Lahore (2238), Sahiwal (1010) and Lyallpur (1506). In the neighbouring districts, Sheikhupura has a density of 850 persons per sq. mile and Multan 960. High densities are also found in Rawalpindi (51114), Peshawar (1474) and Mardan (1344). Densities ranging from 500 to 600 persons per sq. mile occur in the Mohmand and Khyber Agencies, and the districts of Sargodha and Jhang. Districts with 300-500 persons per sq. mile are Hazara, Bannu, Jhelum, Bahawalnagar, Rahimyar Khan, Larkana, Nawabshah and Hyderabad. Density of 200-300 persons per sq. mile is found in Malakand and Kurram Agencies, and Kohat, Campbellpur, Mianwali Muzaffargarh, Jacobabad, Sukkur and Sanghar districts. The remaining areas of North Western Frontier Province, Punjab, and Sind have densities varying between 100 and 200 persons per sq. mile. Baluchistan is sparsely populated: the only district with a population density of 50 persons per sq. mile is Quetta-Pishin, while all other districts are still more thinly peopled. In four districts of Baluchistan, namely Chagai, Kharan, Zhob and Makran, covering a vast area of 72,004 sq. miles, the density of population is under 10 persons per sq. mile.

The uneven areal distribution of the population of Pakistan is principally related to:

(1) The diversity of landforms, the population being denser in plain areas and thinner in difficult terrains;

(2) The availability of water for raising crops, areas with surface and ground-water irrigation facilities being densely peopled; and

(3) The degree of urbanization, entailing both rural-urban and regional migration of population to urban centres offering better financial prospects.

(ii) GROWTH OF POPULATION:

Pakistan has one of the highest rates of population growth in the world. The annual rate of increase was 2.40 per cent during the two decade 1997-2017 and 3.82 percent over the period 1961-72.1 This figure compares with 3.5 per cent for Mexico, 3.0 percent for the Philippines, 2.5 percent for Thailand, 2.3 percent for India.2.0 percent for China, 1 some of the countries with highest population growth rate in the world.

The high rate of growth is due to natural increase, that is, the excess of births over deaths. The data used in compiling the vital statistics are inadequate, and known to be badly under-reported. However, the presumption that the increased rate of growth is due to some extent to a decline in the death-rate is well-founded. Improved medical facilities have reduced the death rate, particularly the infant mortality rate. Some improvements in social welfare may also have contributed to this effect.

The above figures clearly show a high and accelerating rate of growth, the rise during the 1997-2017 period being unprecedented. If the recent rate continues, the population of Pakistan will double by 2027.

The rate of increase over the last inter-censal period, although high everywhere, was not equally high in all parts of the country. The newly-established Federal Capital Territory of Islamabad showed the highest percentage increase (150 percent). Among the provinces, Baluchistan showed the highest percentage increase (78 percent), followed by Sind (66.9 percent). The increase in Punjab and N.W.F.P. was respectively 46.63 and 46.60 percent. The centrally administred Tribal Areas underwent the least percentage increase (35.7 percent). In Baluchistan and Sind, all Districts except Lasbela, Khairpur and Tharparkar, returned a high percentage increase. The Districts of N.W.F.P. and Punjab which stand out in terms of high percentage increase are Kohat, Bannu, Rawalpindi, Gujranwala, Lahore, Lyallpur and Muzaffargarh.

Birth and death rates can be expected to vary somewhat between various parts of the country, but the additional factor explaining higher growth of population in some administrative units is internal migration. Short-distance mobility results in growth of urban centers at the expense of the country side, while long distances mobility results in an uneven growth rate between districts. The motive forces of mobility are numerous, the most important being related to employment opportunities. The varying rates of percentage increase by Districts are suggestive of a large-scale movement of population within the country.

(ii) RURAL AND URBAN DISTRIBUTION

The basis of urbanity of a settlement in Pakistan is its administrative organization (municipality, town committee, cantonment, civil lines) and size (5,000 persons or over, except in a few cases where a lower population size is recognized as urban on the basis of urban characteristics of the settlement). In 1961 urban population was 22.5 percent of the total, the remaining 77.5 percent being rural. In 1951 urban population expressed as percentage of total population was 17.8 percent. Percentage figures of urban population to the total since the beginning of regular censuses in the country indicate a generally accelerating growth of urban population. The rate of natural increase of urban population has been lower than that of rural population. The higher rate of growth of urban population is, therefore, largely a result of rural-urban migration. Traditionally the rural settlements of Pakistan were considered to be autonomous—with the proverbial solidarity of rural society. This inhibited a large-scale rural-urban migration. However, with the passage of time, the village autonomy and solidarity crumbled under the impact of economic forces conducive to rural-urban migration. The 'freedom' of the city or the availability of greater job opportunities in the town acted as a magnet. Urban settlements have attained various forms or patterns, resulting from peculiarities of site, historical developments, and socioeconomic requirements.

Towns are the locales of industrialisation. The process of industrialisation has involved marked shifts in the use of material and human resources. It has altered the occupational structure of our society and these changes have given rise to a large-scale movement of population from the rural to the urban areas. The lure of the town has now been enhanced by worsening conditions in the rural areas, where the acreage of cultivated land per head of rural population has been constantly decreasing.

An interesting feature of urbanization during recent decades has been the tendency towards 'metropolitanism' with a few bigger cities growing faster, not only at the expense of the countryside, but also drawing people from medium-sized and small towns. An examination of the increase of urban population reveals that over recent decades the 'cities' (urban centres with a population of one hundred thousand or over) have grown spectacularly. Between 1961 and 1972, eight towns achieved the status of 'cities' bringing the total to twenty, and the population of twelve of these grew by more than 50 per cent. In most of the metropolitan centres, improvement of facilities has failed to keep pace with the rapid growth of population, and these cities can be said to be 'overgrown'. The distances to be covered are long, and the means of transport and the width of the roads, inadequate. Fast moving vehicles mingle with sluggish horse, camel, and donkey-drawn carts in congestion and confusion. The historical evolution of the cities has been such that they have two distinct parts the old and the modern. The modern sections have wide roads, impressive lay-out, and expensive buildings. The old city suffers from narrow roads and alleys, close-set and small buildings, and residential over-crowding. The location of functional areas (areas under various urban uses) has developed haphazardly and is generally inappropriate.

(iii) AGE DISTRIBUTION OF POPULATION

The age profile of the population of Pakistan shows an unusually large proportion of children. A large child population indicates a high rate of dependency in relation to the work force, and reflects not merely a rapid growth of population in the past but pretends rapid growth in the future. Of the total population in2017, 40 percent were children under 10 years of age, 52 percent were of working age and 7 per cent were 60 years or over.

There are marked differences in the age composition between urban and rural areas. In urban areas, the proportion of children under 10 years is less, and the proportion of working-age groups (10-24, and 25-44 years) is higher. The sex ratio (the proportion of males to females) is also higher in urban areas, 119 in the cities compared with 114 in the rural areas. The sex ratio of the working age groups in the urban areas is still higher. These figures reflect the influx of males from rural to urban areas.

(iv) RELIGIOUS GROUPS AND LITERACY

Pakistan came into existence in 1947 as the homeland of Muslims in the Indo-Pakistan sub-continent. In 1961 Muslims comprised 97.2 percent of the total population, caste Hindus 0.5 percent, scheduled castes 1.0 percent, Christians 1.3 percent, and Buddhists 0.01 percent. During the past decade, the percentages have probably remained approximately the same. Pakistan is a preponderantly Muslim country.

In computing the percentage of literacy, children under 5 years of age are excluded. In 1961, the average percentage of literacy in Pakistan was 16.3 percent, 23.9 percent for males, and 7.4 percent for females. By the more stringent standards of the United Nations, under which literacy includes the ability to write a short statement on a topic of everyday life as well as being able to read a language with understanding, literacy in Pakistan in 1961 was 14.0 percent for both sexes (21.6 percent for males and 5.9 percent for females). Literacy was higher in urban areas (33.0 percent) than in rural (10.9 percent), and highest in the big cities (Karachi, 38.1 percent; Rawalpindi, 32.4 percent; Lahore, 25 percent). Urban localities, with only 23 percent of the total population, contained half the literates in Pakistan. The 10-14 year age group had the highest percentage of literacy (28.2 percent), much higher than the 13.3 percent of the age group 25 years and over. Although the overall percentage of literacy in Pakistan is low, it is increasing with the passage of rime.

(v) CIVILIAN LABOUR FORCE

As indicated above, the composition of population by age-groups is such that the burden of dependency is high. In 2017 only 52 percent of the population was in the work force, the balance being housewives (23.7 percent) and dependents (43.9 percent). The labour force is overwhelmingly male. Of the working population, almost three-fifths was engaged in agriculture. Population categorized in the 1961 census as ‘not working but looking for work was 1.4 percent for rural and 2.8 percent for urban areas. This figure, which is strikingly small compared even with developed countries’ was noted in the census report as being under-estimated. Our cities have by no means reached levels even approximating full employment, and all cities have a large number of beggars and idlers.

However, comparison of the data for the 1951 and 1961 census reveals some improvement in the overall employment situation during the decade. While total population increased 27.0 percent, the civilian labour force increased 32.1 percent. The rise in the non-agricultural labour force was substantial (55.1 percent), and the rise in the agricultural labour force (19.8 percent) less than the rate of growth of the total population.

To sum up, Pakistan has a substantial total population (65 million), with a markedly uneven areal distribution. The rate of population growth is one of the highest in the world and it is this rate of growth rather than the present size which is of concern to economic planners. Urbanization, an index to industrialization, is on the increase, but its economic base needs reinforcement. The percentage of the population which is economically active or literate is low, but there are signs of improvement.

11.10 IMPORTANT URBAN CENTRES

An important urban centre, with a population of 100,000 or more, or with a lesser population but a high administrative status (e.g. capital of a province) is classified by the census as a 'city'. All other urban centres are known as 'towns'. At the time of the 1972 census, Pakistan had 20 cities, the populations of which are listed in Table 10. Of these 20 cities, eight are singled out, by reason of their economic, administrative, or historical importance, for discussion in this chapter. By way of preface, however, it is appropriate to set forth some general characteristics of Pakistan's cities.

FUNCTIONAL LANDSCAPE OF PAKISTAN CITIES

Urban land use or 'urban functional areas', are categorized differently by different authors. In the present work, six categories of urban land use are considered, namely: industrial, commercial, administrative and other public buildings, cantonment, residential, and open recreational land.

11.10.1. Industrial Areas

Zoning of industry into compact areas which is an important objective of modern town-planning, has begun in some cities. Karachi has a large, well-planned industrial site, and new industry is zoned in Hyderabad, Multan, and Lyallpur. Most of these industrial sites have a location peripheral to the urban complex. This affords a solution to a number of traffic problems by chanelling a large volume of intra-city daily commuting into a smaller number of highways, mostly avoiding the congested centre. It also makes economical the construction of railway extensions, power and water lines, and other requirements of industry.

Industries located within Pakistani cities are generally either old-established industries, which had a peripheral location at the time of their installation, or non-noxious industries, permitted by municipal by laws to be located inside the city.

11.10.2. Commercial Areas

The present arrangement of commercial areas in our cities is generally defective. Unlike Western urban centres, commerce in Pakistani cities is not concentrated in a large compact central area which can be identified as the commercial core. Commercial facilities fall into two broad categories, mandis and bazaars. Mardis are markets for agricultural produce, grains, fruit and vegetables. They commonly cover sizeable areas, away from the main streets, and are generally scattered throughout the city. In some cases even the regional entrepots for agricultural products are in the heart of the city. This is an example of the gravitational effect of the old-established markets on the flow of commodities. The result is an unnecessarily large volume of slow-moving vehicular traffic on the intra-city roads. *Bazaars* are shopping areas for local and foreign manufactured goods. Usually the bazaars are highly-elongated along the main streets, and not broken at adequate intervals by adjacent groups of shops. According to the principles of town-planning, it is desirable to break the continuity of long shopping streets by spreading subsidiary centres to back streets, at intervals.[1]

11.10.3. Administrative and other Public Buildings:

The most suitable location for administrative buildings is the central district of the city. In our cities, the administrative buildings are usually located away from the centre. The explanation is historical. In pre-British days, settlements were compact. The larger the settlement the more crowded it tended to be. Under British rule, the larger of the existing settlements were generally selected as administrative headquarters. Owing to the prior occupation of the interior of these large agglomerations by other functions, mainly residential and commercial, the administrative function could not be conveniently located in the central district. Large areas for adminis-trative buildings were set aside on the outskirts. Compact areas of administrative buildings exist in such cities as Karachi, Lahore and Lyalipur.

Modern educational institutions, with large space requirements are generally located on the outer fringes of the cities. Some universities are quite isolated. Hospitals, libraries, and other public build-ings are dispersed through the urban complex, as and where space could be obtained.

11.11 IMPORTANT CITIES

11.11.1. Karachi :

The capital of Pakistan until 1959 and now the capital of the province of Sind, Karachi is the largest city in Pakistan by a considerable margin, and the industrial and commercial hub of the country. It is also the port for both Pakistan and Afghanistan, the terminus of Pakistan's railway system, the location of its naval headquarters, the site of the principal international airport, and an important educational and service centre. It is a multi-functional city.

The early history of the settlement is obscure. About the beginning of the eighteenth century, it was a small fishing village called Dibro.[1] From 1730 or thereabouts, it began to attract the merchant class of the nearby urban centres of Sind. The merchant community established an autonomous administration and raised a small army. The name 'Karachi' seems to have been derived from a fresh water well, known as Kalachi Kun.[2] At the time of the British occupation in 1842, the settlement covered an area of 30-40 acres, and was surrounded by a defensive wall, which was by then in a dilapidated condition.3

It was the British who harnessed Karachi's potential as the 'gateway' to the Indus Valley and founded the modern city. Significant dates in the growth of the city were the establishment of the Indus Flotilla (1843), the creation of the municipality (1852), the railway linkage with Kotri (1859) and with the Punjab, railway system (1877), the founding of the Port Trust (1886), the establish-ment of a civilian airfield (1923-5), and its selection as the capital of the newly created Province of Sind (1936).

After Independence in 1947, a large number of Muslim refugees from India settled in Karachi and at the time of the 1951 census refugees made up 58.7 percent of the population of the city. The immigrant businessmen added to the monetary resources of the city, and to its industrial and commercial activities. By 1951 the population of Karachi had outstripped that of Lahore, previously the largest city, and by 1972 it had reached 3,469,000, increasing about 80 percent each decade.

This rapid increase in population called for a rapid increase in housing, water supply (including 280 million gallons a day from the Indus), sewage and transportation (including a two-track circular railway skirting the city).

Karachi has a strong industrial-commercial base. Of the total working population, 45.2 per cent is employed in these categories. Twenty-six per cent of the total industrial units [4] and 22 per cent of the industrial workers of Pakistan are in Karachi. The more impor-tant industries are textiles, footwear, metal products, food and beverages, furniture, machinery and chemicals. About 5,500 acres have been developed as industrial estates on the western margin of the city The foreign sea-borne trade of Karachi has increased significantly. The total tonnage of exports and imports handled by the port rose from 3.4 million tons in 1950/51 to 9.3 million tons in 197102. A second port to serve the projected steel mill it being built nearby at Pitti Creek industry, silk, gold, and silver scarves, and embroidery work. Modern factory industries include cotton ginning, textiles, glass-wor: vege- vegetable-oil mills, and tanneries. Before the British period, the city was mostly contained within a defensive wall, and occupied a bluff on the left bank of the Ravi. This area remains congested and overcrowded During the British period, it extended beyond the city walls in both planned and unplanned development. Planned development included the Mall (now the Shahrahe Quaid-i-Azam) and areas to the south of this road, and the cantonment section. Since 1947, development has been, for the most part, planned and includes upper and middle class residential districts and local marketing and other facilities. The city now covers 128 sq. miles, with an average population density of 16,780 persons per sq. mile.

11.11.2. Lahore

Lahore ranks second in population among the urban centres of Pakistan (pop. 1972: 2,148,000). Set in the midst of the fertile alluvial plains of the Punjab, it occupies a focal position in the Upper Indus Plain, at the bridge-head over the Ravi on the historic route from Central Asia into the sub-continent. It has been the capital of the Punjab for about a thousand years. Before Independence, it was the capital of the undivided province of the Punjab. It is now the capital of Punjab Province, Pakistan.

Although Lahore is an ancient city, its earliest written record occurs in connection with the campaigns of Mahmood of Ghazniagainst.the Rajas of Lahore between A.D. 1001 and 1008. From that time onward, Lahore figured prominently in the historical annals of the Punjab region. The period of Moghul rule, starting from 1524, was the golden period, when at times the Royal Court was held in Lahore. After the decline of Moghul power, Lahore suffered from the political instability of the region until the Sikh ruler, Ranjit Singh, came to power (1798-1839). It again suffered under the successors of Ranjit Singh and was reduced to 'a mere expanse of .crumbling ruins' by the time it came under British occupation in 1849.

Of the total population, one-third is gainfully employed, 30 per cent in industry, 25 percent in trade and commerce and 26 percent in services (Government, Community and personal). Eighteen per cent of all the industrial establishmehts in Pakisan, mainly textile factories, are in Lahore and these occupy about 10 percent of the area of the city. Lahore is well connected with the other important cities of Pakistan by rail, road and air. Restricted communication has been re-opened with India through the Wagah border, about 17 miles to the east. Lahore is an important educational centre (fig. 44).

11.11.3. Islamabad

Islamabad and Rawalpindi, each of which has its own independent city administration, are often regarded as twin-cities because of their physical proximity. The distance between the two is 9 miles and with the expansion of the built-up area they may not take long to coalesce. Rawalpindi airport serves both. The two are very different in construction and layout, and in function: Islamabad is an administrative centre, while Rawalpindi is a multi-functional city.

11.11.4. Rawalpindi

Rawalpindi is a thriving city, growing more rapidly since the selection of Islamabad as the site for the new capital in 1959. It has a favourable location on the Pindi Plain of the Potwar Plateau, on the Grand Trunk Road 108 miles from Peshawar and 179 miles from Lahore. It is also the junction of the main road through Murree to Kashmir. The main extension of the city in recent years has been along the Murree Road, where a sizeable residential area Satellite Town, was planned in 1952. Since then, the commercial function of the road between the satellite town and the old city has improved remarkably, furnishing an interesting example of re-adjustment in the functional landscape of a city. Recently Rawalpindi has also been growing as an industrial centre, with 2 percent of Pakistan's industrial establishments now located there. Industries comprize cotton and silk textiles, hosiery, foundries, electrical goods, medicines, printing and publishing, an oil refinery, and a brewery (fig. 45).

Islamabad, the capital of Pakistan, with a population in 1972 of 77,000 is a city still under construction. The site consists of gently undulating land, with the Himalayan foothills forming a scenic background. The diversified topography has been utilized in a spacious and attractive layout, with different functional zones. The eight zones are (I) administrative sector: (2) diplomatic enclave; (3) special institutions; (4) industrial zones; (5) commercial areas (6) residential sectors; (7) National Park area including Islamabad University: and (8) Forest and Green Belt. As buildings arc completed, more and more functions of the national government are transferred to Islamabad. The National Assembly meets there and all foreign embassies have been transferred there from Karachi. The site of the ancient city of Taxila is nearby (fig. 46).

11.11.5. Peshawar

The capital of the N.W.F.P., Peshawar is an old city of great historical importance. It lies at the eastern end of the famous Khyber Pass through which came most of the past invaders of the subcontinent. The history of Peshawar goes back to the Buddhist Kingdom of Gandhara (first century A.D.), famous for its art works. Pushkalavati, identified by Cunninghaml with the modern settlement of Charsadda, was the capital of Gandhara. By the time of the visit of the Chinese pilgrim, HwenThsang, in A.D. 630, Peshawar had become a 'great city' some 2-3 miles in circumference. It is next mentioned by the Muslim historian, Masudi, as being taken by Sabuktagin in 997, and being the rallying point of Mahmood's invasions of India in 1017 and 1023. Babar conquered Peshawar in 1505, and it remained under the control of the Moghuls until falling to Ranjit Singh in 1823. This was followed by British occupation in 1849.

The long and chequered history of Peshawar has resulted in the presence of several old structural remains. The fort, BalaHisar, is said to have been built by Babar, but destroyed not long after by neighbouring Afghans, and re-built on a larger scale.

The population of Peshawar (273,000 in 1972) is steadily increasing. The Peshawar Plain in which the city is located is land of high fertility. In addition to being a local marketing centre, Peshawar is a way-station for trucks entering and leaving the Khyber Pass en route to and from Afghanistan and Central Asia. It is also the headquarters of the Pakistan Air Force, has a large cantonment, and a university. Industries include textiles, fruit canning, furniture, and various handicrafts.

11.11.6. Quetta

Quetta has the distinction of being the only sizeable urban settlement in the vast area of Baluchistan. It is the headquarters of Quetta-Pishin district, a divisional headquarters, and the capital of the province. The name 'Quetta' is derived from the Pashto word `kwatta', meaning 'fort', and the immediate predecessor of the present settlement was located at Miri, which also means 'fort'. Quetta came into being after the treaty of Gandamak (1879) at the end of the Second Afghan War, and the permanent lease of the Bolan Pass area to British India by the state of Kalat (1883). To this day, the city derives most of its importance from its strategic location on the Khojak-Bolan Pass, and the cantonment population is about one-third that of the entire city.

Quetta is also a commercial center, an outlet for goods imported from Afghanistan. These include hand-woven woolen cloth, sheepskin coats, and carpets. The city is well planned, with rectili-near streets, and includes a university, the headquarters of the Geological Survey of Pakistan, and a center for seismic studies—Quetta being in a sensitive location for the study of earthquakes.

CHECK YOUR PROGRESS

Note (a) Write your answers in the space given below.
(b) Check your answers with the above subsection.

1. Write short note on the Himalayan region.

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2. Describe the physical characteristic of Baluchistan.

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____

3. Write a short note on Indus river system.

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4. Write a short note on natural vegetation of Pakistan.

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11.12 LET US SUM UP

Physio graphically Pakistan can be divided into five regions, the central inner ranges lies in the state of Jammu and Kashmir large part of which is in India. The Hindu Kush branch off from the Pamir Knot where the border of Pakistan, Afghanistan, former USSR, and China meet. The Passes through the western Bordering Mountains are of special geographical and historical interests. Broad Passes which are difficult to traverse occurs south of Kabul River. The other Passes of importance include Khyber, Kurram, Tochi, Gomal and Bolan.

The climate of Pakistan is more 'continental' than that of other parts of the sub-continent, which come under a more typical monsoon regime. The rainfall in most parts of Pakistan is insufficient and its usefulness for agriculture is further reduced by its variable nature. Moreover, the efficiency of the rainfall is reduced because it takes place in the late summer months when, because of the high temperatures, much of it is evaporated.

The high rate of growth is due to natural increase, that is, the excess of births over deaths. The data used in compiling the vital statistics are inadequate, and known to be badly under-reported. However, the presumption that the increased rate of growth is due to some extent to a decline in the death-rate is well-founded. Improved medical facilities have reduced the death rate, particularly the infant mortality rate. Some improvements in social welfare may also have contributed to this effect.

Towns are the locales of industrialization. The process of industrialization has involved marked shifts in the use of material and human resources. It has altered the occupational structure of our society and these changes have given rise to a large-scale movement of population from the rural to the urban areas. The lure of the town has now been enhanced by worsening conditions in the rural areas, where the acreage of cultivated land per head of rural population has been constantly decreasing. An interesting feature of urbanization during recent decades has been the tendency towards 'metropolitanism' with a few bigger cities growing faster, not only at the expense of the countryside, but also drawing people from medium-sized and small towns.

11.13 GLOSSARY

- **Region:** An uninterrupted portion of the earth that has some internal features of uniformity, for example; the trade area of a city or an area of similar climate.
- **Pass:** A passage between two hills.
- **Pamir Knot:** A mountain range in central Asia, at the junction of Tian Shan, Karakoram, Kunlun, Hindu Kush, Suleman and Hindu Raj range. They are among the world's highest mountains.
- **Urbanization:** Proportion of people living in built environments such as "towns and cities".
- **Metropolis:** A major city, especially the chief city of a country or region.

11.14 LESSON END EXERCISE

1. Divide Pakistan into Physiographic divisions and write a detail account on each of them.
2. What is climate? Divide Pakistan into climatic regions and explain each of them.
3. What is natural vegetation? Classify Pakistan into Vegetation Regions.

4. What is Drainage system? Write a detailed account on Indus River System.

5. Give the different types soils found in Pakistan.

6. Write an account on the distribution and density of population in Pakistan.

7. Punjab is the density populated province of Pakistan. Give reasons.

8. What is Urbanization? Discuss the process and development of urbanization in Pakistan.

11.15 SUGGESTED READINGS

- Geography of Pakistan by K.U. Kureshy Oxford university Press, New-Delhi, 1978
- Geography and Development a world regional approach by James Fisher, Merrill Publishing Company, London. 1980.
- World Regional Geography by D.S. Monku, Kalayani Publishers, New Delhi, 2002

11.16 REFERENCES

1. Blij, Harm J.De. And Peter, O.Muller (1993). "Geography—Regions and Concepts", John Wiley, New York.

2. Blij, Harm J.De. (1977). "Human Geography-Culture, Society and Space", John Wiley & Sons, Newyork.

3. Cairns, G.O. and J.F. (1962). "Australia", Macmillan Co. New York.

4. Coysh A.W. and Tomlinson M.E. (1960). "The Southern Continents," University Tutorial Press Ltd. London.

5. Cressey, G.B. (1951) "Asia's Lands and People", Mc Graw Hill, London.

6. Dicken, Samuel N & Pitts, Forrest R. (1970) "Introduction to Cultural Geography", Xerox College Publishing, Waltham, Massachusetts.

7. Dobby, E.H.G. (1950) "South east Asia", University of London Press, London.

8. Dohrs, F.E & Sommers, L.M. (1976). "World Regional Geography", West Publishing Co. New York.

9. East and Spate (1953)"The Changing Map of Asia",

10. English Paulward and James, A. Miller (1989) "World Regional Geography—A Question of Place", John Wiley, New York.

PAKISTAN-MAIN FEATURES OF AGRICULTURE, LOCALIZATION OF INDUSTRIES AND INDUSTRIAL REGIONS.

12.0 STRUCTURE

12.1 INTRODUCTION

The economy of Pakistan is predominantly agricultural. Although of recent years the rate of growth of manufacturing has surpassed that of agriculture, the latter remains the most important single sector of the economy, contributing more than two-fifths of national income and employing two-thirds of the working population. Of the estimated total area of Pakistan (131.7 million acres) 47.5 million, or over 30 percent, is cultivated. Of the area cultivated, more than half is in Punjab Province. On an average, three-quarters of the cultivated area is sown each year, and the remainder left fallow. About 13 percent of the sown area is double-cropped. Agriculture is highly dependent on irrigation, and 65 percent of the cultivated area is irrigated.

The industrial base of Pakistan at the time of Independence was very weak. In 1949-50 manufactures accounted for only, 1.5 percent of the total national income. After about ten years, the ratio improved to 5.0 percent, and improved again to 8.4 percent in 1968-69. These figures refer to combined Pakistan including both the Eastern and Western wings. For present Pakistan, the 1970-71 figure was 16.6 percent. Industry is, thus, the second largest sector of the economy, next to agriculture.

12.2 OBJECTIVES

After studying this lesson, you will be able to :-

1. Analyse the agriculture development in Pakistan.
2. Highlight the present position of Agriculture in Pakistan.
3. Analyse the growth of industry in Pakistan.
4. Analyse the locational characteristics of Industries in Pakistan.

12.3 AGRICULTURE

(i) Agricultural Performance:

The agricultural growth rate increased from 3.8 per cent in the Second Plan, 1960-65, to 5.7 percent in the Third Plan, 1965-70. Agriculture is progressing toward the objective of self-sufficiency in food grains. Pakistan grew 80 percent of her food grain requirement in 1972/73. The advance in agricultural production has resulted from several interrelated efforts:

(ii) Improvement of Irrigation Facilities:

During the five years, 1965-56 to 1969-70, the supply of irrigation water increased by 20 percent. The uncertainty of agriculture resulting from aridity and variability of rainfall was thus reduced and farm incomes commensurately stabilized. During the Fourth Plan (1970-75), an additional area of 1.2 million acres is to be irrigated and 7.5 million acres of presently irrigated land are to receive supplementary supplies.

(iii) Use of Chemical Fertilizers:

With a view to encouraging the use of chemical fertilizers, the government subsidies prices to the extent of 35 percent. In 1970-71, consumption was 289,000 tons, with an average use of 12 lbs. per acre of arable land. Additional fertilizer plants are being established in the country and, with government assistance, applications will soon be heavier and more widespread.

(iv) Plant Protection Programmes:

The environmental conditions of Pakistan are proniotive of pests and plant diseases. Plant protection programmes have two aspects, preventive and curative. Preventive measures comprise the breeding and treatment of seeds to be resistant to diseases, and curative measures entail spraying with insecticides against pests and diseases. The plant protection programme covered 2.5 million acres under preventive measures and 1.6 million acres under curative measures in 1969/70 and is being further intensified.

(v) Introduction of High-Yielding Varieties:

Much of Pakistan's 'green revolution' is attributable to the introduction of scientifically-bred varieties of seed which have. Much higher yields per plant than the varieties previously used. These new varieties include Mexi-Pak for wheat, Irri-Pak for rice, and MS-39 and MS-40 for cotton. All have responded well under conditions of adequate watering and heavy manuring. High-yielding varieties of maize, oil-seeds, and fodder crops, including strains adapted to the hilly areas, have also been developed. In the barani or rain-fed areas, where application of the new technology of improved seeds remains limited, the emphasis is on soil conservation programmes.

(vi) Mechanization:

The recent break-through in agriculture has prompted increased mechanization, as evidenced by the increasing number of tractors, the total number of which is now about 20,000. A substantial proportion of these are privately, rather than co-operatively or governmentally, owned. (Only 2 percent are owned and used co-operatively.) Their use is almost entirely in irrigated, rather than barani, areas.

(viii) Land Reforms:

Under the West Pakistan Consolidation of Holdings Act of 1960, about 12.5 million acres in small, sub-marginal farms were consolidated into larger holdings of greater economic viability. The minimum 'economic' holding is adjudged 12.5 acres of irrigated, and 16 acres of un-irrigated land. On the other hand, under the Land Reforms of 1959, about 2.4 million acres was resumed from big landlords and sold to 200,000 tenants, to intensify the use of this land. The Land Reforms of March 1972 were designed to further arrest the concentration of landed wealth and to rationalise the landlord-tenant relationship.

The 1959 reforms fixed the ceiling for individual ownership of irrigated land at 36,000 produce index units, that is 500 acres of irrigated or 1,000 acres of un-irrigated land. This apparently high ceiling was further liberalized by allowing a series of exemptions for orchards, stud farms, and shikargarh (areas reserved for game). The recent reforms lowered the ceiling to 15,000 produce units, that is, 150 acres of irrigated or 300 acres of un-irrigated land. An additional area of 3,000 produce units is allowed to an existing owner of a tractor or a tube-well. Lands resumed from big landlords are to be distributed on easy instalment terms among landless tenants or holders of below-subsistence farms. Prior to the reforms, 79 percent of the farms were of 10 acres or less. To check sub-division and fragmentation into sub-marginal holdings, the previous restrictions on the division of joint holdings and the alienation of holdings remain in force.

Tenant-landlord relations have been modified to assist the tenant. According to the new rules, the batai or tenant's share of a farm's produce will be increased, the landlord becomes responsible for the payment of all land taxes, and the tenant is given security of tenure and the right of pre-emption in the event of sale of the land
AGRICULTURAL PROBLEMS

Agriculture in Pakistan has its numerous problems. It is occasionally exposed to the vagaries of nature, such as failure of rains, floods, pests, diseases, and locust swarms. In addition to plant protection and breeding, irrigation and flood control, four other major programmes are directed toward improving agricultural productivity. The first of these, the SCARP projects for the reduction of salinity and water-logging, has already been discussed. Through government agency 8,270 tube-wells have been installed to depress the water-table, leach salts, and supply additional irrigation water.

Other programmes now under way relate to the control of soil erosion. Soil erosion is adversely affecting extensive areas, particularly in the rough and undulating hilly lands and plateaux, where sheet and gully erosion are much in evidence and the land has been badly dissected. No detailed official survey of eroded lands in Pakistan has yet been made, but a survey for the Punjab places the eroded acreage at 3 million, of which 0.5 million acres have been totally destroyed, and 1 million acres seriously damaged.' In the N.W.F.P., almost the whole area, apart from Mardan District, suffers from soil erosion, while in Sind wind erosion is a serious problem in Tharparkar and Khairpur Districts. In large areas of Baluchistan, bedrock has been exposed as a result of loss of topsoil.

Control of soil erosion requires a planned system of land use in the catchment areas, afforestation and re-grassing of the land surface, proper management practices in agriculture and livestock grazing, and a variety of engineering projects to re-direct and delay run-off. At present, several government departments are working separately on such problems in individual drainage basins. No co-ordinated master plan has yet been prepared to tackle the problem on a large scale.

A third problem, and one to which attention is being directed is that of farming techniques. The average Pakistani farmer is unable to put his land to the best possible use and maximize its productivity because he lacks the professional know-how and necessary monetary resources to do so. To assist him, the government offers various facilities. The Food and Agricultural Commission was set up in 1959. Since then, the Agricultural Development Corporation and the Agricultural Research Council inter alia have been established to advise farmers on various technical aspects of agriculture, to facilitate the flow of such supplies as seed and fertilizer, and to encourage co-operation. Demonstration farms illustrate modern agricultural methods and monetary assistance is provided in the form of loans. In 1970/1, the Agricultural Development Bank provided Rs. 92.6 million in loans to needy farmers. In addition, taccari loans2

A fourth problem, and the most significant in human terms, is the quantity and quality of the food supply, in other words, the national diet. The Pakistani diet is low when measured both by calorific content and nutritional value. It is lower than the requisite levels by 250 calories, and 14 grams of protein, per capita, per day. About 75 percent of the calories and 80 percent of the proteins are obtained from grains. The per capita food intake, although still deficient, is improving.

Since the normal diet is exceptionally deficient in protein, the government wishes to promote the production of protein-rich and fat-bearing foods, including soya-beans, groundnuts, and pulses. Some pilot work has been started on the establishment of agricultural estates in Rawalpindi, Islamabad, Lahore, and Karachi. Growth of population must not outstrip the growth of food supply.

12.4 INDUSTRIES AND INDUSTRIAL DEVELOPMENT

The industrial base of Pakistan at the time of Independence was very weak. In 1949-50 manufactures accounted for only, 1.5 percent of the total national income. After about ten years, the ratio improved to 5.0 percent, and improved again to 8.4 percent in 1968-69. These figures refer to combined Pakistan including both the Eastern and Western wings. For present Pakistan, the 1970-71 figure was 16.6 percent. Industry is, thus, the second largest sector of the economy, next to agriculture.

In 1970-71, Pakistan's 3,289 industrial establishments produced goods worth Rs. 914 crore. Sind, principally Karachi, had 49 percent of the factories and 49 percent of the value of manufacturing production. The Punjab almost equalled Sind in the number of factories (48 percent of the total), and provided 43 percent of the value of factory production. N.W.F.P. and Baluchistan have very little industry.

At the time of Independence and for some time thereafter, industry was concentrated in Karachi, which was then the national capital. Further, many of the old Muslim trading communities of India migrated to Karachi, making this city also the financial capital. Karachi is still the outstanding manufacturing centre, but from the time of the Second Plan, some effort was made to minimizeregional disparities by the dispersal of industry. A recent study of industrial concentrations found a very high concentration of industry in Karachi District with Lyallpur District ranking second, with a concentration one-fourth that of Karachi. Lahore District came next, followed by the districts of Hyderabad and Multan. Other less important centres were Peshawar-Nowshera, Mardan, Rawalpindi-Taxila, Sheikhupura and Gujranwala. Industrial Estates have been established at Karachi, Hyderabad, Sukkur, and Peshawar, and are planned for Rahimyar Khan, Multan, Sargodha, Lyallpur, Lahore, Jhelum, and Nowshera.

Industry now provides employment for 400,000 people. The average number of employees per factory is 121. Factories with less than 20 employees account for 3 per cent of total factory employment and 2 percent of the value of manufactures; those with 20-49 employees, for 13.5 per cent of employment, and an equal proportion of value; establishments with 50-499 workers contribute 35 percent of the value with only 24 percent of the workers; and factories with 500 or more employees engage 59.8 percent of the industrial labour, but provide 47.4 percent of the value of manufacturing. These figures clearly suggest that productivity per worker is highest in plants of medium scale (50-499 workers).

With the growth of manufacturing industry, manufactured goods are entering the export trade in increasing amounts and increasing diversity. This has resulted in a remarkable change in the composition of the export trade. In 1949-50, raw materials constituted 87 percent of exports. By 1969-70, the proportion derived from raw materials had dropped to 31 percent, and that of manufactures had risen to 55 percent. Manufactured goods are now the principal element in the export trade. Furthermore. Development of manufactures is being promoted as a measure of import substitution. The engineering industry, for example, is being assigned high priority for the production of replacements and spare parts for imported capital equipment.

Investment in industry has been derived from both local and foreign sources. The percentage of local investment to the total has been increasing. In combined Pakistan, it rose from 59.9 percent in 1960 to 71 percent in 1968. Total foreign investment in Pakistan at the end of 1971 was Rs. 1,114.9 million, and foreign and joint enterprises accounted for 4 percent of the total number of factories and 18 per cent of the total value of factory production.

Cotton textiles are the overwhelmingly predominant industry. In 1970-71, cotton textiles contributed 48 percent of the total value of industrial output, followed by cigarettes (10 percent), sugar (7 percent), edible vegetable oil (6 percent), basic metals, electrical goods, and transport equipment (5 percent each), and cement and fertilizers (3 percent each).

In the industrial development of the country, both private industry and the government have participated. Some 'basic' industries, including banking have been taken over by the government. In 1972, despite the take-over of the industries of 'national import', 82 percent of the investment in organized industry continued to remain in private hands.'

Industrial Development is promoted by various public institutions, including the Pakistan Industrial Development Corporation (PIDC) and the Pakistan Small Industries Corporation (PSIC). PIDC was set ut, in 1952 and its basic function has been to promote industries foi- which private capital was deficient. Major PIDC investments have been in fertilizers, natural gas, cement, minerals, and shipbuilding. Other undertakings include the manufacture of sugar, paper and board, and textiles. About 61 percent of PIDC investments have been in the Punjab, and some 29 percent in Sind. PSIC was established in 1965 to promote cottage and small-scale industries. With its aid, nine small industrial estates have been set up in Peshawar, Gujrat, Gujranwala, Sialkot, Lahore, Bahawalpur, Sukkur, Larkana, and Quetta. PSIC also runs several Developmental Centres to impart technical skills, provides credit and marketing facilities, and has established sales and display depots for these wares.

12.4.1. Different Industries of Pakistan

Various industries and their description is as follows :-

(i) COTTON TEXTILES

The manufacture of cotton textiles is Pakistan's biggest industry and in the past twenty years it has made outstanding progress. In 1948, there were 17 cotton textile factories, with 177,000 spindles and 5,000 looms, in combined Pakistan. In the Pakistan of today there are 116 cotton textile mills, with 2.6 million spindles and 30,000 looms. From being a big importer of cotton cloth, the country has not merely become self-sufficient, but developed into a large exporter of yarn and cloth. This has occurred despite an increase in per capita domestic consumption of cloth, from 5.2 yards a year in 1948 to 14 yards in 1970.

In the beginning, the industry was concentrated in Karachi, outside the cotton-growing area. More recently there has been a shift to up-country centres within the cotton belt. Lyallpur is now second to Karachi. Other centres within the cotton belt are Hyderabad, Tando Yousaf (Hyderabad District), Gambat (Khairpur Mirs), Rahimyar Khan, Khairpur, Multan, Ciotra (Lyallpur), Okara (Sahiwal), Burewala, Sargodha, and Lahore. Other centres, located outside the cotton-producing areas but near local markets, are Rawalpindi, Peshawar, Nowshera, Habibabad (Kohat), Haripur (Hazara), Kala (Jhelum), and Saryab (Quetta). At Liaqatabad and Bhakkar, in Mianwali District, cotton textile factories were established as a part of a colonization scheme in the Thal region.

The cotton textile industry has considerable scope for expansions. Of the annual production of cotton of about 3.9 million bales, 0.6 million bales are exported as raw cotton. These exports earn over Rs. 314 million per annum, but if exported as cloth, the earnings would be higher. The same is true of cotton exports in the form of yarn. The value of cotton manufactures exported already exceeds the value of raw cotton exported, and could be much greater with an increase in the export of cotton cloth and piece goods.

(ii) WOOLLEN TEXTILES

The woollen textile industry is small by comparison with cotton. There are 20 spinning and weaving mills employing over 6,000 people. These are located at Mastung, Harnai, Bannu, Nowshera, Lawrencepur, Campbelipur, Rawalpindi, lsmailabad (Multan), Quaidabad (Thal), Larkana, and Karachi. Hyderabad has a yarn factory. The industry is concentrated in the north where the cooler climate creates a demand for warm clothing and where sheep are grazed. For fine quality woollens, the wool is imported. The value of production (1967/8) is Rs. 113.5 million.

(iii) SILK, ART SILK, AND SYNTHETIC TEXTILES

There are 148 units, at different places, producing silk and art silk textiles, largely shawls and scarves (dupatta) for women. The more important centres are Karachi, Gujranwala, Lyallpur and Lahore. Other centres include Hyderabad, Rohri, Multan, Rawalpindi, Mingora (Swat), and Saidu Sharif (Swat). Synthetic fibres involve modern technology, and are produced at Karachi and Lyallpur.

(iv) SUGAR

The acreage under sugar-cane varies with the weather and the availability of irrigation water, but is increasing. Only about 30 percent of the cane reaches the mills for refining into sugar. Most is eaten either as unrefined sugar or consumed raw. Production of sugar in 1970/71 was 0.5 million tons. Sugar beets are not widely grown although cultivation is being encouraged in the northwest. The quantity of sugar beet sliced at mills in 1970-71 was 257,000 tons.

There are 19 sugar mills: 4 in N.W.F.P., 10 in the Punjab, and 5 in Sind. The important centres are Mardan, Charsadda, Lyallpur, Nawabshah, Khanpur, and Jauharabad. The mills at Mardan, Charsadda, and Takht-i-Bahai are also equipped for processing beets. The percentage of sugar recovered is highest in Sind (8.7 percent) and lowest in N.W.F.P. Yields per acre are also low by comparison with such countries as India, U.S.A., Ecuador, Puerto Rico, and Mauritius. Local production is inadequate, and every year large quantities are imported.

(v) CHEMICAL FERTILIZERS

Production of chemical fertilizers has been given high priority by the government in order to improve agricultural output. Although local production had increased to 372,000 tons by 1969-70, in that same year 651,000 tons were imported. By 1973, the sanctioned capacity for local plants had been increased to 853,000 tons, with proposals for additional plants still under review.

Production of nitrogenous fertilizers is facilitated by the availability of natural gas. Production of phosphatic fertilizers in the past has been dependent upon imported ingredients, namely rock phosphates and sulphur. However, it is now established that phosphatic fertilizers can be produced with sulphuric acid obtained from locally available gypsum. The potassic fertilizers will continue to be imported as local potash is not available. The present aim is to achieve self-sufficiency in nitrogenous and phosphatic fertilizers, perhaps as early as 1975.

(vi) CEMENT

Growth of the cement industry has kept pace with the huge demand for cement for developmental works. Limestone and gypsum, the two important raw materials of the industry, are indigenous and available in large quantities, and cheap fuel is available in the form of natural gas. The import of machinery for the future development of the industry is likely to be appreciably reduced after the complex for the manufacture of heavy machinery at Taxila comes into full production.

There are nine cement factories, employing over 51,500 workers, and producing 3.2 million tons valued at Rs. 255 million.

The plants are located at WahHattor (Hazara), Danadot, Daud-khel, Ismailwal (Jhelum), Rohri, Hyderabad, and Karachi. The Fourth Five-Year Plan calls for a production of 6.3 million tons in 1974/5. The installed capacity of existing plants is being increased and new factories are planned for Rawalpindi District and Sibi.

(vii) CHEMICALS

The industry includes a large number of basic industrial chemicals, such as sulphuric acid and non-edible oils, as well as dyes and colours, paints, varnish, and lacquers, medical and pharmaceutical preparations, disinfectants, insecticides, soaps, washing and cleaning compounds, and the like. It also includes fertilizers, which have been discussed under a separate head because of their importance. The chemical industry is thus made up of numerous large and small factories manufacturing various products. The number of such factories is about one-tenth of the total number of industrial units. The percentages of employment in the industry and the value of production in relation to the total, are about six and nine per cent, respectively.

Important centres of the industry are Karachi, Lahore, Kalashah Kaku (Sheikhupura), Daudkhel (Mianwali) and Nowshera. Soda ash is manufactured in

Khewra and Karachi; caustic soda in Kalashah Kaku; sulphuric acid in Jaranwala (Lyallpur); drugs in Nowshera; insecticides in Kalashah Kaku and Nowshera; and paints and varnishes in Karachi and Lahore.

The raw material bases for a petro-chemical industry, namely natural gas and naphtha (a by-product of oil-refining) are available in large quantities. The prospects for the establishment of these sophisticated industries at some time in the future are, therefore, bright.

(viii) IRON AND STEEL AND ENGINEERING WORKS

Pakistan has many small engineering works turning out small machines and replacement parts. It has had no steel mill but one is shortly to be constructed east of Karachi at Pitti Creek. It will have a capacity of about 1 million tons of crude steel per annum and is being built with the technical and economic assistance of the U.S.S.R. The construction and operation of the port to serve the steel mill, and possibly other industries, will be controlled by a special Port Authority established by the Government of Pakistan. A machine-tool factory, close to the port, has been in partial operation since 1968 and is ultimately expected to manufacture machine-tools, automobile parts, and military equipment.

In the northern part of the country, at Taxila, west of Islamabad, an important centre of heavy machinery and electrical equipment has been established with the assistance of China, and is already in partial production. The foundry and forge project at l'axila will provide the country's first large-scale facilities for iron and steel casting and for the forging of billets. The heavy electrical complex will produce transformers, circuit breakers, switch gears, and capacitors.

(ix) MISCELLANEOUS INDUSTRIES

There are several other industries worthy of note. General engineering works are located at Karachi, Hyderabad, Lyallpur, Lahore and Gujranwala. Surgical instruments are manufactured in Sialkot and Lahore. Nazimabad (Karachi) and Sialkot are important centres for cutlery. Electric fans are produced in Gujranwala, Gujrat, Lahore, and Karachi. The shipyards at Karachi are capable of buildings ships of 10,000-13,000 tons capacity and undertaking the repair of ships.

Glass factories are located in Karachi and Hyderabad. The making of glass and mirrors is a traditional industry of Sind, with its large quantities of suitable sand. More recently, Lahore, Gakhar (Gujranwala District), and Jhelum have been producing increasing quantities of glass.

Pakistan produces large numbers of hides and skins, some of which are exported, and others tanned for use within the country. Local lime, salt, and the bark of trees like the hahul and mangrove arc used in the tanning process, which is helped by the dry climate. Gujranwala, Khairpur, Sibi, Sukkur, and Hyderabad are all important centres for the industry. The associated industry of shoe and sandal-making is concentrated in the large cities of Karachi, Lahore, and Hyderabad. The value of footwear, leather goods, and leather exported in 1969-70 was Rs. 200 million.

Chinaware is made at Karachi, Gujrat, and Lala Musa. Flour mills are widely scattered, with the chief centres at Karachi, Sukkur, Lyallpur, Okara (Sahiwal) and Lahore. Rice-husking mills are mostly found in the districts of Sheikupura, Gujranwala, Dadu, and Larkana. Lyallpur, Hyderabad, Lahore, Karachi, Chichawatni (Sahiwal), and Nowshera are important centres for vegetable ghee. Rubber goods are produced in Karachi, Lahore and Sialkot, and Karachi also has P.V.C. and plastics factories. Sialkot is famous for its sports goods. Hand-woven woollen carpets are made at numerous places, but machine-loomed carpets are now made in Karachi.

(X) SMALL AND HOUSEHOLD INDUSTRIES

Small and household industries can play a vital part in increasing rural incomes and reducing the pressures to migrate to the cities. Small-scale rural industries have their origin in the historical self-sufficiency of the village. Every village had its own weavers, carpenters, tailors, shoe-makers, blacksmiths, gold and silver smiths, and other craftsmen. These rural crafts were based on skills passed on from generation to generation. As urban centres developed, craftsmen migrated to the cities where they are able to ply their skills for a larger market and in some instances expand their operations to small-scale industries. Some of the typical Pakistani fancy goods have developed a market abroad. It is convenient, therefore, to distinguish between those industries which have remained in the rural areas, and those which are more strongly developed in the cities.

RURAL AREAS

Most rural settlements are not well-connected with outside areas and tend to fulfil most of their requirements within the village itself. These cottage industries and rural crafts are largely governed by local raw materials and local demand. Such industries include atta chakies (flour milling), rice-husking, oil-seed milling, rope-making, bakery, and basketry, and these are found in almost all villages. A survey of these agro-based industries by the Pakistan Small Industries Corporation showed them to be second to agriculture itself in providing employment in rural areas.

A wide range of articles and consumer goods are produced by the village craftsman. Carpentry, shoe-making, leather tanning, weaving, dyeing, printing, pottery, and tailoring, together with the working of iron and gold and the making of bricks, are the most common and widespread rural crafts. Carpenters produce cartwheels, agricultural instruments, cots, doors, and other small itemsof furniture. Tanners and shoe-makers produce sandals, horse-bridles and saddles, whips, and other leather goods. Iron and other instruments are produced by the blacksmiths. Certain of these artefacts are made in distinctive local styles locally made Khaddar cloth and Durrees (coarse rugs) have their traditional designs. Earthen wares are made from local clay, and in some instances, such as the glazed tiles of Hala, have achieved national repute.

The total value of these crafts is easy to under-estimate. In most areas, it is three to four times that of the agro-based industries, and in some rural districts employs 16 percent or more of the population. Per capita income in the villages is very low, varying from Rs. 250 to Rs. 550 a year in different regions. This lack of spending-power handicaps the artisan in acquiring more proficient tools and improving his techniques. As agriculture becomes more mechanised, the need will be for tractor drivers, tube-well mechanics, auto mechanics and maintenance men. Some way should be found to help the traditional artisan transfer to modern skills.

URBAN AREAS

The small and craft industries of urban areas fall into two categories, household units and small manufacturing units. Household units are located in residential premises and have assets not exceeding Rs. 15,000. Small manufacturing units have fixed assets up to Rs. 500,000, excluding land. Altogether, there are some 50,000 household and small manufacturing units, employing more than 2 lakh of people, and having a total value of fixed assets of Rs. 425 million. About half the units employ 2-4 workers and about one-quarter employ only one person, in addition to family members. Larger units employing more than 50 persons are very few. Most are in the major cities and the larger the city, the greater the number. According to the survey, 87 percent of all the small and household units were in Karachi, Lahore, Sargodha, Multan, Peshawar, Rawalpindi, and Hyderabad.

(xi) TEXTILES

Among these small industries, textiles are the most important group. Cotton spinning and weaving of rough Khaddar clod. Is widespread, and some centres have gained greater importance because of their production of a special type. Lungis and Khases are made in Peshawar, Kohat, Multan, D. I. Khan, Thatta and Gumbat. Durrees are made in Karachi, Lahore, Sahiw4l, Gujranwala, and Gakhar and cotton carpets in Lahore, Multan, and Jacobabad. Blankets, Lois, and pattu are prepared from homespun wool. Blankets are a speciality of Multan, Jhang and D.G. Khan. Lois come from Mingora (Swat), and thick rough woollen cloth is woven in Swat, Chitral, Gilgit, and Kalat. Woollen carpets are made in Lahore, Multan, Hyderabad, Peshawar, D. I. Khan, Kalat, Bannu, Leiah, Bahawalpur and Landhi. Silk cloth and turbans are made in Peshawar and Kohat.

(XII) Embroidery and Fancy Needlework: This industry is centred in urban areas such as Karachi, Lahore, Hyderabad, Multan, Bahawalpur, and Quetta. Phulkari work, silk embroidery over rough cotton cloth, is done in many centres in the Punjab, Swat and N.W.F.P. Sindhi and Makrani embroidery and golden thread embroidery is done in Quetta, Karachi, Lahore, Hyderabad, Multan, Bahawalpur and Peshawar. These goods are exported in substantial quantities.

(xiii) LEATHER, POTTERY, AND FURNITURE

Embroidered leather sandals and shoes are a speciality of Peshawar, Multan, Bahawalpur, Lahore, Karachi and Rawalpindi. These fancy sandals and embroidered handbags have found a market in America and Europe. Fine pottery is prepared from good quality clay in Sialkot, Gujrat, Gujranwala, Peshawar, Bahawalpur and Multan. Articles like ashtrays, flower-vases, fruit bowls and plates are exported to the Middle East. Carved wooden articles and art furniture, inlaid with copper, brass, and ivory, are made in Lahore, Chinois, D. G. Khan, Gujrat, Karachi, and Peshawar.

Miscellaneous

Utensils made from brass, copper, silver, iron, and aluminium are hand-made at many places. Peshawar, Gujranwala, Sialkot, Larkana and Shikarpur are the main centres. Sialkot produces sports goods from mulberry wood. Other Pakistani crafts include glass bangles (Hyderabad), marble lamps, bowls and ashtrays (Karachi), camel-skin lamps (Baluchistan and Multan). These latter items are exported and also appeal to tourists.

CHECK YOUR PROGRESS

Note (a) Write your answers in the space given below
(b) Check your answers with the above subsection.

1. Write a short note on Sugar cane.
2. Write a short note on the pattern and distribution of cereal crops in Pakistan.

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3. Write a short note on the main characters of agriculture of Pakistan.

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4. Agriculture is the main stay of Pakistan's economy. Comment.

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5. Write a short note on industrial development in Pakistan.

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6. Write a short note on household industries of Pakistan.

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7. Write a short note on modern textile industries in Pakistan.

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12.5 LET US SUM UP

Economic growth and development is defined as a broad improvements in economic and social patterns and in people's life-styles. From the perspective of Rostow's stages of economic growth of Pakistan appear to be in the second stage, preconditions for take-off, in which production is increasing only modestly but changes in traditional outlook and attitude are beginning to take hold, or in the third stage, take-off, in which new technologies and capital are applied to production processes and agricultural and manufacturing output begins to increase rapidly. One problem, however, is that these changes and improvements are unevenly distributed spatially within Pakistan. Moreover, within each States wealth is very un-evenly distributed among the various strata of society, Another problem, one that may be viewed as a partial criticism of the Rostow model, is that population growth is so rapid in Pakistan that the urban and industrial economies cannot generate enough jobs and sufficiently high wages to meet the demands of the enormous and growing pools of surplus labour. Consequently, growth processes that occurred in the industrializing west a century ago and that Rostow assumed would occur in all countries, may fail to take place in South Asia including Pakistan. Prospects for take-off will be dim until population growth is moderated.

12.6 GLOSSARY

- **Economic Growth:** A broad improvement in economic and social patterns and in people's lifestyles.
- **Economic Base:** The set of economic activities from which a region can derive income.

- **Factory:** A manufacturing unit based on quantity production.
- **Heavy Industries:** A term applied to manufacturing that uses large amount of raw material such as coal, iron ore, and sand that has relatively low value per unit of weight.

12.7 LESSON END EXERCISE

1. Discuss the salient features of agriculture in Pakistan.
2. Discuss the production and distribution of rice and maize in Pakistan.
3. What are the factors responsible for the growth and development of cotton textile industries in Pakistan?
4. Discuss the role of industries is the upliftment of Rural economy of Pakistan.

12.8 SUGGESTED READINGS

- Geography of Pakistan by K.U. Kureshy Oxford university Press, New-Delhi, 1978
- Geography and Development a world regional approach by James Fisher, Merrill Publishing Company, London. 1980.
- World Regional Geography by D.S. Monku, Kalayani Publishers, New Delhi, 2002

12.9 REFERENCES

1. Fisher, C.A. (1964). "South-east Asia", Methuen, London.
2. Fisher, W.B. (1978) "The Middle East", Methuen, London.
3. Gilbert, Alan (1974) "Latin American Development : A Geographical Perspective", Hanwoodsworth, Penguin, Middlesex, London.
4. Gottmann, Jean, "A Geography of Europe", G. Harrap& Co. London.
5. Government of India, "India-2000", New Delhi.
6. Gregory, J.S. (ed) (1975) "The Geography of U.S.S.R", Novosti Press Agency Publishing House, Moscow.

7. Hance, William, A.(1965) "The Geography of Modern Africa", Columbia University Press, London.

8. Hartshorne Truman, A. and John W. Alexander (1992) "Economic Geography", Prentice Hall of India, Pvt. Ltd., New Delhi.

9. Heintzelman, Oliver H., Highsmith, Richard M. (Jr.) (1965) "World Regional Geography", Prentice Hall of India (Pvt.) Ltd, New Delhi.

10. Hudson, F.S. (1975) "North America", Mc Donald and Evans, Fly mouth.

CHINA – PHYSIOGRAPHY, CLIMATE, DISTRIBUTION AND DENSITY OF POPULATION

13.0 STRUCTURE

13.1 INTRODUCTION

In this lesson, we will study the most diverse and breathtaking geography of China. This is a large country which is made up of heaps of mountains, and plenty rivers. It stretches 3,100 miles (5,000 kilometers) from east to west and 3,400 miles (5,500 kilometers) from north to south. China is a large country, in fact the third largest country in the world.

The vast land expanses of China include plateaus, plains, basins, foothills, and mountains. Mountains occupy nearly two-thirds of the land, higher in the West and lower in the East like a three-step ladder. The highest step of the typical 'ladder topography' is formed by the Qinghai-Tibet Plateau at the average height of over 4,000 meters. The highest peak in the world, Everest, at 8844.43 meters high is known as 'the Roof of the World'. On the second step are large basins and plateaus, most of which are 1,000 - 2,000 meters high. The third step, abundant in broad plains, is dotted with the foothills and lower mountains, with altitudes of over 500 meters. These well-cultivated and fertile lands produce abundant crops. In China, a vast land spanning many degrees of latitude with complicated terrain, climate varies radically. China has a variety of temperature and rainfall zones, including continental monsoon areas. In winter, most areas become cold and dry, in summer hot and rainy. You also know that China is most populous country in the world. With a population estimated at 1.4 billion people as of 2017, China clearly ranks as the world's most populous country. With the world's population approximately 7.6 billion, China represents 20 percent of the people on Earth. However, policies the government has implemented over the years may well result in China losing that top ranking in the near future. At the same time, China's complex natural conditions have produced an unevenly distributed population. Population density varies strikingly, with the greatest contrast occurring between the eastern half of China and the lands of the west and the northwest. 94 percent of their population is located in the east coast alone while the other 6% are in the west. So in this lesson you will be acquainted with the various geographical aspects of China.

13.2 OBJECTIVES

After going through this lesson, you will be able to:

1. Explain the physiographic divisions of China.
2. Describe the climatic zones of China.
3. Discuss the patterns of population distribution in China and factors responsible for uneven distribution.
4. Know the densely and sparsely populated regions of China.

13.3 PHYSIOGRAPHIC DIVISIONS OF CHINA

Located in Southeast Asia along the coastline of the Pacific Ocean, China is the world's third largest country, after Russia and Canada. With an area of 9.6 million square kilometers and a coastline of 18,000 kilometers, its shape on the map is like a rooster. China's landscape is diverse and expansive. Hainan Province, China's southernmost region is in the tropics, while Heilongjiang Province which borders Russia, can dip to below freezing. It reaches Mohe in Heilongjiang Province as its northern end, Zengmu Ansha (or James Shoal) to the south, Pamirs to the west, and expands to the eastern border at the conjunction of the Heilongjiang (Amur) River and the Wusuli (Ussuri) River, spanning about 50 degrees of latitude and 62 degrees of longitude. Along with Japan and Korea, China is often considered part of Northeast Asia. China is bordered by 14 countries — Korea, Vietnam, Laos, Burma, India, Bhutan, Nepal, Pakistan, Afghanistan, Tajikistan, Kyrgyzstan, Kazakhstan, Mongolia, and Russia. Marine-side neighbors include eight countries — North Korea, Korea, Japan, Philippines, Brunei, Indonesia, Malaysia and Vietnam.

Map 13.1 : Location of China in Asia

China has great physical diversity. The eastern plains and southern coasts of the country consist of fertile lowlands and foothills and is the location of most of China's agricultural output and human population. The southern areas of the country (South of the Yangtze River) consist of hilly and mountainous terrain. The west and north of the country are dominated by sunken basins (such as the Gobi and the Taklamakan), rolling plateaus, and towering massifs. It contains part of the highest tableland on earth, the Tibetan Plateau, and has much lower agricultural potential and population. In general, the land is high in the west and descends to the east coast. Mountains (33 percent), plateaus (26 percent) and hills (10 percent) account for nearly 70 percent of the country's land surface. Most of the country's arable land and population are based in lowland plains (12 percent) and basins (19 percent), though some of the greatest basins are filled with deserts. Accordingly, the physiography of China has been divided into following sub- divisions:-

1. **Four Major Plateaus: - The four major plateaus of China are as under:-**

i. Qinghai-Tibet Plateau : Situated in southwest China, it is the largest plateau in China, covering 2.5 million square km, or nearly a quarter of the national total land area. It is also the highest plateau on earth, and is known as the "roof of the world." As it is surrounded and traversed by several snow-capped mountain ranges, like the Kunlunshan, Qilianshan, Hengduanshan and the Himalayas, which abound in glacier, the Qinghai-Tibet Plateau is where many of China's major rivers originate.

ii. Inner Mongolia Plateau The second largest plateau in China, it lies between 1,000 and 1,500 meters above sea level in north China. Covering 700,000 square km, the plateau has a gentle rolling terrain and vast grasslands, with some parts covered with arid Gobi deserts.

iii. Loess Plateau With the Taihangshan Mountains to its east, the Qilianshan Mountains to its west, the Great Wall to its north and the Qinling Mountains to its south, the Loess Plateau covers around 500,000 square km and lies 1,000 to 2,000 meters above sea level. Covered with thick, porous loess, the plateau is crisscrossed with ravines and gullies, covered with little vegetation, and have fragmented landforms due to long-term scouring of rainfall and streams. Water-eroded area accounts for 430,000 square km.

iv. Yunnan-Guizhou Plateau Covering 500,000 square km, it comprises east Yunnan Province and most parts of Guizhou Province. It has an elevation of 1,000 to 2,000 meters and a terrain that descends from northwest to southeast. It is covered with numerous valleys and small basins. Typical Karst topography, shaped by the dissolution of limestone rich in the region, is common on the plateau.

2. Main Mountain Ranges

Numerous lofty mountains form many mountain systems, which serve as the framework of China's topography. Well-known mountain ranges include the Himalayas, the Kunlunshan Mountains, the Tianshan Mountains, the Qinling Mountains, the Greater Hinggan Mountains, the Taihangshan Mountains, the Qilianshan Mountains and the Hengduanshan Mountains.

i. Himalayan Mountain Range Extending more than 2,400 km in a crescent-shape along the Chinese-Indian and Chinese-Nepalese borders, it has an average elevation of 6,000 meters. It is the world's highest and largest mountain range, and its main peak, Qomolongma, is 8,844.43 meters above sea level, the highest in the world.

ii. Kunlunshan Mountain Range Extending over 2,500 km from the Pamirs Plateau in the west to the northwest of Sichuan Province in the east, it has an average elevation of 5,000 to 7,000 meters. Its highest peak, Kongur, is 7,719 meters above sea level.

iii. Tianshan Mountain Range Traversing Xinjiang Uygur Autonomous Region, it has an average elevation of 3,000 to 5,000 meters, with its highest peak, Tomur, being 7,455.3 meters above sea level.

iv. Tanggula Mountain Range Situated in central Qinghai-Tibet Plateau, it has an average elevation of 6,000 meters. The Yangtze River rises from its highest peak, Geladaindong, which is 6,621 meters above sea level.

v. Qinling Mountain Range Stretching from east Gansu Province in the west to the west of Henan Province in the east, it has an average elevation of 2,000 to 3,000 meters. Its main peak, Taibaishan, is 3,767 meters above sea level. It is an important geographic line of demarcation between north and south China.

vi. Greater Hinggan Mountain Range Extending 1,000 km from Mohe in Heilongjiang Province in the north to the upper reaches of Laohahe River at the juncture of Inner Mongolia Autonomous Region and Liaoning Province in the south, it has an average elevation of 1,500 meters. Its main peak, Huanggangliang, is 2,029 meters above sea level.

vii. Taihangshan Mountain Range Extending over 400 km along the eastern fringe of the Loess Plateau from north to south, it has an average elevation of 1,500 to 2,000 meters. Its main peak, Xiaowutaishan, is 2,882 meters above sea level.

viii. Qilianshan Mountain Range Stretching along the northeastern fringe of the Qinghai-Tibet Plateau, it has an average elevation of over 4,000 meters. Its main peak, Qilianshan, is 5,547 meters above sea level.

ix. Hengduanshan Mountain Range Situated at the juncture of Tibet Autonomous Region and Sichuan and Yunnan provinces in the southeast of the Qinghai-Tibet Plateau, it has an average elevation of 2,000 to 6,000 meters. Its highest peak, Gonggashan, is 7,556 meters above sea level.

x. Taiwan Mountain Range Running through the eastern part of Taiwan Island, it has an average elevation of 3,000 to 3,500 meters. Its main peak, Yushan (Jade Mountain), is 3,952 meters above sea level.

3. Basins: - The five major basins of China are as: -

i. Tarim Basin Situated in the southern part of Xinjiang Uygur Autonomous Region and embraced by the Tianshan and Kunlunshan mountains, it is China's largest basin. With its base averaging 800 to 1,300 meters above sea level, it covers 530,000 square km. The basin, widely covered with deserts and dotted with oasis at the fringe, has a terrain descending from west to east. The 330,000-square-km Taklamakan in the center of the basin is the largest and the most arid desert, and one of the richest areas in oil and gas reserves in China.

ii. Junggar Basin Situated between the Tianshan and Altay mountains in north Xinjiang Uygur Autonomous Region, it is the second largest basin in China, covering 380,000 square km. With its base averaging 200-1,000 meters above sea level, the basin has a terrain descending from east to west, with its central part covered with grasslands and deserts. It abounds in coal and oil reserves.

iii. Qaidam Basin Situated in northwest Qinghai Province in the northeastern part of the Qinghai-Tibet Plateau, the basin is surrounded by the Kunlunshan and Qilianshan mountains. It covers 220,000 square km, with its base averaging 2,700-3,000 meters above sea level. Gobi desert, hills, plains and lakes are distributed from the fringe to the center of the basin, which has a terrain descending from northwest to southeast, where salty lakes and swamps are abundant.

iv. Sichuan Basin Situated in the Sichuan-Chongqing area, the basin is surrounded by Wushan and Dabashan mountains and covers 200,000 square km. With its base averaging 300-800 meters above sea level, it has a terrain descending from north to south. Its northwestern part is Chengdu Plain, and its central and eastern parts are hills and low mountains.

v. Turpan Basin Situated at the eastern terminus of the Tianshan Mountains in the middle-eastern part of Xinjiang Uygur Autonomous Region, the basin covers 50,000 square km. Aydingkol Lake at its base, lying 155 meters below sea level, is the lowest point of China's mainland.

4. Plains: The plains of China has been divided into following sub-divisions:-

i. Northeast China Plain Situated in northeast China, the plain lies near the Changbaishan Mountains to the east and the Greater Hinggan Mountains to the west, the Lesser Hinggan Mountains to the north and Liaodong Bay to the north. Covering 350,000 square km, it is China's largest plain. With most of it having an elevation of lower than 200 meters, it embodies the Songhuajiang-Nenjiang-Heilongjiang Plain, watershed between Songhuajiang and Liaohe rivers and the Liaohe Plain. Therefore, the plain is also called Songliao Plain.

ii. North China Plain Bordering on the Taihangshan Mountains in the west, the coast in the east, the Yanshan Mountains in the north and the Huaihe River in the south, the plain covers 300,000 square km, with an average elevation of lower than 100 meters. Formed of alluvial deposits from the Yellow, Huaihe and Haihe rivers, it is also known as the Yellow River-Huaihe-Haihe Plain. It has a smooth terrain and vast fertile land.

iii. The Middle-Lower Yangtze Plain Stretching eastward from the Wushan Mountain to the coast, the plain was formed of alluvial deposits from the Yangtze River and its tributaries. With an average elevation of lower than 50 meters and part of it lying below 5 meters above sea level, it is generally lower than the North China Plain. Crisscrossed by many rivers and dotted with lakes, it is known as "a swampy region."

iv. Pearl River Delta Plain Situated in the central-south of Guangdong Province, the plain covers 11,000 square km, with an average elevation of around 50 meters. It has crisscrossing rivers and is dotted with isolated hills.

v. Hetao Plain Lying along the banks of the Yellow River in Inner Mongolia and Ningxia Hui autonomous regions, the plain covers 24,800 square km, with an average elevation of around 1,000 meters. Rich in irrigation facilities, it is known as "the northern frontier resembling the south of the Yangtze".

Map : 13.2 - Physiography of China

13.4 CLIMATE OF CHINA

Dear students, the physiographic divisions of any country largely determine its climatic conditions. So as in China, the immense physical diversity produce varied climatic zones. China's climate varies from bitter cold in winter to unbearable heat in summer. The Yangtze River serves as China's official dividing line between north and south. Given the size and varied landscape of the country, there is no one time in the year when Chinese weather is ideal. Of course, the warmest areas in winter are to be found in the South and Southwest, such as Sichuan, Banna in Yunnan, and Hainan Island. In summer the coolest spots are in the far northeast. China is divided into two main climatic regions; the north and west are semi- arid or arid, with extreme temperature variations. The south and southeast are warmer and more humid with year round rainfall.

China has a climate dominated by dry seasons and wet monsoons, which make for clear temperature differences in winter and summer. In winter, northern winds coming from high latitude areas are cold and dry; in summer, southern winds from sea areas at lower latitude are warm and moist. Climates differ from region to region because of the country's extensive and complex topography. In the south of the Nanling Mountains, rains are prolific and the temperature is high all year round. In the Yangtze and Huaihe River valleys in the central part of China, there are four distinctive seasons. In northeast China, summer is short but there is much sunshine, while winter is long and cold. Precipitation is limited in northwest China where it is cold in winter and hot in summer. In southwest China of low latitudes, the land is elevated high, and has characteristically vertical seasonal zones.

North China: Northern winters, from December to March, can be extremely cold. Beijing generally experiences temperature of -20C, dry and no sun. Further north, temperatures reaching -40C are not uncommon. During the summer, from May to August, temperatures in Beijing can hit 38C (100F), coinciding with the rainy season for the city. Daytime temperatures range from 20C to 30C (68F to 86F) and drop a lot at night. Precipitation is 6370cm (25-28 inches) per year.

Central China: The Yangtze River valley has long and humid summer with high temperatures from April to October. The city of Wuhan, Chongqing and Nanjing on the Yangtze are China's three famous 'furnaces'. Winters there, with temperatures dropping well below freezing, can be as cold as in Beijing. Precipitation averages around 76 cm (30 inches) per year.

South China: Near Guangzhou, the summer is a season of typhoons between July and September. Temperatures can rise to around 38C. Winters are short, between January and March. The day temperatures in autumn and spring ranges between 20°C to 25°C (68°F to 75°F) range. Sometimes, it can be miserably wet and cold, with rain or drizzle. Precipitation averages 76 cm (30 inches) per year.

Northwest China: It gets hot in summer, dry and sunny. The desert regions can be scorching in the daytime. Turpan, which sits in a depression 150m below sea level, is referred as the 'hottest place in China' with maximums of around 47C. In winter this region is as severely cold as the rest of northern China. Temperatures in Turpan during winter are only slightly more favorable to human existence. This area of China experiences little rain, and as a consequence, the air is very dry. Summers, however, can exceed 40C, while winters may drop to -10°C. Precipitation averages less than 10 cm (4 inches) per year.

Tibet: Undoubtedly, Tibet is one of the harshest places for human existence. It is cool in summer but freezing cold in winter. In Lhasa, the mildest city in Tibet, temperature may exceed 29 in summer while plummeting to minus 16 in winter! Sun radiation is extremely strong in Tibet. The sunlight in Lhasa is so intense that the city is called Sunlight City. The thin air can neither block off nor retain heat so that the temperature extremes can be met in daytime and the same night respectively in Tibet. The average temperature in north Tibet is sub zero and winter arrives in October until the following May or June. May, June and September is the tourist season in east Tibet. In winter, roads are all blocked by heavy snow. Landslides and rock falls frequently occur, which will make travel difficult.

Most annual rainfall comes in the rainy season which starts from June to September. Usually it rains at night in Lhasa, Shigatse and Chamdo area. From November to the coming May, the wind blows often.

Map 13.3 : Climatic zones in China

CHECK YOUR PROGRESS 1

Note: (a) Write your answers in the space given below.
(b) Check your answers with the above subsection.

1. Enlist the major mountain ranges of China.

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2. Write down the climatic conditions in western China.

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13.5 POPULATION DISTRIBUTION IN CHINA

Students, relief features and climate plays an important role in influencing population distribution. The main concentrations of human population are confined to the areas marked with flat topography. Rugged and undulating topography restricts the concentration of human population in any area. In China, the majority of the areas that are densely populated in the east are on the coast. This is because the land in these particular locations is very flat and only just above sea level. Also, people would prefer to live in the much more comfortable climatic conditions in the southeast area of China. The west of China is considerably more hostile. Its relief ranges from 500m-4000m above sea level. This kind of relief makes construction very difficult and the only use for the land is agriculture and the climatic conditions are far more extreme and get excessively hot and too cold for humans, therefore you would expect much less of the population to be distributed in these regions. As a result, these are sparsely populated.

China's 2018 population is 1.42 billion, based on United Nations projections. China, officially the People's Republic of China, is the largest country in the world today. But the distribution is very uneven. The country can be clearly divided into two distinct halves by the pattern of its population, the east section and the west section. The east is considerably more densely populated than the west and has areas with more than 400 people per km^2. The majority of China's people live in the fertile, humid lowlands of the east, with about a third of China's people living along China's coast. The deserts and highlands in the west make up half of China's territory but are home to only 6 percent of the population.

About 94 percent of China's population lives on approximately 46 percent of land and is located in the east coast alone while the other 6 percent are in the west. The major population centers include the North China Plain and Shandong Peninsula (an area smaller than Texas with more people than the U.S.); the Sichuan basin, (a Michigan-size area with 100 million people); and the Yangtze River area (where 150 million people live). The overall trend of China's population distribution is very uneven. Hong Kong is an extreme outlier with a density of 6,900 per square km.

The west is the complete opposite; it is very sparsely populated with a huge area where the density ranges from 2 people per square kilometer, to 19 people per square kilometer, which is similar to New Zealand. Although around the border there are some slightly more densely populated areas. In total China's population is very uneven, and throughout the east very clustered and dense whereas in the west, it is much dispersed and less dense.

13.6 DENSITY OF POPULATION IN CHINA:

China has an estimated population density of 145 people per square kilometer, or 375 people per square mile. China ranks 81st despite the country itself being one of the largest in terms of size and the largest in terms of population. It is also important to mention that while comparing the data between India and China, area wise China is approximately three times bigger than India, whereas Population wise India's is little less than China, making India more densely populated country than China.

Coast and eastern China

In the 11 provinces, special municipalities, and autonomous regions along the southeast coast, population density was 320.6 people per km^2. Broadly speaking, the population was concentrated east of the mountains and south of the northern steppe. The most densely populated areas included the Yangtze River Valley (of which the delta region was the most populous), Sichuan Basin, North China Plain, Pearl River Delta and the industrial area around the city of Shenyang in the northeast.

Western areas

Population is most sparse in the mountainous, desert, and grassland regions of the northwest and southwest. In Inner Mongolia, Autonomous Region, portions are completely uninhabited, and only a few sections have populations denser than ten people per km^2. The Inner Mongolia, Xinjiang, and Tibet autonomous regions and Qinghai and Gansu comprise 55 percent of the country's land area but in 1985 contained only 5.7 percent of its population.

Much of China's land is virtually uninhabited, such as the Gobi Desert, the steep slopes of the Himalayas, and the vast dry grasslands of the north-central region. The Yangtze Delta, Sichuan, and the counties and cities along the eastern coast are the main population centers. In contrast, 50 percent of China's landmass is very sparsely populated, with a density ranging from 2 people per square kilometer in Tibet to 19 people per square kilometer in Inner Mongolia. Only 3.6 percent of the country's population lives in these vast areas. There are many reasons for the uneven population distribution and density all throughout China.

1. **Terrain:** The steep slopes in the mountainous areas tend to restrict the availability of land for agriculture, development of transport, industries and other economic activities which could potentially discourage the concentration of population and its growth. Terrain is the number 1 cause for population distribution because if the terrain is too rough or too mountainous nobody can live there, it would be extremely hard, if not impossible to create a way of transport though the mountains, or the land is too steep, or the soil isn't fertile enough to create a business with agriculture.

2. **Climate:** Climate is another cause of population distribution because the people who would potentially live in that area would have to be comfortable with the temperature, to hot and nobody will like it, to cold and people will freeze so it is important that people feel comfortable with the temperature. Extreme climates may discourage the concentration of population in a certain areas. Rainfall is said to be a common denominator, because where it rains, it will allow sufficient water for agriculture, providing job opportunities for people in the country side.

3. **Job:** is another important reason for population distribution. This is because of

peoples drive to earn more money and support their family. So they move to areas that have a job opportunities that fit their qualifications, most of these jobs are towards the east of China. It's in the east where we find the oceans and rivers needed to facilitate communication and transportation. So because of these key ingredients, China was able to construct buildings, urbanize causing massive population growth in the east.

CHECK YOUR PROGRESS 2

Note: (a) Write your answers in the space given below.
(b) Check your answers with the above subsection.

1. China has greater population than India, but has less population density as a whole, while compared to India. Why?

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2. Why China has the unequal distribution of population?

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13.7 LET US SUM UP

Students, in this lesson we have studied the various physical features of China. The major physiographic divisions are categorized into mountain ranges, plateaus, basins and plains. The mountains and plateaus are largely located in the west and plains in the east. The world's highest mountain Mount Everest is located on the border of China and Nepal. The climate is also not homogenous, as China is divided into two main climatic regions; the north and west are semi- arid or arid, with extreme temperature variations. The south and southeast are warmer and more humid with year round rainfall.

We also studied that how population is distributed in the world's most populous nation. The population is highly concentrated in the south and the east. As these areas have plain topography and also climate is also suitable for habitation. People find more job opportunities in the plain areas, which is also serving a pull factor for high population density.

13.8 GLOSSARY

Rooster: An adult male chicken. By looking at the map of China, its shape is remarkably similar to that of a rooster.

Taklamakan: The Taklamakan Desert, also known as Taklimakan and Teklimakan, is a desert in northwest China.

Plateau: A plateau is a flat, elevated landform that rises sharply above the surrounding area on at least one side.

Basin: A basin is a depression, or dip, in the Earth's surface. Basins are shaped like bowls, with sides higher than the bottom. They can be oval or circular in shape, similar to a sink or tub you might have in your own bathroom. Some are filled with water. Others are empty.

Plains: In geography, a plain is a flat, sweeping landmass that generally does not change much in elevation.

Autonomous Region: Autonomous region (also referred to as an autonomous area, entity, unit, subdivision, or territory) is a subdivision or dependent territory of a country that has a degree of self-governance, or autonomy, from an external authority. Typically, it is either geographically distinct from the rest of the country or populated by a national minority.

Population density: The population density of a country or city or other place is a number showing how crowded that place is. It is calculated by dividing the population by the area. It is expressed as number of people living per sq. km or per sq. mile.

13.9 LESSON END EXERCISE

1. Discuss the major physiographic divisions of China.
2. Explain the different climatic zones of China?
3. Why is China's east more populated than its west?
4. List the factors affecting population distribution in China.

13.10 SUGGESTED FURTHER READINGS

1. Burrad, S.G. (2017). A sketch of the geography and geology of the himalaya mountain and tibet: The high peaks of asia. London, UK: Forgotten Books.
2. Gupta, A. (2005). The physical geography of southeast asia. London, UK: OUP.
3. Peterson, D. (1998). Asia. UK: Children's Publishers.
4. Reynolds, J.B. (2018). Regional geography: Asia. London, UK: Forgotten Books.
5. Sharma, Y.P. (2015). Geography of asia. India: Neha Publishers & Distributors.
6. Tirtha, R. (2006). Geography of asia. Jaipur, India: Rawat publishers.

CONTEMPORARY ISSUES AND GEOSPATIAL TECHNOLOGY IN GEOGRAPHY

14.0 STRUCTURE

14.1 INTRODUCTION

Students, this lesson will introduce the different contemporary and geospatial technologies in geography. Geographers and others using geographic knowledge and perspectives, in fact, are engaged in valuable research and teaching on matters ranging from environmental change to social conflict. The value of these activities derives from geography's focus on the evolving character and organization of the Earth's surface, on the ways in which the interactions of physical and human phenomena in space create distinctive places and regions, and on the influences those places and regions have on a wide range of natural and human events and processes. Such concerns are not simply exercises in expanding the encyclopedic knowledge of far away places; they go to the heart of some of the most urgent questions before decision makers today: How should societies respond to the accelerated pace of environmental degradation in many parts of the world? What are the underlying causes and consequences of the growing disparities between rich and poor? What are the mechanisms that drive the global climate system? What causes the severe floods that have occurred in recent years, and how can society cope with such events? How is technology changing economic and social systems?

The other aspect which we are going to deal is Geospatial technology which is used to describe the range of modern tools contributing to the geographic mapping and analysis of the Earth and human societies. You will be familiar with the terms like Remote sensing, GIS and GPS.

14.2 OBJECTIVES

This lesson will serve the following objectives:-

1. Enable students to identify various issues prevailing among global community from geographical perspective.
2. Students will able to describe the terms like Remote Sensing, Geographic Information Systems (GIS) and Global Positioning System (GPS).

14.3 CONTEMPORARY ISSUES IN GEOGRAPHY

A contemporary issue refers to an issue that is currently affecting people or places and that is unresolved. A geographic issue refers to a topic, concern or problem, debate, or controversy related to a natural and/or cultural environment, which includes a spatial dimension.

The study of geography, by its very nature, covers a range of contemporary issues and events. These are the issues and events that are 'in the news'. They are issues and events that are discussed and debated widely in the community. Contemporary geographical issues and events have both a spatial and temporal dimension. This means that they occur in a particular context and timeframe. They might, for example, be a local community-based issue (such as a development proposal) that is a focus of peoples' attention for just a short period of time, or an environmental issue that affects the whole planet (for example, global climate change) which may be of concern for generations.

Some examples of contemporary geographical issues and events include:

- Air and water pollution, child labor and exploitation, coastal erosion, coal seam gas extraction and drought.
- Endangered species, famines, flooding, food security and global climatic change.
- Global inequalities, global terrorism and habitat loss (e.g. deforestation).
- Human rights, impacts of tourism, management of river catchments (e.g. Murray-Darling Basin), mining, natural hazards and disasters.
- Population growth, population movements (e.g. refugees), poverty, refugees and rights of Indigenous people.
- Salinity, soil erosion, unemployment, urban developments, waste disposal, water quality and whale hunting etc.

14.4 GEOSPATIAL TECHNOLOGY IN GEOGRAPHY

Geospatial technology is a term used to describe the range of modern tools contributing to the geographic mapping and analysis of the Earth and human societies. These technologies have been evolving in some form since the first maps were drawn in prehistoric times. In the 19th century, the long important schools of cartography and mapmaking were joined by aerial photography as early cameras were sent aloft on balloons and pigeons, and then on airplanes during the 20th century. The science and art of photographic interpretation and map making was accelerated during the Second World War and during the Cold War it took on new dimensions with the advent of satellites and computers. Satellites allowed images of the Earth's surface and human activities therein with certain limitations. Computers allowed storage and transfer of imagery together with the development of associated digital software, maps, and data sets on socio economic and environmental phenomena, collectively called geographic information systems (GIS). An important aspect of a GIS is its ability to assemble the range of geospatial data into a layered set of maps which allow complex themes to be analyzed and then communicated to wider audiences. This 'layering' is enabled by the fact that all such data includes information on its precise location on the surface of the Earth, hence the term 'geospatial' is used. Especially in the last decade, these technologies have evolved into a network of national security, scientific, and commercially operated satellites complemented by powerful desktop GIS. In addition, aerial remote sensing platforms, including unmanned aerial vehicles (e.g. the Global Hawk reconnaissance drone), are seeing increased non-military use as well. High quality hardware and data is now available to new audiences such as universities, corporations, and non-governmental organizations. The fields and sectors deploying these technologies are currently growing at a rapid pace, informing decision makers on topics such as industrial engineering, biodiversity conservation, forest fire suppression, agricultural monitoring, humanitarian relief, and much more. There are now a variety of types of geospatial technologies potentially applicable to human rights, including the following:

14.4.1. Remote Sensing: Remote sensing is the acquisition of information about an object or phenomenon without making physical contact with the object and thus in contrast to on-site observation. Remote sensing is used in numerous fields, including geography, land surveying and most Earth Science disciplines (for example, hydrology, ecology[1] , oceanography, glaciology, geology); it also has military, intelligence, commercial, economic, planning, and humanitarian applications. In current usage, the term "remote sensing" generally refers to the use of satellite- or aircraft-based sensor technologies to detect and classify objects on Earth, including on the surface and in the atmosphere and oceans, based on propagated signals (e.g. electromagnetic radiation). It may be split into two types:-

i. Active remote sensing: - Active collection, emits energy in order to scan objects and areas whereupon a sensor then detects and measures the radiation that is reflected or backscattered from the target. RADAR and LIDAR are examples of active remote sensing where the time delay between emission and return is measured, establishing the location, speed and direction of an object.

ii. Passive remote sensing: - Passive sensors gather radiation that is emitted or reflected by the object or surrounding areas. Reflected sunlight is the most common source of radiation measured by passive sensors. Examples of passive remote sensors include film photography, infrared, charge- coupled devices, and radiometers.

Remote Sensing Systems offer four basic components to measure and record data about an area from a distance. These components include the energy source, the transmission path, the target and the satellite sensor. The energy source, electromagnetic energy, is very important. It is the crucial medium required to transmit information from the target to the sensor.

Applications of Remote Sensing: - Remote sensing has a wide range of applications in many different fields:-

i. Forest mapping: -One of the basic applications is forest cover typing and species identification. Hyper-spectral imagery can be used to generate signatures of vegetation species and certain stresses (e.g. infestations) on trees. Hyper-spectral data offers a unique view of the forest cover, available only through remote sensing technology. RADAR is more useful for applications in the humid tropics because it's all weather imaging capability are valuable for monitoring forest. LiDAR data allows the 3-dimensional structure of the forest. The multiple return systems are capable of detecting the elevation of land and objects on it. The LIDAR data help estimate a tree height, a crown area and number of trees per unit area

ii. Land cover mapping: - Land cover mapping is one of the most important and typical applications of remote sensing data. Land cover corresponds to the physical condition of the ground surface, for example, forest, grassland, concrete pavement etc., while land use reflects human activities such as the use of the land, for example, industrial zones, residential zones, agricultural fields etc Initially the land cover classification system should be established, which is usually defined as levels and classes. The level and class should be designed in consideration of the purpose of use (national, regional or local), the spatial and spectral resolution of the remote sensing data, user's request and so on.

Land cover change detection is necessary for updating land cover maps and the management of natural resources. The change is usually detected by comparison between two multi-date images, or sometimes between an old map and an updated remote sensing image. Information on land cover and changing land cover patterns is directly useful for determining and implementing environment policy and can be used with other data to make complex assessments (e.g. mapping erosion risks).

iii. Coastal applications: - Monitor shoreline changes, track sediment transport, and map coastal features. Data can be used for coastal mapping and erosion prevention.

iv. Ocean applications: Monitor ocean circulation and current systems, measure ocean temperature and wave heights, and track sea ice. Data can be used to better understand the oceans and how to best manage ocean resources.

v. Hazard assessment: Track hurricanes, earthquakes, erosion, and flooding. Data can be used to assess the impacts of a natural disaster and create preparedness strategies to be used before and after a hazardous event.

vi. Natural resource management: Monitor land use, map wetlands, and chart wildlife habitats. Data can be used to minimize the damage that urban growth has on the environment and help decide how to best protect natural resources.

CHECK YOUR PROGRESS 1

Note: (a) Write your answers in the space given below.
(b) Check your answers with the above subsection.

1. List some of the contemporary issues in Geography.

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2. Define remote sensing?

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3. Differentiate between Active remote sensing and Passive remote sensing.

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14.4.2 Geographic Information System (GIS)

A geographic information system (GIS) is a system designed to capture, store, manipulate, analyze, manage, and present spatial or geographic data. In general, the term describes any information system that integrates stores, edits, analyzes, shares, and displays geographic information. GIS applications are tools that allow users to create interactive queries (user-created searches), analyze spatial information, edit data in maps, and present the results of all these operations. Geographic information science is the science underlying geographic concepts, applications, and systems. GIS can refer to a number of different technologies, processes, and methods. It is attached to many operations and has many applications related to engineering, planning, management, transport/logistics, insurance, telecommunications, and business.

The first known use of the term "geographic information system" was by Roger Tomlinson in the year 1968 in his paper "A Geographic Information System for Regional Planning". Tomlinson is also acknowledged as the "father of GIS"

Types of GIS Data: - The two primary types of spatial data are **vector and raster data** in GIS.

i. Vector Data: Vector data is *not* made up of a grid of pixels. Instead, vector graphics are comprised of **vertices and paths.** The three basic symbol types for vector data are points, lines and polygons (areas). Because cartographers use these symbols to represent real-world features in maps, they often have to decide based on the level of detail in the map. **Vector points** are simply XY coordinates. Generally, they are a latitude and longitude with a spatial reference frame.

ii. Raster data: Raster data is made up of pixels (or cells), and each pixel has an associated value. Simplifying slightly, a digital photograph is an example of a raster dataset where each pixel value corresponds to a particular colour. In GIS, the pixel values may represent elevation above sea level, or chemical concentrations, or rainfall etc. The key point is that all of this data is represented as a grid of (usually square) cells.

Components of GIS: - There are mainly 5 components of GIS, hardware, software, data, people, and methods.

i). Hardware: Hardware is the computer on which a GIS operates. Today, GIS software runs on a wide range of hardware types, from centralized computer servers to desktop computers used in stand-alone or networked configurations.

ii). Software: GIS software provides the functions and tools needed to store, analyze, and display geographic information.

iii). Data: Possibly the most important component of a GIS is the data. Geographic data and related tabular data can be collected in-house or purchased from a commercial data provider. A GIS will integrate spatial data with other data resources and can even use a DBMS, used by most organizations to organize and maintain their data.

iv). People: GIS technology is of limited value without the people who manage the system and develop plans for applying it to real world problems. GIS users' ranges from technical specialists who design and maintain the system to those who use it to help them perform their everyday work.

v). Methods: A successful GIS operates according to a well-designed plan and business rules, which are the models and operating practices unique to each organization

Applications of GIS: -

i). GIS in Mapping: Mapping is a central function of Geographic Information System, which provides a visual interpretation of data. GIS store data in database and then represent it visually in a mapped format. Google map, Bing map, Yahoo map are the best example for web based GIS mapping solution.

ii). Telecom and Network services: GIS can be a great planning and decision making tool for telecom industries. GDi GISDATA enables wireless telecommunication organizations to incorporate geographic data in to the complex network design, planning, optimization, maintenance and activities.

iii). Accident Analysis and Hot Spot Analysis: GIS can be used as a key tool to minimize accident hazard on roads, the existing road network has to be optimized and also the road safety measures have to be improved. This can be achieved by proper traffic management. By identifying the accident locations, remedial measures can be planned by the district administrations to minimize the accidents in different parts of the world. Rerouting design is also very convenient using GIS.

iv). Urban Planning: GIS technology is used to analyze the urban growth and its direction of expansion, and to find suitable sites for further urban development

v). Transportation Planning: GIS can be used in managing transportation and logistical problems. If transport department is planning for a new railway or a road route then this can be performed by adding environmental and topographical data into the GIS platform.

vi). Environmental Impact Analysis: EIA is an important policy initiative to conserve natural resources and environment. Many human activities produce potential adverse environmental effects which include the construction and operation of highways, rail, roads, pipelines, airports, radioactive waste disposal and more. The EIA can be carried out efficiently by the help of GIS, by integrating various GIS layers; assessment of natural features can be performed.

vii) Agricultural Applications: GIS can be used to create more effective and efficient farming techniques. It can also analyze soil data and to determine: what are the best crops to plant? Where they should go? How to maintain nutrition levels to best benefit crop to plant? This could increase food production in different parts of the world so the world food crisis could be avoided.

viii). Disaster Management and Mitigation: Today a well-developed GIS system is used to protect the environment. It has become an integrated, well developed and successful tool in disaster management and mitigation. GIS can help with risk management and analysis by displaying which areas are likely to be prone to natural or man-made disasters.

ix). GIS Applications in Geology: Geologists use GIS in a various applications. The GIS is used to study geologic features, analyze soils and strata, assess seismic information, and or create three dimensional (3D) displays of geographic features. GIS can be also used to analyze rock information characteristics and identifying the best dam site location.

x). Determine land use/land cover changes: The role of GIS technology in land use and land cover applications is that we can determine land use/land cover changes in the different areas. Also it can detect and estimate the changes in the land use/ land cover pattern within time. It enables to find out sudden changes in land use and land cover either by natural forces or by other activities like deforestation.

xi). Navigation (routing and scheduling): Web-based navigation maps encourage safe navigation in waterway. Ferry paths and shipping routes are identified for the better routing. Arc GIS supports safe navigation system and provides accurate topographic and hydrographic data.

xii). Flood damage estimation: A local government needs to map flooding risk areas for evaluate the flood potential level in the surrounding area. The damage can be well estimate and can be shown using digital maps.

xiii). Natural Resources Management: By the help of GIS technology the agricultural, water and forest resources can be well maintain and manage. Foresters can easily monitor forest condition. Agricultural land includes managing crop yield, monitoring crop rotation, and more. Water is one of the most essential constituents of the environment. GIS is used to analyze geographic distribution of water resources.

xiv). GIS Solutions in Banking Sector: Today, the success of banking sector largely depends on the ability of a bank to provide customer and market driven services. GIS plays an important role providing planning, organizing and decision making.

xv). Soil Mapping: Soil mapping provides resource information about an area. It helps in understanding soil suitability for various land use activities. It is essential for preventing environmental deterioration associated with misuse of land. GIS Helps to identify soil types in an area and to delineate soil boundaries. It is used for the identification and classification of soil. Soil map is widely used by the farmers in developed countries to retain soil nutrients and earn maximum yield.

xvi). Deforestation: Nowadays forest area is decreasing every year, due to different activities. GIS is used to indicate the degree of deforestation and vital causes for the deforestation process. GIS is used to monitor deforestation.

14.4.3. Global Positioning System (GPS)

GPS Stands for "Global Positioning System." GPS is a satellite navigation system used to determine the ground position of an object. GPS is also known as the NAVSTAR (Navigation System for Timing and Ranging). GPS technology was first used by the United States military in the 1960s and expanded into civilian use over the next few decades. Today, GPS receivers are included in many commercial products, such as automobiles, smart phones, exercise watches, and GIS devices. It was initially developed for use by the United States military and became fully operational in 1995. It was allowed for civilian use in the 1980s. Roger L. Easton of the Naval Research Laboratory, Ivan A. Getting of the Aerospace Corporation, and Bradford Parkinson of the Applied Physics Laboratory are credited with inventing it.

The GPS system includes 24 satellites deployed in space about 12,000 miles (19,300 kilometers) above the earth's surface. They orbit the earth once every 12 hours at an extremely fast pace of roughly 7,000 miles per hour (11,200 kilometers per hour). The satellites are evenly spread out so that four satellites are accessible via direct line-of-sight from anywhere on the globe. Each GPS satellite broadcasts a message that includes the satellite's current position, orbit, and exact time. A GPS receiver combines the broadcasts from multiple satellites to calculate its exact position using a process called triangulation. Three satellites are required in order to determine a receiver's location, though a connection to four satellites is ideal since it provides greater accuracy. GPS uses a lot of complex technology, but the concept is simple.

The GPS receiver gets a signal from each GPS satellite. The satellites transmit the exact time the signals are sent. By subtracting the time the signal was transmitted from the time it was received, the GPS can tell how far it is from each satellite. The GPS receiver also knows the exact position in the sky of the satellites, at the moment they sent their signals. So given the travel time of the GPS signals from three satellites and their exact position in the sky, the GPS receiver can determine your position in three dimensions - east, north and altitude.

Almanac and Ephemeris

To determine the location of the GPS satellites two types of data are required by the

GPS receiver: the almanac and the ephemeris. This data is continuously transmitted by the GPS satellites and GPS receiver collects and stores this data.

The almanac contains information about the status of the satellites and approximate orbital information. The GPS receiver uses the almanac to calculate which satellites are currently visible. The almanac is not accurate enough to let the GPS receiver get a fix. If the GPS receiver is new, or has not been used for some time, it may need 15 minutes or so to receive a current almanac. In older GPS receivers, an almanac is required to acquire the satellites, but many newer models are able to acquire the satellites without waiting for the almanac.

To get a fix, GPS receiver requires additional data for each satellite, called the ephemeris. This data gives very precise information about the orbit of each satellite. GPS receiver can use the ephemeris data to calculate the location of a satellite to with a meter or two. The ephemeris is updated every 2 hours and is usually valid for 4 hours. If GPS receiver has been off for a while, it may take up to several minutes to receive the ephemeris data from each satellite, before it can get a fix

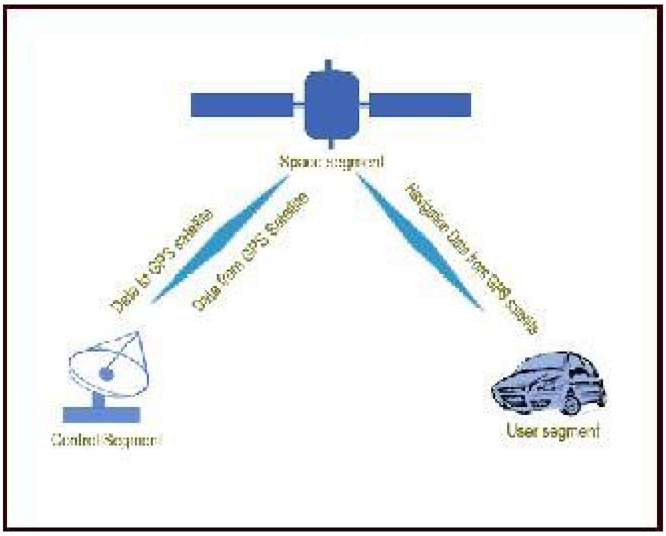
Structure / Segment of GPS

The GPS system comprises of three parts:

- Space segment,
- User segment and
- Control segment.

The following diagram is showing the structure of GPS.

Map 14.1 : Structure of GPS



1. **Space segment: –** The satellites are the heart of the Global positioning system which helps to locate the position by broadcasting the signal used by the receiver. The signals are blocked when they travel through buildings, mountains, and people. To calculate the position, the signals of four satellites should be locked. You need to keep moving around to get clear reception.

2. **User segment: –** This segment includes military and civilian users. It comprises of a sensitive receiver which can detect signals (power of the signal to be less than a quadrillionth power of a light bulb) and a computer to convert the data into useful information. GPS receiver helps to locate your own position but disallows you being tracked by someone else.

3. **Control segment: –** This helps the entire system to work efficiently. It is essential that the transmission signals have to be updated and the satellites should be kept in their appropriate orbits.

GPS technology became a reality through the efforts of the American military, which established a satellite-based navigation system consisting of a network of 24 satellites orbiting the earth. GPS works all across the world and in all weather conditions, thus helping users track locations, objects, and even individuals! GPS technology can be used by any person if they have a GPS receiver.

Applications of GPS

This technique was initially developed for military applications. During 1980, the government decided to make it available for the civilian use as well. GPS has become an efficient tool in the field of scientific use, commerce, surveillance and tracking. GPS is used except in locations where it is difficult to detect the signal for example, underwater, subterranean location, inside the building and caves.

- **Civilian Applications**

Navigation – Used by navigators for orientation and precise velocity measurements.

Geotagging – Map overlays can be created by applying location coordinates to photographs and other kind of documents.

Surveying – Surveyors create maps and verify the boundaries of the property.

Map-making – Used by civilians and military cartographers.

Tectonics – Detect the direct false motion measurement in earthquakes.

Geofencing – Vehicle, person or pet can be detected by using GPS vehicle tracking system, person tracking systems, and pet tracking systems.

- **Military Applications**

Navigation – Soldiers can find objectives in the dark and unknown regions with the help of GPS.

Search and Rescue – Knowing the position of a downed pilot, its location can be traced out easily.

Reconnaissance – Patrol movement can be handled.

Target tracking – Military weapon systems use GPS to track air targets and potential ground before they are flagged as hostile.

GPS carry a set of nuclear detonation detectors (such as optical sensor, dosimeter, electromagnetic pulse sensor, X-ray sensor) which is a part of United States Nuclear Detonation Detection System.

Missile and projectile guidance – Targets military weapons such as cruise missiles, imprecision – guided munitions.

CHECK YOUR PROGRESS 2

Note: (a) Write your answers in the space given below.

(b) Check your answers with the above subsection.

1. Define vector and raster data.

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2. How GIS can be used in urban planning?

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3. What type of data is required by the GPS receiver?

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4. Explain the control segment of GPS.

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14.4 LET US SUM UP

Dear students, in this lesson we have studied the various issues that are more in news across the globe. We have become familiar with the terms like remote sensing, GIS & GPS. Remote sensing data has shown tremendous potential for applications in various fields for example in land use mapping and detection, geologic mapping, water resource applications (pollution, lake-eutrophisation assessment), wetland mapping, urban and regional planning, environment inventory, natural disaster assessment or archaeological applications and other. In this unit we accented some examples of touched fields to show the remote sensing as data source and the benefits of remote sensing applications. GIS can be used as tool in both problem solving and decision making processes, as well as for visualization of data in a spatial environment. Geospatial data can be analyzed to determine (1) the location of features and relationships to other features, (2) where the most and/or least of some feature exists, (3) the density of features in a given space, (4) what is happening inside an area of interest (AOI), (5) what is happening nearby some feature or phenomenon, and (6) and how a specific area has changed over time (and in what way). The fields and sectors deploying geospatial technologies are currently growing at a rapid pace, informing decision makers on topics such as industrial engineering, biodiversity conservation, forest fire suppression, agricultural monitoring, humanitarian relief and much more.

14.6 GLOSSARY

Contemporary Issues: These are the issues and events that are in the news and are discussed and debated widely in the community.

Sensor: A sensor is a device, module, or subsystem whose purpose is to detect events or changes in its environment and send the information to other electronics, frequently a computer processor.

PIXEL: A pixel is the smallest unit of a digital image or graphic that can be displayed and represented on a digital display device. Pixels are combined to form a complete image, video, text or any visible thing on a computer display. A pixel is also known as a picture element.

RADAR: RADAR stands for Radio Detection and Ranging. Radar is an object-detection system that uses radio waves to determine the range, angle, or velocity of objects.

LIDAR: It stands for Light Detection and Ranging. LIDAR is used to examine the surface of the earth.

DBMS: A database management system (DBMS) is system software for creating and managing databases. The DBMS provides users and programmers with a systematic way to create, retrieve, update and manage data.

14.7 LESSON END EXERCISE

1. Define contemporary issues. What global issues do geographers study?
2. What is Geospatial technology? Enlist its types.

3. Define remote sensing. Discuss the applications of remote sensing.
4. What does the abbreviation "GIS' stands for? What are the essential components of a GIS?
5. Discuss the military applications of GIS.
6. What is GPS? Explain three segments of GPS.

14.8 SUGGESTED FURTHER READINGS

1. Bhatta, B. (2011). Remote sensing and gis. England, UK : Oxford University Press
2. Chang, K. T. (2017). Introduction to geographic information systems. US : McGraw Hill Education
3. Joseph, G. (2017). Fundamentals of remote sensing. Hyderabad, India: Universities Press
4. Kaplan, E.D., & Hegarty, C.J. (2006). Understanding gps: Principles and applications. London, UK: Artech House
5. Kumar, S. (2017). Basics of remote sensing and gis. New Delhi, India: Laxmi Publications
6. Lo, C.P., & Yeung, A.K.W. (2006). Concepts and techniques in geographic information systems. US: Prentice Hall.
7. Rabbany, A.E l. (2002). Introduction to gps: The global positioning system. London, UK: Artech House.
8. Reddy, M.A. (2015). Text book of remote sensing and geographical information systems. Hyderabad, India: Adithya Art Printers.

LESSON NO. 15 **UNIT - IV**

WORLD SUMMITS ON ENVIRONMENT

15.0 **STRUCTURE**

15.1 Introduction

15.2 Objectives

15.3 World Summits on Environment

15.4 Let us Sum up

15.5 Glossary

15.6 Lesson end Exercise

15.7 Suggested Further Readings

15.1 INTRODUCTION

Students, as we all know that our environment is constantly changing. Environmental issues are harmful effects of human activity on the bio physical environment. Environmental protection is a practice of protecting the natural environment on individual, organizational or governmental levels, for the benefit of both the environment and humans.

Environmental issues are addressed at a regional, national or international level by government organizations. The largest international agency, set up in 1972, is the United Nations Environment Programme. The International Union for Conservation of Nature brings together 83 states, 108 government agencies, 766 Non-governmental organizations and 81 international organizations and about 10,000 experts and scientists from countries around the world. International non-governmental organizations include Greenpeace, Friends of the Earth and World Wide Fund for Nature. Governments enact environmental policy and enforce environmental law.

15.2 OBJECTIVES

After studying this lesson, you shall be able to:

1. Explain the various world summits on environment initiated for achieving sustainable development at local, national and global level.
2. State the different environmental problems faced by global community.
3. Describe the diverse policies and practices which are environmentally sound.

15.3 WORLD SUMMITS ON ENVIRONMENT

The Earth Summits are decennial meetings of world leaders, organized since 1972 with help of the United Nations, to help defining ways to stimulate sustainable development at the global level. The aim is to bring together the best individuals and organizations humanity can bring forward from all kind of categories of life, to identify and update what are humanity's most pressing challenges, to quantify them, identify solutions and develop a plan of action not to run into a wall. This plan of action is called Agenda 21 and implemented by many local governments under the name Local Agenda 21. The plans of action is designed as a TQM – Total Quality Manual, designed smartly and open enough, so that also organizations, companies and individuals can use it as a basis for their own plan of action and guidance not to miss out on important issue; it helps speed up understanding and identifying partners by e.g. using similar wordings and symbols. The 2000-2015 Millennium Development Goals and the 2015-2030 Global Goals are results from these Earth Summits. The first summit took place in Stockholm (Sweden) in 1972, the second in Nairobi (Kenya) in 1982, the third in Rio de Janeiro (Brazil) in 1992 and the fourth in Johannesburg (South Africa) in 2002. Last Earth Summit, called Rio+20, also took place in Rio de Janeiro in 2012.

The 1972 summit gave birth to the United Nations Environment Program (UNEP), while the 1992 Summit launched the United Nations Framework Convention on Climate Change (UNFCCC), whose signatory countries have met annually since 1995.

List of major Earth Summits

1. 1972 - The United Nations Conference on the Human Environment (UNCHS)

2. 1982 - The 1982 Earth Summit in Nairobi (Kenya). An Earth Summit was held in Nairobi, Kenya, from 10 to 18 May 1982. The events of the time (Cold War) and the disinterest of US President Ronald Reagan (who appointed his delegated daughter Of the United States) made this summit a failure. It is not even mentioned as an official Earth Summit.

3. 1992 - The United Nations Conference on Environment and Development (UNCED) in Rio de Janeiro (Brazil)

4. 2002 - The World Summit on Sustainable Development "(WSSD) in Johannesburg (South Africa)

5. 2012 - The United Nations Conference on Sustainable Development (UNCSD) or Rio+20 also took place in Rio de Janeiro (Brazil).

1. Stockholm Conference, 1972 The United Nations Conference on the Human Environment (also known as the Stockholm Conference) was an international conference convened under United Nations auspices held in Stockholm, Sweden from June 5-16, 1972. It was the UN's first major conference on international environmental issues, and marked a turning point in the development of international environmental politics. The meeting agreed upon a Declaration containing 26 principles concerning the environment and development. Principles of the Stockholm Declaration:

i. Human rights must be asserted, apartheid and colonialism condemned.

ii. Natural resources must be safeguarded.

iii. The Earth's capacity to produce renewable resources must be maintained.

iv. Wildlife must be safeguarded.

v. Non – renewable resources must be shared and not exhausted.

vi. Pollution must not exceed the environment's capacity to clean itself.

vii. Oceanic pollution must be prevented.

viii. Development is needed to improve the environment.

ix. Developing countries therefore need assistance.

x. Developing countries need reasonable prices for exports to carry out environmental management.

xi. Environment policy must not hamper development.

xii. Developing countries need money to develop environmental safeguards.

xiii. Integrated development planning is needed.

xiv. Rational planning should resolve conflicts between environment and development.

xv. Human settlements must be planned to eliminate environmental problems.

xvi. Governments should plan their own appropriate population policies.

xvii. National institutions must plan development of states' natural resources.

xviii. Science and technology must be used to improve the environment.

xix. Environmental education is essential.

xx. Environmental research must be promoted, particularly in developing countries.

xxi. States may exploit their resources as they wish but must not endanger others.

xxii. Compensation is due to states thus endangered.

xxiii. Each nation must establish its own standards.

xxiv. There must be cooperation on international issues.

xxv. International organizations should help to improve the environment.

xxvi. Weapons of mass destruction must be eliminated.

2. United Nations Environmental Programme (UNEP)

The United Nations Environmental Programme (UNEP) is an agency of United Nations and coordinates its environmental activities, assisting developing countries in implementing environmentally sound policies and practices. The United Nations Environmental Programme (UNEP) is the main institutional response most immediate to the Stockholm conference. The recommendations of the conference 1972, were implemented by General Assembly through resolution 2997 (XXVII) stressed the need to assist developing countries to implement environmental policies and programmes that are compatible with the development plants‘. A 58 member Governing council for UNEP was set up and its first session was held in Geneva in June 1973. UNEP‘s Governing Council is also entrusted the duty to ensure that environmental programmes and projects shall be in conformity with the developmental plans and priorities' of the developing states. The conference deals with all kinds of human settlements and to improve people's living environment.

UN Environment has aided in the formulation of guidelines and treaties on issues such as the international trade in potentially harmful chemicals, trans-boundary air pollution and contamination of international waterways.

3. World's Charter of Nature (1982)

World Charter for Nature was adopted by United Nations member nation-states on October 28, 1982. It proclaims five "principles of conservation by which all human conduct affecting nature is to be guided and judged."

1. Nature shall be respected and its essential processes shall not be impaired.
2. The genetic viability on the earth shall not be compromised; the population levels of all life forms, wild and domesticated, must be at least sufficient for their survival, and to this end necessary habitats shall be safeguarded.
3. All areas of the earth, both land and sea, shall be subject to these principles of conservation; special protection shall be given to unique areas, to representative samples of all the different types of ecosystems and to the habitats of rare or endangered species.
4. Ecosystems and organisms, as well as the land, marine and atmospheric resources that are utilized by man, shall be managed to achieve and maintain optimum sustainable productivity, but not in such a way as to endanger the integrity of those other ecosystems or species with which they coexist.

5. Nature shall be secured against degradation caused by warfare or other hostile activities

The UN General Assembly adopted the World Charter of Nature for bringing attention to the intrinsic value of species and ecosystems. The Charter is an important symbolic expression of the intent among nations to achieve a more harmonious and sustainable relationship between humanity and the rest of the biosphere – between mankind and earth. The acceptance of the Charter which declares the principle of sustainable development in a new binding form shows the positive change of attitude in the developing world towards the adoption of a global environmental policy.

4. Nairobi Declaration, 1982

The Nairobi Declaration was adopted at Nairobi for celebrating the 10th Anniversary of the Stockholm conference on human Environment in 1972. This Conference was conducted from 10th to 18th May 1982. The Declaration envisaged the creation of a special commission to frame long term environment strategies for achieving sustainable developments upto the year 2000 and beyond. The Declaration was endorsed by the governing Council of United Nations Environment Programme (UNEP) in 1987 and also by the General Assembly of the United Nations Organisation.

Main features of Nairobi Declaration 1982:

i). The participating members found that the environmental problems remained the same as were in 1972.

ii). Nairobi Declaration aimed to continue the principles of the Stockholm Declaration. Further, it was stressed to refine those principles suited to present and the coming global environment.

iii). Nairobi Declaration reaffirmed its commitment of the Stockholm Declaration and the action plan as well as to further strengthen and expansion of national efforts and International Co-operation for the environmental protection.

iv). It requested all the Governments and peoples of the world to participate in the programmes to eradicate environmental pollution and to protect our mother earth.

CHECK YOUR PROGRESS 1

Note: (a) Write your answers in the space given below.

(b) Check your answers with the above subsection

1. Define earth summits?

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2. When and where first world summit on environment was held?

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3. Discuss the features of Nairobi Declaration.

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5. Vienna convention for the protection of ozone layer (1985)

The Vienna Convention for the Protection of the Ozone Layer is a multilateral Environment Agreement. The convention was adopted on 22nd March, 1985 by the conference of Plenipotentiaries which was organized by the UNEP. The convention came into force on Sep. 22, 1988. The main object of the convention was to provide to States the international legal framework for working together to protect the stratospheric ozone layer. The convention defines ozone layer under Article 1 which says that Ozone layer means the layer of atmospheric Ozone above the planetary boundary layer.

Article 2 of the convention provides the general obligations of the parties which says that the parties shall take appropriate measures in accordance with the provisions of the convention and of those protocols in force in which they are parts to protect human health and the environment against adverse effects resulting or likely to result from human activities which modify or are likely to modify the ozone layer. The Vienna convention of 1985 was the starting point of the global cooperation for protection of ozone layer. Under the protocol countries agreed to phase out the production and consumption of certain chemicals that deplete ozone. Phase out of these substances is required by specific deadlines. The Vienna

Convention and its Montreal Protocol are the first and only global environmental treaties to achieve universal ratification, with 197 parties.

6. Montreal protocol on substances that deplete ozone layer (1987)

The Protocol came into force in 1989 as amended in 1990, 92 and 95 was adopted and by 2000, 173 states have become parties to Montreal protocol. The protocol set targets for reducing the consumption and production of a range of ozone depleting substances. In a major innovation the protocol recognized that all nations should not be treated equally. The agreement acknowledges that certain countries have contributed to ozone depletion more than others. It also recognizes that a nation's obligation to reduce 64 current emissions should reflect its technological and financial ability to do so. Because of this, the agreement sets more stringent standards and accelerated phase-out timetables to countries that have contributed most to ozone depletion. India accepted this protocol along with its London Amendment in September 1992. The Ministry of Environment and Forest has established an ozone cell and a steering committee on the protocol to facilitate implementation of the India country program, for phasing out ozone depleting substances production by 2010 to meet the commitments India has also taken policy decisions. The Ozone Depleting Substances (Regulation and Control) Rules 2000 were drafted under Environment (protection) Act, 1986. Helsinki Declaration 1989: On protection of Ozone layer, phase out CFC Production and consumption by 2000. Basel convention on trans-boundary movement of hazardous wastes, 1989 The Convention came into force in 1992. The objectives of the convention are to reduce trans-boundary movements of hazardous wastes, to minimize the creation of such wastes and to prohibit their shipment to countries lacking the capacity to dispose hazardous wastes in an environmentally sound manner. India ratified the convention and enacted Hazardous Wastes Management Rules Act 1989, encompasses some of the Basal provisions related to the notification of import and export of hazardous wastes, illegal traffic and liability.

7. Earth Summit (1992)

In continuation of Stockholm Declaration, 1972 and the Nairobi Declaration, 1982 the third major Declaration was held in Rio-de-Janeiro in Brazil in the year 1992. Hence it is termed as Rio-Declaration and attended by over 150 countries. It is also well known as —Earth Summit. It discussed global and environmental problems widely. It was the biggest International Conference in the history of International relations.

The Rio Declaration The Rio Declaration was adopted in the conference recognizing the universal and integral nature of Earth and by establishing a global partnership among states and enlisting general rights and obligations on environmental protection.

- The Rio Declaration is a statement of 27 principles for the guidance of national environmental behavior and enlisting general rights and obligations on environmental protection.
- Rio principles placed human beings at the centre of sustainable development concerns by stating that humans are entitled to a healthy and productive life in harmony with nature.

Agenda-21

- It is a comprehensive action plan which gives a future plan in relation to environment and development.
- The Agenda emphasizes on issues like poverty, health consumption patterns, natural resource use, financial resources human settlements and technological
- It also includes energy, climate and other wide range of issues concerning environment and development.
- Agenda-21 is not a binding document but it constitutes the key document of the Rio.

8. U.N. Frame Work Convention on Climate Change (UNFCCC), 1992

The United Nations Frame Work Convention on Climate Change (UNFCCC) is an international treaty agreed in 1992. It creates a legally- binding framework for international climate diplomacy, establishes how the world should come to political agreement on the issue of climate change, and paves the way for further treaties that aim to limit global greenhouse gas emissions. The primary goals of the UNFCCC were to stabilize green house gas emissions at levels that would prevent dangerous anthropogenic interference with the global climate. The convention embraced the principle of common but differentiated responsibilities which has guided the adoption of a regulatory structure. India signed the agreement in June 1992 which was ratified in November 1993. As per the convention the reduction/ limitation requirements apply only to developed countries. The only reporting obligation for developing countries relates to the construction of a GHG inventory.

Since its establishment the UNFCCC has shaped international climate and energy diplomacy. The treaty establishes that richer developed countries should take the lead in emissions reductions, describing the "common but differentiated responsibilities" of world nations to address climate change. It requires rich countries to commit to provide financing for poor countries to deal with climate change, introduces the concept of carbon trading into international climate diplomacy, and allows developed countries to 'offset' emissions by sponsoring projects in less developed countries.

CHECK YOUR PROGRESS 2

Note: (a) Write your answers in the space given below.
(b) Check your answers with the above subsection

1. What was the main objective of Vienna Convention?

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2. Define Rio-Declaration?

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3. When UNFCCC treaty was signed? .

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9. Convention on Biological Diversity (1992)

The Convention on Biological Diversity (CBD), known informally as the Biodiversity Convention, is a multilateral treaty. This convention is a legally binding framework treaty that has been ratified by 180 countries. This pact among the vast majority of the world's governments sets out commitments for maintaining the world's ecological underpinnings as we go about the business of economic development. The CBD sets out commitments for maintaining the world's ecological state while economic development also continues. In order to achieve this, the Convention establishes three main goals:

- the conservation of biodiversity,
- the sustainable use of biological resources and
- the fair and equitable sharing of benefits arising from their sustainable use.

The convention came into force in 1993. Many biodiversity issues are addressed including habitat preservation, intellectual property rights, bio safety and indigenous people's rights. India's initiative under the convention on biodiversity includes the promulgation of the Wild life (protection) Act of 1972, amended in 1991 and participation in several international conventions.

10. Kyoto Conference (1997)

The Kyoto Protocol is an international agreement linked to the United Nations Framework Convention on Climate Change, which **commits** its Parties by setting internationally binding emission reduction targets. Recognizing that developed countries are principally responsible for the current high levels of GHG emissions in the atmosphere as a result of more than 150 years of industrial activity, the Protocol places a heavier burden on developed nations under the principle of "common but differentiated responsibilities."

The Kyoto Protocol was adopted in Kyoto, Japan, on 11 December 1997 and entered into force on 16 February 2005. The detailed rules for the implementation of the Protocol were adopted at COP 7 in Marrakesh, Morocco, in 2001, and are referred to as the "Marrakesh Accords." Its first commitment period started in 2008 and ended in 2012.

It was adopted in the form of a protocol, which requires the industrialized countries as a whole to reduce their average annual emissions of six green house gases like carbon dioxide, methane, CFC, etc., by 5.2 percent from 1990 levels between the year 2008 and 2012. As of Dec 2001, 84 parties signed and 46 parties ratified or acceded to the protocol. All developed countries were committed to cut gas emissions. Thus in spite of Kyoto protocol, it is difficult to say that the world would be safe from the green-house effect. 150 Clean development mechanism is a key concept in Kyoto protocol.

Under the Protocol, countries' actual emissions have to be monitored and precise records have to be kept of the trades carried out. Reporting is done by Parties by submitting annual emission inventories and national reports under the Protocol at regular intervals.

The Kyoto Protocol, like the Convention, is also designed to assist countries in adapting to the adverse effects of climate change. It facilitates the development and deployment of technologies that can help increase resilience to the impacts of climate change. The Kyoto Protocol is seen as an important first step towards a truly global emission reduction regime that will stabilize GHG emissions, and can provide the architecture for the future international agreement on climate change.

11. Johannesburg Declaration (2002)

Yet, another Earth Summit was held at Johannesburg, South Africa, from 26th August to 4th September 2002. It was the consequential follow up action of the decision of the Earth Summit 1992. Johannesburg conference confirmed that significant progress has been made towards achieving a global consensus and partnership amongst all the people of our planet. Over 4000 delegates from about 100 countries participated in it.

It is an agreement to focus particularly on the worldwide conditions that pose severe threats to the sustainable development of our people, which include chronic hunger, malnutrition, foreign occupation, armed conflict, illicit drug problems, organized crime, corruption, natural disasters, terrorism, trafficking in persons etc.

To achieve sustainable development, states shall reduce and eliminate unsustainable patterns of production and consumption, exchange of scientific and technological knowledge, compensation for adverse effects of environmental damage caused by activities within their jurisdiction or control to areas beyond their jurisdiction, precautionary approach shall be widely applied by states polluter should bear the cost of pollution, Environmental impact assessment as an instrument to monitor the likely environmental effects.

12. The United Nations Conference on Sustainable Development (UNCSD)

Also known as Rio 2012, Rio+20 or Earth Summit 2012 was the third international conference on sustainable development aimed at reconciling the economic and environmental goals of the global community. Hosted by Brazil in Rio de Janeiro from 13 to 22 June 2012, Rio+20 was a 20-year follow-up to the 1992 Earth Summit/ United Nations Conference on Environment and Development (UNCED) held in the same city, and the 10th anniversary of the 2002 World Summit on Sustainable Development (WSSD) in Johannesburg. Governments participating in the 1992 meeting politically endorsed the objective of "sustainable development" as achieving economic, environmental, and social development that "meets the needs of the present without compromising the ability of future generations to meet their own needs." The Governments outlined three overall objectives of the conference:-

i. Securing renewed political commitment for sustainable development

ii. Assessing the progress and implementation gaps in meeting previous commitments.

iii. Addressing new and emerging challenges

In Rio, Member States decided to launch a process to develop a set of Sustainable Development Goals (SDGs), which will build upon the Millennium Development Goals and converge with the post 2015 development agenda. The Conference also adopted ground-breaking guidelines on green economy policies. It resulted in over 700 voluntary commitments and witnessed the formation of new partnerships to advance sustainable development.

12. UN Sustainable Development Summit (2015)

UN Sustainable Development Summit held in September 2015 in New York, USA. On 25 September 2015, the 193 countries of the UN General Assembly adopted the 2030 Development Agenda titled "Transforming our world: the 2030 Agenda for Sustainable Development" The Sustainable Development Goals (SDGs) are a collection of 17 global goals set by the United Nations. The broad goals are interrelated though each has its own targets to achieve. The total number of targets is 169. The SDGs cover a broad range of social and economic development issues. These include poverty, hunger, health, education, climate change, gender equality, water, sanitation, energy, environment and social justice. The SDGs are also known as "Transforming our World: the 2030 Agenda for Sustainable

Development" or Agenda 2030 in short. The goals were developed to replace the Millennium Development Goals (MDGs) which ended in 2015. Unlike the MDGs, the SDG framework does not distinguish between "developed" and "developing" nations. Instead, the goals apply to all countries.

CHECK YOUR PROGRESS 3

Note: (a) Write your answers in the space given below.
(b) Check your answers with the above subsection

1. Which country hosted the Kyoto Conference?

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2. Write about Johannesburg Declaration.

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3,. Mention the Objectives of UNCSD.

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4. Define Sustainable Development Goals?

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15.4 LET US SUM UP

Well students, we have discussed the various world summits on environment which had been organized by the international organizations so far. We are facing the environmental problems and the world Summits on environment are helping in finding ways to halt the destruction of irreplaceable natural resources and tackle pollution of the planet. It forced environmental issues to the top of political agendas and forced recognition of the importance of policies that achieve environmental, social and economic gains simultaneously, rather than trying to balance one against the other. A number of issues had been discussed like climate change, biodiversity loss, water scarcity, infectious diseases, poverty, reduce vehicle emissions, congestion in cities and the health problems caused by polluted air and smog, reducing global green house gas emission, environmental degradation and many more which affected the lives of the people. Different summits discussed varied environmental problems and provided the solutions or alternatives to tackle these problems.

15.5 GLOSSARY

United Nations (UN): The organization was established on 24 October 1945 after World War II with the aim of preventing another such conflict. At its founding, the UN had 51 member states; there are now 193. The headquarters of the UN is in Manhattan, New York City. Further main offices are situated in Geneva, Nairobi, and Vienna.

Millennium Development Goals (MDGs): MDGs were the eight international development goals for the year 2015 that had been established following the Millennium Summit of the United Nations in 2000.

Protocol: The records or minutes of a diplomatic conference that show officially the agreements arrived at by the negotiators.

Rio+ 20: From June 13 to 22, 2012, 45000 participants from governments, the private sector, non- governmental organizations, and major groups met in Rio De Janeiro for the Rio+ 20 United Nations Conference on Sustainable Development.

Convention: A formal agreement between country leaders, politicians, and states on a matter that involves them all.

15.6 LESSON END EXERCISE

1. What were the main objectives of Stockholm Conference?

2. Describe the functions of UNEP.

3. Discuss Agenda 21 of Rio De Janeiro earth summit 1992.

4. What were the outcomes of Montreal protocol?

5. Explain Rio + 20 in detail.

6. Discuss the UN Sustainable Development Summit 2015 and what development goals were set up in the summit.

7. List the diverse issues debated in the Earth Summits.

15.7 SUGGESTED FURTHER READINGS

1. Agarwal, K.C. (2001). Environmental biology. Bikaner, India: Nidi Publication.
2. Basu, M. & Savarimuthu SJ, X. (2017). Fundamentals of environmental studies. Bengluru, India: Cambridge University Press.
3. Miller, T. (2014). Environment science. Boston, USA: Cengage Learning.
4. Rajagopalan, R. (2015). Environmental studies: From crisis to cure. USA: Oxford University Press.
5. Sinha, J. (2011). Environment science. Delhi, India: Galgotia Publications.

LESSON NO. 16	UNIT - IV

GLOBAL WARMING - CAUSES AND CONSEQUENCES

16.0 STRUCTURE

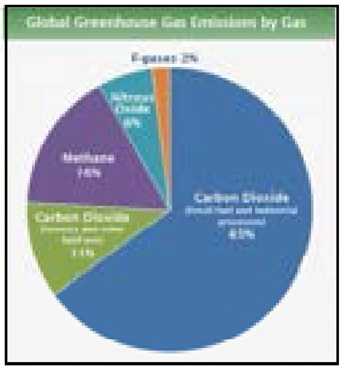
16.1 INTRODUCTION

Global warming means a gradual increase in the average temperature of the earth's atmosphere and its oceans, a change which is believed to be permanently changing the earth's climate. The scientific consensus on climatic changes related to global warming is that the average temperature of the earth has risen between 0.4^0 and 0.8^0C over the past 100 years. The increased volumes of carbon dioxides and other green house gases released by the burning of fossil fuels, land clearing, agriculture and other human activities are the primary source of the global warming that has occurred in last 50 years. Scientists from intergovernmental penals on climate carrying out global warming research have recently predicted that average global temperatures could increase between 1.4 and 5.8^{0}C by the year 2100. In other words, global warming may be defined as the rise in the mean global temperature to a level, which effects the life form on the earth surface. The factors responsible for this warming may be both natural and manmade. Global warming by natural factors is not an unusual phenomenon. The earth' climate is variable, for example 18000 years ago, the temperature of the earth was 5^0 C cooler than it is today, that was the last glacial period on the earth, thereafter the temperature rose.

Under normal conditions i.e. normal green house gases, The earth surface temperature is maintained by the energy balance of the sun's rays that strike our globe and the heat that is radiated back into the space. However, when the percentage of these gases exceeds the normal value in the atmosphere, the thick layer of this gas prevents the terrestrial heat from being re- radiated back into the surface. Actually these green house gases function like the glass panels of a green house, allowing the short wave solar radiations to pass through but preventing the heat inside the house from passing out in outer space . In other words these gases are transparent for incoming solar radiation but opaque for long wave terrestrial radiation.

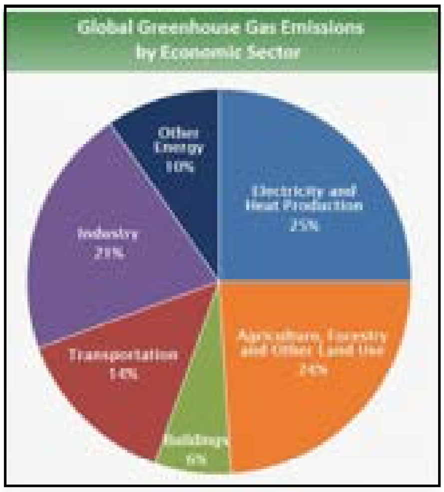
The earth is kept warm due to green house effect, without it the earth would be frozen waste land. The short wavelength radiation or ultra violet radiation coming from the sun penetrates the atmosphere and is absorbed by the earth. The absorbed energy is radiated back to the space as long wave or terrestrial waves. The earth's atmosphere contains gases, which trap some of the outgoing radiation and these warm the earth. These gases are known as green house gases like water vapours, carbon dioxide, methane, nitrous oxide, CFC are prominent examples. To maintain the global energy balance, both the atmosphere and surface will warm until outgoing energy is equal to the incoming energy. The increase in the quantity of green house gases in the atmosphere leads to the global warming. After the industrial revolution, the rate has increased about 0.5 to 1.0^{0}C since the last century. The rate of global warming for the last quarter was greater than the any previous period since 1880.

Fig : 16.1



Source: IPCC 2014 based on global emission from 2010

Fig : 16.2



Source: IPCC 2014 based on global emission from 2010

16.2 OBJECTIVES

After going through this lesson, you shall be able to explain:

1. Explain the global Warming.
2. Describe green house effect.

3. Discuss the role of green house gases in global warming.
4. Explain the different causes of global warming.
5. State the impacts of global warming.
6. Discuss the different measures to prevent global warming

16.3 CAUSES OF GLOBAL WARMING

Global warming is primarily a problem of too much green house gases in the atmosphere which act as a blanket, trapping the heat and warming the planet. As we burn fossil fuels like coal, oil and natural gas for energy or cut down and burn forest to create pasture and plantations, carbon content accumulates and overloads our atmosphere. Certain waste management and agricultural practices aggravate the problem by releasing other global warming gases such as methane and nitrous oxide.

Increase in the concentration of green house gases such as Co_2, Methane (Ch_4), chloro flouro carbons (CFCs), nitrous oxide(N_20)and Ozone(O_4) in the atmosphere lead to the global warming.

16.3.1 Carbon Dioxide:

Carbon dioxide is the largest contributor to the global warming as it has the largest share among the green house gases in the atmosphere. It is to be noted that half of this additional carbon dioxide is absorbed by the oceans and plants; the remaining 50 percent is present in the atmosphere. Increasing concentration of carbon dioxide in the atmosphere is due to the human activities. The major source of increased carbon dioxide is the combustion of fossil fuels such as coal, gas, oil and burning of natural vegetation. It has been estimated that carbon dioxide level has increased by 25 percent since 1850. Carbon dioxide blocks the outgoing radiation from the earth and contributes in global warming.

There are both natural and human sources of carbon dioxides emissions. Natural sources include decomposition, ocean release, respiration and volcanoes. Human sources come from activities like cement production deforestation and burning of fossil fuels. About 87percent of all human carbon dioxide come from burning of fossil fuels like coal, natural gas and oil. Other sources include deforestation (9 percent) and industrial processes such as cement manufacturing (4 percent). Before the influence of humans, carbon dioxide levels were quite steady because of natural balance (carbon sink). Since the industrial revolution, human sources of carbon dioxide emissions have been growing. Activities such as burning of fossil fuels as well as deforestation are the primary cause of increased carbon dioxide in the atmosphere.

16.3.2 Methane:

Methane gas is found in small amount in the atmosphere under natural condition. Methane is very absorbent of earth's radiation. It is about 20 times more effective than carbon dioxide. The main source of methane which is released in the atmosphere which contributes in the global warming are livestock rairing, combustion of cowdung, rice cultivation, industries , mining, natural gas, land fills and swamps.

Swaps and rice fields are thought to be contribute about 25-30 percent in the world production. Asia is the largest contributor of methane production because about 90 percent of the world paddy fields exist in Asia and about 60 percent of these are found in India and China.

Methane has both natural and human sources, while humans create the majority of total emissions .the main natural source includes wetlands, termites and oceans. Important human sources come from landfills, paddy cultivation, livestock farming as well as production, transportation and use of fossil fuels. Human caused emissions have increased greatly since the industrial revolution. Activities such as paddy cultivation, Fossil fuel production and intensive livestock farming are the primary cause of increased methane concentrations in the atmosphere.

16.3.3 Chloroflourocarbons:

The chloroflourocarbons, popularly known as CFCs, belonging to category of chemicals synthesised by man for use in several kinds of industries including refrigeration, are relatively simple compounds of elements chlorine, fluorine and carbon. These are initially stable compounds which do not have any toxic effect on the life processes in the bio sphere at ground level. These synthetic chemicals are widely used as propellant in spray can dispensers, as fluids in the in air conditioners and refrigerators, as blowing agents in the insulation foams (stryfoam) and industrial solvents . It is estimated that about more than 25 percent of the total world production of chloroflourocarbons is used to propel 'personel care products' such as deodorants, hair spray, shaving creams and numerous other cosmetic products.

The emissions of chloroflourocarbons in aerosol and non aerosols form from aerosols spray cans, air conditioners, refrigerators, foam plastics, fire extinguisher, cosmetic goods etc. into the troposphere and their transport to stratosphere, increase the concentration of chloroflouricarbons. The chloroflorocarbon further broken down by the by the ultraviolet solar radiation and depletes the stratosphere ozene layer. Thus the ozone depletion caused by the increased concentration of chlorofluorocarbon would adversely affect the global climate, biotic communities and human beings.

16.3.4 Nitrous oxide

It is another important greenhouse gas which depletes the ozone layer and contributes in the global warming. Nitrous oxide is released by the bacteria acting on the nitrogen fertilizers in soils and runoff water. Different means of transport are also source of atmospheric nitrous oxides. Though this greenhouse gas is present in small quantity but is better absorbers of long wave radiation than carbon dioxide and is more effective at increasing the green house effect.

16.4 EFFECTS OF GLOBAL WARMING:

Global warming has far reaching, long lasting and in many cases devastating consequences for the planet earth. Global warming is the gradual heating of earth's surface, oceans, and atmosphere is caused by the human activity mainly burning of fossil fuels that pump the carbon dioxide, methane and other green house gases . the major impacts of global warming are as under:

16.4.1 Increase in average temperatures and temperature extremes:

One of the important effects of global warming is the increase in the temperatures around the world. The average global temperature has increased by 0.80Cover the past 100 year. According to NASA and NOAA data 2016 was the 0.990C warmer than the average across the entire 20th century. Before 2016, 2015 was the warmest year on the record and before 2015, 2014 was the warmest year.

16.4.2 Extreme weather events:

It is another effect of global warming. While experiencing some of the hottest summers on record, much of the united states has also been experiencing colder than normal winters.the change in climate can shift the boundary between cold north pole air and warm equatorial air south and bringing with it cold arctic air. Due to global warming intensive hurricanes will occur like typhoon Haiyan in Philippines in 2013. Lightening is another weather feature that is affected by the global warming, number of lightening strikes has been increased.

16.4.3 Ice melt:

One of the main impact of climate change is the ice melt. North America, Europe and Asia have all seen a trend toward of less snow cover between 1960 and 2015. According to nation Snow and Ice Data centre, there is 10 percent less permafrost or permanently frozen ground in the northern hemisphere as compared to 1900s. There is less ice in the arctic sea due to global warming. There is less thick sea ice that persists for multiple years. That means less heat is reflected back into the atmosphere by shiny surface of the ice and more is absorbed by the darker oceans. According to U.S. Geological Survey, there are only 25 glaciers bigger than 25 acres found in Montana's Glacier National Park, where about 150 glaciers were found.

16.4.4 Sea level and ocean Acidification:

Generally, as Ice melts, sea level rise. In 2014 World Meteorological Organisation reported that sea level rise accelerated 0.12 inches (3 millimeter) per year on average worldwide. This is around double the average annual rise of 0.07inch (1.6 mm) in 20th century. Melting polar ice in the Arctic and Antarctic regions, coupled with melting ice sheets and glaciers across Greenland , north America south America Europe and Asia are expected to raise the sea levels significantly. Global sea levels have rised about 8 inches since 1870 and this rate of rise wil be more in the coming years. Sea level is not the only thing changing for oceans due to global warming. As levels of carbon dioxide increase, the oceans absorb some of the gas which increases the acidity of the seawater. Since the industrial revolution began in early 1700s, the acidity of oceans has increased about 25 percent, according to E.P.A. If current ocean acidification trend is continue, coral reefs are expected to become rare in the areas where they are common including most U.S. water. In 2016 and 2017, portions of the great Barrier Reef in Australia were hit by Bleaching.

16.4.5 Plants and Animals

The effects of global warming on the ecosystem are expected to be profound and widespread. Many species of plants and animals are already moving their range to the northward or to the higher latitudes as a result of warming of temperature. Additionally , migratory birds and insects are now arriving in their summer feeding and nesting grounds several days or weeks earlier than they did in the 20th century. Warmer temperatures are also expanding the range of many disease which were once confined to tropical and sub tropical areas.

16.4.6 Social Effects:

Global warming has also influenced the human society. Agricultural systems will likely to crippling blow. Though the growing season in some areas will expand, combined with impacts of draught, severe weather, lack of accumulated snowmelt, greater number and diversity of pests, lower ground water table and loss of arable land could cause severe crop failures and livestock shortage worldwide

16.5 MEASURES TO PREVENT GLOBAL WARMING:

The Global Warming attributed is to green house effect caused by increased levels of carbon dioxide, chloro flouro carbon (C F C) and other pollutants. These are following ways in which amount of these gases can be reduced in the atmosphere:

- In order to achieve comprehensive and systematic promotion of the measures to prevent t global warming, basic policies relating to basic directions and actions by each government body shall be established.
- Observation and monitoring of changes in the concentrations of Green House Gases (GHGs) shall be conducted and comprehensive measures to prevent global warming shall be established and implemented
- The Government should strive to improve energy appliances through the top runners

approach to establish fuel efficiency targets for automobiles and energy efficiency standards for household electrical products and office appliances.

- Reduction in energy consumption for heating and cooling for housing and other buildings. Financial incentives should be offered for energy efficient housing and buildings. In addition, the standards for energy efficient construction material should be improved.

- The Government should provide guidance to factories and business sites regarding the efficient use of energy

- The government should improve traffic and reduce traffic congestion. Bypass and round abouts should be improved in order to smooth traffic flow. Government should conserve green spaces, increasing greenery securing water sources inside urban areas and promoting absorption of rainwater into the ground.

- Distribution systems should be enhanced through promoting rail and coastal shipping instead of road transport. The Government should promote public transport to reduce carbon dioxide emissions. Specifically, bus service should be improved for smoother connections and railroad should be promoted through construction of new lines, increase in speeds and improvement in railroad capacity. Streetcars and new transportation systems should be promoted.

- Energy conservation measures in industrial sector should be promoted by the development and diffusion of new energy efficient technology such as high efficiency industrial furnaces and next generation high efficiency boilers. In addition, energy conservation measures in the commercial/ residential sector should be promoted through the development and diffusion of light emitting diodes and development of energy efficient housing and building.

- The use and development of clean energy and low emission vehicles should be promoted. In addition the use of high efficiency vehicles should be promoted on a large scale to address the global warming.

- To reduce the carbon dioxide emissions, it is necessary to construct nuclear power plants and increase the share of electrical power supplied by nuclear power plants.

- New alternatives for refrigerants, cleaners and foaming agents should be developed.
- Methane emissions can be reduced by introducing measures to decrease emissions caused by waste in the landfills and measures to reduce emissions from agricultural industry by farm and management and establishing technology to reduce methane emissions from livestock raising.
- Nitrous oxide emissions can be reduced by incinerating waste material, waste water sludge, etc. at high temperature incineration facilities

16.6 LET US SUM UP

Global warming is the slow increase in the global temperatures due to increase in the green house gases in the atmosphere. After considering all the aspects of the global warming, one can conclude that It is a problem that can be prevented by the efforts of government and public as well. The government of various countries, developed and developing, restrict the human activities that add carbon dioxide gases to the atmosphere. In order to reduce the additional carbon dioxide and other green house gases the environmental scientists should suggest eco friendly technologies and non conventional sources of energy such as nuclear energy, wind energy. People should use public transport to reduce carbon dioxide emissions like buses, rails and other forms of transport.

The government should improve conditions roads of and reduce traffic congestion. Bypass and round about should be improved in order to smooth traffic flow. Government should conserve green spaces, increasing greenery securing water sources inside urban areas and promoting absorption of rainwater into the ground.

The carbon dioxide emission can be reduced by individual efforts like replacing the bulbs by fluorescent light bulb, by drive less and , less use of hot refrigerators and heaters , by avoiding products with lot of packaging, plant trees turn of electronic devices.

16.7 CHECK YOUR PROGRESS

Notes: (a) Write your answers in the space give below.
(b) Check your answers with the above subsections.

1. Define Global Warming?

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2. Name different green house gases.

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3. Name different factors of global warming ?

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4. What is the impact of global warming on sea level?

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16.8 LESSON END EXERCISE

1. Define global warming. Explain its causes.
2. Write a detailed note on global warming.
3. Discuss causes and impacts of global warming

16.9 SUGGESTED FURTHER READINGS

1. Savindra Singh, Climatology, Prayag Pustak Bhawan, 20-A, University Road, Allahabad 211 002.

2. D.R Khullar, Physical geography, published by Mrs Usha Raj Kumar for Kalyani Publishers, New Delhi, 110 002.

2. D. S. Lal, Climatology, Sharda Pustak Bhawan, 11, University Road Allahabad 211 002.

4. P. D. Sharma, Ecology and Environment, published by Rakesh kumar Rastogi for Rastogi publications, Gangotri' Shivaji Road Meerut.
5. Dr. S. D. Santra, Environmental Science, New central book agency (p) Ltd, Web Offset Division Daulagarh, Sankrail, howrah.S