1

MAHARASHTRA: MAJOR RELIEF FEATURES, RIVERS AND CLIMATE

After going through this chapter you will be able to understand the following features.

Unit Structure:

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- 1.2 Introduction
- 1.3 Subject- Discussion
- 1.4 Major relief features of Maharashtra
 - 1.4.1 Hill ranges
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1.1. OBJECTIVES

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

• The location and distribution of major relief features of Maharashtra

- The flow of major rivers and their tributaries in Maharashtra
- Climate of Maharashtra with reference to its variation in temperature and rainfall distribution.

1.2. INTRODUCTION

The State of Maharashtra was formed on 1st May 1960. The movement by Sanyukta Maharashtra Samiti led to the division of the Bombay State into Gujarat (speaking Gujarati and Kutchhi) and Maharashtra (speaking Marathi and Konkani through Bombay Reorganisation Act, 1960 enacted by the Parliament of India on 25 April 1960. The act came into effect on 1 May 1960. Mumbai is the Capital of the state and financial capital of the country as it contributes to the highest revenue earning deposits to the country. Presently the state has 36 districts as Palghar has been formed as the new district of the state carved out from Thane district on 01st August 2014.

* Location and Size:

i) The absolute location is given with reference to latitude and longitude extent of any area. Thus the absolute latitudinal and longitudinal extent is $15^{0}44$ to $22^{0}6$ north latitudes and $72^{0}36$ to $80^{0}54$ east longitudes of Maharashtra State.

ii) Relative location is explained with reference to its neighbouring area in different directions. Thus state of Maharashtra is confined with land boundaries of Madhya Pradesh to its north, Chhattisgarh to its east, Telangana to its south east, Karnataka to its south, Goa to its south west and, the natural water front boundary of Arabian Sea to west, Dadra and Nagar Haveli (union territories) and Gujarat state to its north-west

iii) Size: Size is explained with reference to its total area and extent. Thus total area of Maharashtra state is 3,07,690 square kilometres (sq.km). Its length (north-south extent) is 720 km. and its breadth (east-west extent) is 800 km. Its total coastline along Arabian Sea is 720 km. while its land boundary with all the neighbouring state is km. When compared with the share of its land and population to India it is 9.36 % of land area and 9.29% share of population (2011 Census). It is the third largest state in terms of land area and second largest populated state of the country.

1.3. SUBJECT DISCUSSION

Relief features also play an important role in determining the climate and drainage system of a region. The consolidated interaction effect of these elements get reflected and recognised in its landscape cover of varied natural vegetation in a region.

The State of Maharashtra is bestowed with great relief features ranging from mountain and hills; peaks and cliffs; ghats and valleys; plateaus; river and coastal plains; beaches and creeks. Its drainage system in the form of large rivers with its tributaries and rivulets; springs, ponds and lakes provide with fresh water resources. The state has **tropical monsoon climate with seasonal rains** as heavy as over 400 cm in some regions. Warm summer starts from March onwards up to late October, while winters are mild. Let us discuss these above mentioned aspects in detail as under:

1.4. MAHARASHTRA RELIEF

- **5.4.1. Introduction: Physiographically** the state of Maharashtra largely comprises of three broad divisions:
- a) The Mountain range of Sahyadri's or Western Ghats
- b) The Plateau region of Deccan
- c) The Coastal Plain of Konkan
- a) The Mountain range of Sahyadri's or Western Ghats: is the mountainous faulted and eroded edge of the Deccan Plateau. The average elevation in this mountain is 1000 to 1200 meters above mean sea level. The Sahyadri mountain range runs parallel to the Arabian seacoast. There are many offshoots branching eastwards from the main Sahyadri ranges such as Satmala, Ajanta, Harishchandra, Balaghat and Mahadeo hills. Its highest peak is Kalsubai at an altitude of 1650 meter. Most of the rivers in Maharashtra originate in the Sahyadri that forms the water-divide to produce eastward and westward flowing rivers. These ranges are also characterised by a number of ghats (passes), the important ones being Thal, Bor, Kumbharli, Amba, Phonda and; Amboli from transport view point since ancient times.



Fig: Sahyadri main water divides

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Geography of Maharashtra

- **b)** The Plateau region of Deccan: In the north the plateau is flanked by Satpura ranges, which run in the East-West direction in Maharashtra. It is important to note that a large area of Maharashtra state is a highland of Deccan plateau formed by the volcanic activity and the subsequent cooling down of the lava. The rocks are of igneous type mainly basalt and granite. The altitude of the plateau varies from 450 to 750 meters. Important cities of this region are Pune, Nagpur and Solapur.
- c) The Coastal Plain of Konkan: Konkan coastal region is a narrow plain that stretches from the states of Gujarat to Kerala lying to the west between the Arabian Sea and the western ghats of the Sahyadri range. This coastal strip is barely 50 km in width which is wider in the north and narrows down to the south. The coastline is dissected by the branches of Sahyadri's and wave-cut platforms that form river creeks up to the coast.
 - The Konkan coastal plains of the State extend from Daman in the north to the Terekhol creek in the south for about 750 km to the west of Sahyadri.
 - The important creeks in Konkan from north to south are Vaitarna, Thane, Dharamtar, Dabhol, Rajapuri, Vijaydurg and Terekhol.
 - The Konkan coastal districts of Maharashtra are Palghar, Thane, Greater Mumbai, Raigad, Ratnagiri and Sindhudurg.
 - Konkan coastal lowland is just 20 to 40 km in width in the southern districts of Ratnagiri and Sindhudurg districts. While the northern districts of Thane and Palghar have relatively wider **coastal lowland** with 80 to 100 km. width. The relief of this lowland is dominated and interspersed with numerous scattered low hills.
 - Greater Mumbai is an island with Salsette largely coalesced by reclaiming the low-lying area of the sea.
 - The Konkan coastal region is marked by hilly and narrow valleys, highly dissected with transverse ridges of the Western Ghats and at many places extending as promontories, notches, sea caves, embayment, submerged shoals and offshore islands.



Fig: Major hill ranges and Rivers in Maharashtra

1.5. MAJOR RIVERS AND RIVER SYSTEM OF MAHARASHTRA

1.5.1. Drainage system: Tapi, Godavari, Bhima and Krishna are the main rivers of the state. About 75% area of Maharashtra is drained by eastward gently flowing rivers of the Godavari and Krishna into the Bay of Bengal. Other 25% area is drained by westward flowing rivers of Narmada and Tapi ; and short-swift flowing Konkan Rivers rising from cliffs of Sahyadri viz: Ulhas, Savitri, Vashishthi and Shastri flowing into the Arabian Sea.

The rivers of Konkan rise from the cliffs of Sahyadri and have a short swift flow into the Arabian Sea. Some important rivers are Ulhas, Savitri, Vashishthi and Shastri. Geography of Maharashtra **Climatically** the State of Maharashtra overall enjoys tropical monsoon type of climate which is hot and humid for most part of the year. Maharashtra receives its rainfall mainly from south-west monsoon. The rainfall in state varies considerably **with** as heavy as over 400 cm in some regions. There is heavy rainfall in the coastal region, scanty rains in rain shadow areas in the central part and moderate rains in eastern parts of the state. The state however experiences four seasons:

- i) The Summer season from March to May
- ii) The rainy season from June to September
- iii) The Post monsoon season from October to November iii) The Winter season from December to February
- **1.4.3 Physiographically** this state may be divided into three natural divisions –
- 1. the coastal strip (the Konkan), consists undulating low lands.
- **2. the Sahyadri** or the Western Ghats, running almost parallel to the sea coast.
- 3. a. the plateau
- b. The Shambhu Mahadeo, Harischandra-Balaghat and AjantaSatmal mountain ranges, again divide Deccan plateau region into three subdivisions separating:

Krishna basin

Bhima basin

Godavari basin

Tapi-Purna basin

1.4.4. The major relief features of Maharashtra are as follows: 1. <u>The</u> <u>Sahyadri Range:</u>

- The Western Ghats of Maharashtra known as the 'Sahyadri' mountain ranges have an average elevation of 1000-1200 m above the MSL.
- It **extends** from near the Tapi mouth to much further beyond the southern limits of the state.
- The Sahyadri hills run southwards, parallel to the seacoast, with many offshoots **branching eastwards** from the main ranges, for example, Satmala, Ajanta, Harishchandra, Balaghat and Mahadeo.
- The **slopes** of the Sahyadri gently descend towards the east and southeast.
- The Western Ghats are not true mountains, but are the faulted edge of the Deccan plateau and are believed to have been formed during the

break-up of the super continent of Gondwana some 150 million years (mya) ago.

- The **special features** are the hills of Trimbakeshwar, Matheran and the Mahableshwar plateau.
- Its highest peak is Kalsubai at an altitude of 1650 m., near Igatpuri. The other important peak is Salher (1567 m) situated about 90 km north of Nasik.
- A number of **spurs and ridges shoot off** to the west and descend down to the sea often forming rocky headlands and promontories jutting into the sea.
- Most of the **rivers** in Maharashtra **originate in the Sahyadri** and then divide to join the eastward and westward flowing rivers.
- These ranges are also characterised by a number of ghats, the important ones being Thal, Bor, Kumbharli, Amba, Phonda and Amboli.
- The **Ghats** are a succession of steep hills, periodically bisected by narrow roads. Most of the famous hill stations of the state are at the Ghats.
- The Western Ghats form one of **the three important watersheds** of India, from which many South Indian rivers originate, like Godavari, Bhima, Koyna and Krishna.

Rank	Name	Elevation in meters	Mountain Range	District	Significance
1	Kalsubai,	1,646	Kalsubai Range	Ahmednagar / Nasik	Highest point in Maharashtra
2	Salher	1,567	Selbari Range	Nasik	Highest fort in Sahyadris and the 2nd highest peak in Maharashtra
3	Dhodap	1472	Satmala Range	Nasik	2nd highest peak in Nasik
4	Taramati	1,431	Malshej Range	Ahmednagar	This is one of two peaks on Harishchandragad.
5	Saptashrungi	1,264	Satmala Range	Nasik	It is a site of Hindu pilgrimage
6	Torna	1,403	Pune Range	Pune	It is the first fort captured by Shivaji Maharaj in 1643

• List of Maharashtra Mountains and Peaks

7	Purandar	1,387	Pune Range	Pune	It is the birthplace of Sambhaji Raje Bhosale son of Shivaji Maharaj
8	Mangi-Tungi	1,331	Selbari Range	Nasik	Only twin- pinnacled peak with plateauin between.
9	Rajgad	1,318	Pune Range	Pune	Formerly known as Murumdev, it was capital of the Maratha Empire during the rule of Chhatrapati Shivaji Maharaj for almost 26 years, after which he moved the capitalto Raigad.
10	Sinhagad	1,312	Pune Range	Pune	Location of the renowned Battle of Sinhagad.
11	Ratangad	1,297	Malshej Range	Ahmednagar	2nd highest peak in Ahmednagar.
			-		
12	Brahmagiri	1,295	Trimbakesh war Range	Nasik	Site of origin of the sacred Godavari river is near Trimbak.
12	Brahmagiri Anjaneri	1,295	Trimbakesh war Range Trimbakesh war Range	Nasik Nasik	Site of origin of the sacred Godavari river is near Trimbak. According to Hindu scriptures, it is the birthplace of Lord
12	Brahmagiri Anjaneri	1,295	Trimbakesh war Range Trimbakesh war Range	Nasik Nasik	Site of origin of the sacred Godavari river is near Trimbak. According to Hindu scriptures, it is the birthplace of Lord Hanuman and thus is named after his mother
12 13 14	Brahmagiri Anjaneri Pratapgad	1,295 1,280 1,080	Trimbakesh war Range Trimbakesh war Range Satara Range	Nasik Nasik Satara	Site of origin of the sacred Godavari river is near Trimbak. According to Hindu scriptures, it is the birthplace of Lord Hanuman and thus is named after his mother Significant as the site of the Battle of Pratapgad, the fort is now a popular tourist destination.

Geography of Maharashtra

2. Maharashtra Plateau:

- Other than the Western Ghats and the Konkan coast, the remaining portion of Maharashtra is a land of the high plateau of the Deccan, having a latitudinal and longitudinal extension of 15° 44-21° 40' N and 73° 15'- 80° 33' E respectively.
- This region includes the entire state of Maharashtra except the Konkan coast and the Sahyadris.
- It starts form the Sahyadri ranges in the west and slopes gradually east wards to Nagpur.
- It is separated from the Konkan coastline by 'Ghats'.
- From the east of Sayadris, hills like Satmal, Ajanta, Harishchandra, Balaghat and Mahadeo stretch across the Maharashtra Plateau towards east with a decreasing height in the same direction. Between these ranges lie the valleys of Godavari, Bhima and Krishna rivers.
- The plateau is therefore divided into different units such as the
- i. Ajanta hills the Godavari valley
- ii. The Balag hat plateau the Bhima basin.
- iii. The Mahadeo uplands and the Krishna basin.
- In the north the plateau is flanked by Satpura ranges, which run in the East-West direction in Maharashtra.
- The river Narmada flows along the north boundary of Maharashtra, and other major rivers like Krishna, Godavari, Bhima, Penganga-Wardha, and Tapi-Purna have carved the plateau in alternating broad river valleys and intervening highlands.
- The plateau character and the topography, which is a dominant physical trait of the state, owe its origin to the cooling down of the lava during the periods of volcanic activity.
- Much of the region except the eastern part of WardhaWainganga basin and a small littoral patch in Ratnagiri is underlain by basaltic rocks of the Deccan Trap.
- Important ridges on Plateau:
- The Mahadeo range branches off from the main ridge at about 18° N and runs towards south east.
- Another ridge named Harishchandra Ghat lies in its western part while Balaghat range in the east.
- These ridges are characterised by extensive plateaus on their top.

- The Mahabaleswar and Panchgani Plateau lie on the Mahadeo Hills whereas Ahmadnagar Plateau lies on the Balaghat range.
- Further north of the Harishchandra Ghat range, from west to east runs a series of detached hill masses known as the **Ajanta range**. At its eastern extremes this ridge has again divided itself into two spurs. The southern one passing through the Parbhani and Nanded districts called the **Nirmal range**. The northern one passing through the Yavatmal district is known as the **Satmal range**.
- On the top of the Ajanta-Satmal range lies the Buldhana plateau of western Vidharbha and Malegaon plateau closer to Sahyadri range.
- Although the Satpura range lies mostly outside the northern limits of the state its sharp crested ridge occurs in the west in Dhule district and as **Gawilgad** hills in the northern part of Am ravati.
- Toranmal is a small plateau which rises to 1 150m.
- The highest peak is Astamba Donger 1325m. It overlooks the Tapi valley.
- The southern slopes of these ranges fall abruptly from the height of about 1200 m. To below 300 m.
- The cliffs run in ENE direction.
- The linear trend of the scarp face indicates that faulting was partly responsible for the formation of this scarp.

1.5. THE DRAINAGE SYSTEM OF MAHARASHTRA

* Maharashtra's **topography** is traversed by river systems draining as far as to the Bay of Bengal Sea in the east and as short and swift flowing rivers to the west into the Arabian Sea.

□ There is concordance between underlying structure and drainage of the region. The direction of the flow of the streams is well adjusted to the structural features and water divides of the Deccan plateau (Padhye 1963).

* The river Narmada flows along the north boundary of Maharashtra. River Krishna, Bhima, Godavari and WardhaWainganga flow towards east and south east cutting through the plateau region to develop well defined river valleys of the state. However Tapi and its tributary Purna are exception as they flow towards west through a rift valley. These are the lifeline of Maharashtra.

The west flowing rivers of Konkan region due to steep slope of the Sahyadri's have formed many swift flowing streams that end up as estuaries.

1.5.1. The river system of Maharashtra can be broadly divided five major systems, such as:

- 1. The rivers of the Konkan
- 2. The Krishna-Bhima system
- **3**. The Godavari system
- 4. The Tapti-Purna System 5. The Wardha system

1. <u>The rivers of the Konkan or the West flowing rivers of the</u> <u>Western Ghats</u>

- The Konkan coastland stretches south of the Tapti valley, along the Arabian Sea.
- It is flanked in the east by an escarpment known as the Sahyadri Mountain or the Western Ghats.
- The foothills of the Sahyadri Mountains reach within 6.4-km of the Arabian Sea in the Konkan.
- The Konkan coastland is narrow, interspersed with hilly spurs from the Sahyadri Mountains and is drained by many small swift west-flowing rivers of these, the Ulhas in the north is the biggest.
- Characteristics of the Konkan rivers are as follows:
- The rivers of the Konkan are not significant in their length and catchment area as compared to rivers to Maharashtra Plateau.
- They are swift flowing and short in length.
- They have their sources in the Western Ghats with lengths varying between 50 km. to 155 km.
- They flow generally parallel to each other.
- Maharashtra has more than 11 important west flowing rivers including Damanganga, Surya, Vaitarna, Ulhas, Savitri, Kundalika, Patalganga, Vashisti, Shastri, Karli, Terekhol etc.
- There are numerous smaller rivers joining the creeks
- These rivers contribute to about 44.54% of the yield at 75% dependability of Maharashtra
- Development of large dams over these rivers has not occurred due to their geographical location, difference in elevation, smaller valleys and weaker economies

- a. North Konkan rivers
- b. Central Konkan rivers
- c. South Konkan rivers
- a. The major rivers of North Konkan area are as follows:
- 1. The Damanganga river:
- The Damanganga river rises in the Sahyadri hill ranges near village Ambegaon in Dindoritaluka of Nasik district of Maharashtra State at an elevation of 950 m above MSL and traverses a total distance of about 131 km before it drains into the Arabian Sea.
- The important tributaries of the Damanganga river are Dawan, Shrimant, Val, Rayte, Lendi, Vagh, Sakartond, Dongarkhadi, Roshni and Dudhni.
- The Damanganga basin drains total area of 2331 sq km in Maharashtra State, Gujarat State and the Union Territories of Dadra, Nagar Haveli (DNH) and Daman & Diu before it drains into the Arabian Sea.

2. Vaitarna basin

- Vaitarna is the principal river of Thane district.
- The river Vaitarna is one of the west flowing rivers in the region North of Mumbai and South of the Tapi river.
- It rises in the Tryambak hills in the Nashik district opposite the source of Godavari and enters Thane at Vihigaon near Kasara.
- It has a length of 154-km.
- The river rises in the Sahyadri hill range in the Nasik district of Maharashtra State and after traversing a distance of about 171 km in Maharashtra joins the Arabian Sea.
- The principal tributaries of river Vaitarna are Pinjal, Surya and Tansa.
- The Pinjal river which is a tributary of Vaitarna river flows entirely in Maharashtra State.

3. Ulhas River

- The Ulhas River is one of the West Flowing Rivers in Maharashtra falling into the Arabian Sea.
- The Ulhas basin lies between North latitudes of 18° 44' to 19° 42' and East longitudes of 72° 45' to 73° 48'
- The Ulhas with a course of 130 km is the longest river of the Konkan coast.

• It rises in the ravines of Bhor Ghat and forms an amphitheatre like basin near Mumbai.

- The boundary of the basin consists of the main Sahyadri hills on the East, Westerly off shoots on the North and South and on the West, a narrow opening at the end leading to the sea.
- It flows in western direction and enters into Thane as well as Raigad district.
- In its course, it meets River Barvi.
- It gets emptied in Bombay Harbour.
- Its significant tributaries are- Bhatsa, Kalu and Bharvi rivers.
- The Ulhas drains an area of 4,637 sq km which lies completely in Maharashtra. The Thane, Raigad and Pune districts fall in the basin. The Ulhas rises from Sahyadri hill ranges in the Raigad district of Maharashtra at an elevation of 600m above M.S.L. The total length of this West flowing river from its origin to its outfall in to the Arabian Sea is 122 km.
- The important tributaries of the Ulhas River are Pej, Barvi, Bhivapuri, Murbari, Kalu, Shari, Bhasta, Salpe, Poshir and Shilar. The Kalu and Bhasta are the major right bank tributaries which together accounts for 55.7% of the total catchment area of Ulhas

b. <u>The major rivers of Central Konkan areas are as follows:</u>

1. Patalganga river

• Patalganga River rising through western scraps is present in Matheran uplands and then branches off through main ridge and that is present near to the Khopoli and it maintaining the general westward flow it then joins Dharamatar creek, a wide estuary.

2. Amba river

- The river Amba originates in the Borghat hill of the Sahyadri ranges near Khopoli-khandala road at an altitude of about 554 m.
- Initially, the river flows in the South direction and then turns further into the North West direction till it joins the Arabian Sea in Dharmatar creek near village Revas.
- The total length of the river is about 76 kms before joining the sea.

3. The Kundalika river

• The river Kundalika, one of the west flowing rivers, in Maharashtra originates in the Sahayadri hills of the Western Ghats near the village Bhamburda • Initially the rivers flow in south West direction up to Patnus village and then turns to north-west till it joins the Arabian sea.

4. The Kal river

- The Kal River is one of the West Flowing Rivers in Maharashtra.
- This is a major tributary of the river Savitri.
- The Kal basin lies between North latitudes of 180 05' to 180 25' and East longitudes of 73 0 10' to 730 13' approximately.
- The Kal rises from Sahyadri hill ranges in the Raigad district of Maharashtra at an elevation of 652m above M.S.L.
- The total length of this West Flowing River from its origin to its confluence with the Savitri River is 40 km.
- The Kal River drains a total area of 670 sq km., in Raigad district of Maharashtra. This is an important tributary of the Savitri river on the right and accounts for 23% of the total catchment area of the Savitri Basin.

5. River Shastri

- Originates near Prachitgad, on the crest line of the Western Ghats, 17 Degrees 27' W and 73 Degrees 48' E on the western slopes of the Western Ghat complex in the Konkan region of Maharashtra, at an elevation of 839 msl.
- It falls entirely in the Ratnagiri district, covering three talukas of Sangameshwar, Ratnagiri and Guhagar.
- Its length is approximately 80 kilometers, with first 20 kilometers in hilly areas of severe slope.
- Basin area is 2173.55 square kilometres
- Tributaries of the river include rivers and rivulets of Gadgadi, Bav, Gad, Asavi and Gandagi which join Shastri at various points.
- It meets the sea at Jaygad,

6. Vashishti river

• The main part of Vashishti basin falls in Ratnagiri district and covers an area of 2233 sq kms, in the blocks of Guhagar, Dapoli, Khed and Chiplun

7. Savitri River

• Savitri River is one of the 5 rivers which originate from Mahabaleshwar in Maharashtra state in India.

• It originates in Mahabaleshwar and flows through Raigad district and eventually meets Arabian Sea at Harehareshwar.

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- It passes through Poladpur, Mahad, Mangaon and Shrivardhan tal u ks.
- In last 100 km it forms the border between Raigad and Ratnagiri.
- Its major tributary is the Kal River which enters from the right (north) near Dasgaon.

C. The major rivers of South Konkan areas are as follows: .

1. Kajavi River

- The Kajavi River rises in the Vishalghat region of Sahyadri hills and flows West ward and joins the Arabian Sea near Ratnagiri port where a 10 km. long creak named Bhatya Creak has been formed.
- During monsoon, tidal effect is felt up to village Hercheri that is about 25 km. from the mouth of river.
- The nature of Bed is sandy mixed with gravels.

2. The Gad river

- The Gad Basin lies between North latitude 160 to 160 20' and East longitude 73° 30' to 74° approximately.
- The Gad River is another West Flowing Rivers in Maharashtra falling into Arabian Sea
- The Gad drains an area of 890 sq km which lies completely in Sindhudurg district of Maharashtra.
- The Gad rises from the Sahyadri hill ranges in the Sindhudurg district of Maharashtra at an elevation of 600m above M.S.L.
- The total length of the River from its origin to its outfall into the Arabian Sea is 66 km.
- The important major tributary of the Gad River is Kasal.
- The Kasal River joins river Gad near the village Chunavara.
- During monsoon, tidal effect reaches up to this village.
- The Kasal River accounts for 20.8% of the total catchment area of the Gad.
- □ Other Konkan rivers are as follows:

a. Bhogeshwari

• The river Bhogeshwari rises in the Western ghats near village Bhogeshwari, District- Raighad of Maharashtra at an altitude of about 228.6 m above the sea level.

- The river flows in the West direction through the Taluka- Pen and merges in the Dharmtar creek near village Antora.
- The total length of the river is about 40 kms. before joining the sea.

b. The Mithi River:

- The Mithi River is known by the name of Mahim river and it is situated at Salsette Island and this is the place where Mumbai city is located.
- River is the combination of Tail Island and that has been discharged through Vihar and Powai Lakes.
- It is regarded as the seasonal river as fed in monsoons.
- It rises through valley that is located adjacent to Sanjay Gandhi Park and gets merged in Arabian Sea, present at the Mahim Creek.
- Oshiwara River originates through Aarey Milk colony and then it gets cut into Goregaon hills that is present across Milk colony and this would happen before getting emptied into Malad creek.

2. The Krishna-Bhima system

□ Krishna River:

- The Krishna River rises in the Western Ghats at an elevation of 1337m north of Mahabaleshwar, near the Jor village, district Satara, about 64-km from the Arabian Sea and flows for about 1400-km and outfalls into the Bay of Bengal.
- The Ghataprabha, the Malaprabha, the Bhima, the Tungabhadra and the Musik are the principal tributaries joining Krishna. Krishna Basin extends over in three states with an area of 258,948 km2, which is nearly 8% of the total geographical area of the country.
- The basin lies in the states of Karnataka (113,271 km2), Andhra Pradesh (76,252 km2) and Maharashtra (69,425 km2). Krishna River has a catchments area of 25.9 m.ha.
- Most part of this basin comprises rolling and undulating country except the western border, which is formed by an unbroken line of ranges of the Western Ghats.
- The important soil types found in the basin are black soils, red soils, laterite and lateritic soils, alluvium, mixed soils, red and black soils and saline and alkaline soils.
- An average annual surface water potential of 78.1 km3 has been assessed in this basin.

3. The Godavari system:

□ Godavari River:

- This is one of the main river of Maharashtra as well as of central India.
- It originates from Western Ghats Timbakeshwar in Nashik district, at the elevation of 1067m and flows for a length of about 1 ,465-km, eastwardly across the Deccan plateau through the state of Maharashtra, before falling to Bay of Bengal.
- It runs from western to southern India.
- It is India's second largest river after the great Ganga.
- It is considered to be one of the big river basins in India.
- The basin lies in the states of Maharashtra (152,199 km2), Andhra Pradesh (73,201 km2), Madhya Pradesh (65,255 km2), Orissa (17,752 km2) and Karnataka (4,405 km2).
- □ The Pravara, the Purna, the Manjra, the Indravati, the Wainganga, the Wardha, the Pench, the Kanhan, the Kolab and the Penganga are the major tributaries of the river.
- The peculiar characteristic of the river Godavari is that it receives most of its water not from the Western Ghats but in the lower reaches. The Manjira, the Pranahita, the Indravati and Sabari contribute 6%, 40%, 20% and 10% of the waters respectively.
- □ Godavari Basin extends over an area of 312,812 km in five states, which is nearly 9.5% of the total geographical area of the country.'
- Godavari River has a catchments area of 31.3 m.ha.
- □ The following table shows:

Particulars of the Principal Tributaries of Godavari

River	Source	Sub- tributaries	length (Km.)	Catchment area (sq.km.)
1	2	3	4	5
Pravara	Western Ghats	Mula	200	6,537
Purna	Ajantha Hills		373	15,579
Manjira	Balaghat	Tima, Kanaya	724	30,844
Penganga	Buldana range	Pus, Arns, Aran	676	23,895

- □ The Godavari basin consists of large undulating plains divided by low flat-topped hill ranges.
- \Box An average annual surface water potential of 110.5 km3 has been assessed in this basin.
- □ The important soil types found in the basins are black soils, red soils, lateritic soils, alluvium, mixed soils and saline and alkaline soils.
- □ Vishnupuri Prakalp', Asia's largest Lift irrigation project is constructed on the river just 5 km away from Nanded city.

4. The Tapi-Purna System

- □ Tapti River is a river in central India.
- Tapi River rises from a place with an elevation of 752m near Multai in the Betul district of Madhya Pradesh.
- It is one of the major rivers of Indian peninsular with a length of around 724 km. before falling out into the Arabian Sea through the Gulf of Cambay.
- It is India's only third river which flows from east to west after the Narmada River and Mahi River.
- The river rises in the eastern Satpura Range of Southern Madhya Pradesh state, and flows westward, Madhya Pradesh's Nimar region, Maharashtra's Khandesh and to the south Gujarat before emptying in Gulf of the Cambay of the Arabian Sea.
- The major tributaries of Tapti Rivers are Purna, Girna, Panjhra, Vaghur, Bori, and Aner. are the principal tributaries of Tapi.
- Tapi Basin extends in three states with over an area of 65,145 km2, which is nearly 2.0% of total geographical area of the country.
- Though smaller than Narmada, Tapti is a rich source of alluvium and produces good agricultural soil
- An average annual surface water potential of 18 km3 has been assessed in this basin.

5. Wardha:

Wardha is the tributary of River Godavari.

- It originates from the Mutai plateau of the Satpura range and flows along the entire northern and western border of the Wardha district.
- The main tributaries are Bor, Dham, Pothra, Asoda and Wunna.

• Upper Wardha Dam is situated at Simbhora, 8-km towards the East from Morshi and 56-km from Amravati. It is build up on the Wardha River. It is an earthen dam with height of 36m and 7-km length and on the boundary of Amravati and Wardha Districts.

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- Its irrigation capacity is nearly 75,000 Hectors of land in these two districts.
- A tourism centre is being developed at this site. It is now named as Nal Damyanti Sagar.

1.5.2. The Other Important Tributaries I. Manjira

- Major tributary of Godavari, arising in Balaghat hills.
- It contributes to around 6% of the total waters of Godavari.
- Manjira River flows along the eastern boundary of the Nanded district towards the north. Later it meets the Godavari.
- Manyad and Lendi are the tributaries of the river.

II.Mula And Mutha

• Pune centre is bordered on the north by the River Mula and to the west by the River Mutha - the two join in the Northwest to form the Mutha-Mula, at Sangam Bridge (previously Wellesley Bridge).

III.Penganga

- Penganga River is one of the tributaries of Godavari River.
- Kayadhu is the tributary of this river.
- It flows along the northern boundary of the Nanded district and a huge amount of land is irrigated by a project named " Upper Penganga Prakalp" built on this river.
- The famous Sahastrakund falls on this river.

IV.Rivem Pumna

- The river Purna which is tributary of Godavari, rises in Betul district of Madhya Pradesh and flows due west across Akola district into Buldana district of Maharashtra.
- It passes from east to west through the northern part of the Parbhani district and joins the Godavari at Kantheshwar in Purna Taluka.
- The chief tributaries of the Purna on the south bank are the Pendhi, Uma, Katepurna, Nirguna and Man.
- The Katepurna, the largest of all tributaries, rises within a few kilometres of Washim and flows across the eastern side of Akola tehsil and the north-western corner of Murtizapur.

• Major Dams on the Purna River are Yeldari Dam (Hydroelectric Power Station) in Jintur Tehsil of Parbhani district.

V.Pench And Kanhan:

• The chief rivers of the eastern tract are the Pench and Kanhan,

both of which flow down from the Saptura range in the

Chindward district and meet near Kamptee when they are also

joined by the Kolar.

- The Kanhan entering the Jalna district near Bargaon takes a south easterly course past Khapa to Kamptee where it receives the Pench and Kolar.
- □ In its subsequent course it marks the boundary of the Ramtek tehsil, and after receiving the Nag river near the hills of Bhivakund, finally empties into the Wainganga at Gondpipri in Bhandara.

VI.Mira:

- □ It is an important **tributary of Bhima River**.
- □ It flows along the northern boundary of Satara district and latter southeastwards.

VII.Sina:

□ A **tributary of Bhima River**, it flows from north to southeast parallel to Bhima, drains eastern Karmala, Central Madha, Barshi, eastern Mohol and Sholapur North and South.

VIII.Wainganga:

- □ Wainganga is the tributary of River Godavari.
- □ Wainganga River receives numerous tributaries on either bank and drains the western, central and eastern regions of the Chandrapur and Nagpur district.
- □ The chief tributaries of the Wainganga are Garhavi, Khobragadi, Kathani and Potphondi on the left bank and Andhari on the Right Bank.

IX.Nira:

□ Nira a **tributary of Bhima River** and it flows in southern boundaries of Pune for a considerable distance.

1.6. CLIMATE OF MAHARASHTRA

The location of Maharashtra, in the western part of India, has accorded the state with a **tropical monsoon type of climate** as it receives a heavy rainfall during the monsoon season with the hot summers and chilly winters. The State experiences **four seasons** during a year. March to May is the summer season followed by rainy season from June to September. The post monsoon season is October and November. December to February is the winter season.

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1.6.1 Influence of physical features on climate of Maharashtra:

- □ The Western Ghats hill ranges that run north to south separates the coastal districts of Thane, Mumbai, Raigarh, Ratnagiri and Sindhudurg from rest of the State. The average height of these ranges is about 1000 m above msl form an important climatic divide.
- Arabian Sea located to the west of Maharashtra has a strong influence on the temperature of the Konkan region of the state. It is observed that the range of temperature is less in the coastal region while it is more in the areas away from the coast as in Nagpur.
- The other major relief category is the plateau which is a part of the Deccan tableland.

1.6.2 Temperature variation

- Maharashtra has got variable climate from continental to typical maritime depending upon the location and physiography.
- The coastal districts of Konkan experience heavy rains but mild winter.
- The weather, however, is mostly humid throughout the year.
- The maximum and minimum temperature varies between 27°C and 40°C & 14°C and 27°C respectively.
- The maximum summer temperature varies between 36°C and 41°C and during winter the temperature oscillates between 10°C and 16°C.
- The average annual temperature of Maharashtra remains 25°C to 27°C in most regions. However, the annual temperature varies in different regions of Maharashtra as it is influenced by different geographical factors.
- **1.6.3.** <u>Temperature variation in few selected districts of Maharashtra:</u> A few districts representing maritime and continental region of Maharashtra are considered here to observe the differences in temperature variation as under:
- 1. **Thane District:** The district is located in the windward side of the Sahayadri mountain / western ghats that experiences moderate to heavy rainfall distributed over 4 months of a year (from June to September)
- Coastal / maritime district of the state experiences average daily maximum temperature in summer at 32.9 °C (maximum recorded at Dahanu is 40.6 °C on 19 April 1955) and in winter average mean daily minimum temperature is 16.8 °C (minimum recorded at Dahanu is 8.3 °C on 8 January 1945).

• But in the interior parts of the district, the average daily minimum temperature is slightly lower in the winter season and the average daily maximum temperature is higher in the summer.

2. Ratnagiri district

- Coastal / maritime district of the state during summer season experiences rise in temperatures from March to May. May is the hottest month.
- However during June with the onset of the monsoon, temperature drops by three to four degrees.
- In the post monsoon months of October and November, day temperatures increase as hot as in May. Winters are short and mild from late November to February. Winters night temperatures are the lowest in January.
- Areas within 20 to 25 kilometres from the coast are the most pleasant particularly in the hot months with the sea breeze blowing, nearly throughout the day.
- Further inland (distantly located from the coast) during the hot months both days and nights can be oppressive and more so in the tract at the foot of the Western Ghats. Along the coast the maximum temperature rarely goes beyond 38°C but in the interior may reach 40° or 41°C.

3. The district Satara

- It is a continental district located on the leeward side of the Sahyadri's/Western Ghats popularly known as rain-shadow area receiving low to scanty rainfall.
- The cold weather starts by about the end of November and continues to about the middle of February, December being the coldest month.
- In this season the mean daily maximum temperature in the plains is 28.4 °C while the mean daily minimum temperature is 14.4 °C.
- At Mahabaleshwar the mean daily maximum temperature in December is only 23.1°C and the mean daily minimum is 13.8°C.
- The period from the middle of February to the end of May is one of continuous increase in temperatures. The rise in temperatures is more marked in the plains than on the hills.





Fig: Range of temperature, Maharashtra

- May is the hottest month in the year and the mean daily maximum temperature in the plains is 36.8°C.
- The day temperatures in the south-west monsoon months are even lower than in the cold season.
- After the withdrawal of the south-west monsoon, day temperatures show an increase in October.
- At Mahabaleshwar the highest maximum temperature ever recorded was 36.1° C on April 3, 1934 and the lowest minimum was 3.9° C on February 1, 1942.

4. The district Aurangabad

- Cold weather commences by about the end of November when temperatures begin to fall rapidly. December is the coldest month of the year with the mean daily maximum temperature at 28.7°C and the mean daily minimum at 13°C.
- In the cold season the district is sometimes affected by cold waves in association with the eastward passage of western disturbances across north India, when the minimum temperature may drop down to about 2° C to 4° C
- □ From the beginning of the month of March there is a rapid rise in both day and night temperatures.

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- \Box May is the hottest month of the year with the mean daily maximum temperature at 39.8° C and the mean daily minimum at 24.4° C.
- \Box During the hot season the heat is often intense and the day temperatures on individual days may rise to about 45° C to 46° C.
- □ The highest maximum temperature ever recorded at Aurangabad was 45.6° C on 25th May 1905.
- \Box The lowest minimum temperature was 22° C on 2nd February 1911.



Fig: Maharashtra rainfall distribution

1.7. RAINFALL DISTRIBUTION IN MAHARASHTRA

- Rainfall starts in the first week of June and July is the wettest month. Rainfall in Maharashtra differs from region to region.
- The State experiences extremes of rainfall ranging from 6000 mm over the Ghats to less than 500 mm in Madhya Maharashtra.
- The Konkan sub-division comprising of coastal districts and Western Ghats receive the heaviest rains, the Ghats receive more than 6000 mm and the plains 2500 mm.

- Rainfall decreases rapidly towards eastern slopes and plateau areas where it is minimum (less than 500 mm).
- It again increases towards east i.e. in the direction of Marathwada and Vidarbha and attains a second maximum of 1500 mm in the eastern parts of Vidarbha.
- Thus, the Madhya Maharashtra sub-division is the region of the lowest rainfall in the State.
- The State receives its rainfall chiefly during the south west monsoon season (June to September) while Konkan receives almost 94% of the annual rainfall during the monsoon season.
- The other sub-divisions namely Madhya Maharashtra, Marathwada and Vidarbha receive 83%, 83% and 87% respectively during this season.
- The numbers of rainy days have great significance in artificial recharge to ground water.
- These vary from 75 to 85 in Konkan and 30 to 40 days in Madhya Maharashtra and Marathwada.
- The number of rainy days in Vidarbha is around 40 to 50 days during south west monsoon season.
- The intensity of rainfall plays a vital role in artificial recharge to ground water.
- In general, the intensity of rainfall is high in coastal and Ghat areas as compared to the other parts of the state.
- The intensity of rainfall varies from storm to storm and with occurrence of depression and low-pressure areas during monsoon season.
- The variability of annual rainfall over the state in general, is high.
- Only in the coastal areas, the variability is less than 20% otherwise the variability ranges between 20% and 35% over the state.
- □ On sub-divisional basis, the variability of annual rainfall in Konkan is the least (23%) while it is the maximum in Marathwada (31%).
- \Box In Madhya Maharashtra and Vidarbha the variability is 30% and 26% respectively.
- □ The total annual rainfall varies in different regions.
- □ The annual rainfall of the state can vary from 400 6000 mm and occurs for 3 4 months in a year
- □ The following table shows the average annual rainfall of Maharashtra

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Geographical Regions	Annual Rainfall
Konkan coast	3005 mm
Madhya Maharashtra:	901mm
Marathwada	882 mm
Vidarbha:	1,034mm



Fig: Maharashtra rainfall

- □ Maharashtra is divided into different regions on the basis of distribution of rainfall.
- **a. Regions of heavy rainfall:** The western slopes of Sahyadri and the mountain top receive very heavy rainfall like Mahabaleswar (620 cm), Amboli (750 cm.), Matheran (520 cm).
- **b. Regions of more rainfall:** All along the coastal strip of Konkan in Palghar, Thane, Raigad, Ratnagiri and Sindhudurg districts receive rainfall about 200-400 cm. Similarly the eastern slope of Sahyadri i.e. western parts of Pune, Satara and Kolhapur districts also fall in this region receiving the same amount of rainfall.
- **c.** Regions of moderate rainfall: The narrow part of western Maharashtra to the east of Maharashtra that is spread in the north-south direction and the Bhandara. Chandrapur, Gadchiroli districts receive moderate amount of rainfall.

- **d. Region of low amount of rainfall:** Western Maharashtra, Marathwada, Khandesh of Vidarbha receive very little rainfall (50-100cm) hence fall in this category.
- e. Extremely less amount of rainfall: Here rainfall is very scanty and not reliable and the amount is less than 50 cm. It reflects draught prone area of Maharashtra. Part of Sangali, Satara, Pune, Ahmednagar and Solapur district fall in this region.



Fig: Konkan receives maximum rainfall

1.8. TEMPERATURE VARIATION AND RAINFALL VARIATION IN DIFFERENT SEASONS OF MAHARASHTRA

□ <u>Summer</u>

- □ Summer in Maharashtra starts in the month of March and ends in May with the temperatures being the highest.
- □ The months of March, April and May are regarded as the hottest months. These months also witnesses thunderstorms all over the state which is a relief from the scorching heat.

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- □ During this time, the **temperature varies between 22°C-39°C.** Cities like Pune though is not characterized by extreme heat witness unbearable humidity during the daytime making the temperatures reach above 40°C.
- Coastal areas like Mumbai experience high level of humidity making the precipitation rate of 242. 2 cm annually.
- While Amravati region in Maharashtra experience hot and dry summers and mild and cool winters, Nagpur experience hot summers with the temperature rising up to 49°C and cool winters going down to 10°C.
- The South western parts of Maharashtra like Kolhapur and Sindhudurg, summer is less hot though it is more humid.

□ <u>Monsoon</u>

- Maharashtra experiences a decent spell of rainfall every year.
- In Maharashtra, monsoon starts in the first week of June with July being the wettest month. While August also gets rain, September witnesses the retreat of monsoon.
- The maximum amount of rain is received by Konkan and Eastern Vidarbha region while the central region of the state receives less rainfall.
- In districts of Thane, Ratnagiri, Raigad and Sindhudurg rainfall is around 3000 mm while in other districts of Nasik, Pune, Ahmadnagar, Dhule, Satara, Sangli, Jalgaon, Solapur and parts of Kolhapur receive moderate to less rainfall of 500 to 700 mm.
- While Nagpur region witness's heavy rainfall, Amravati region also heavy rainfall for three to four months from the south Westerly monsoons.
- Mumbai region also receives heavy monsoon of 2,200 mm, often resulting in floods.

□ Winter

- Winter in Maharashtra starts in the month of November and it persists till February.
- During this time, the state witness clear skies, pleasant weather and gentle breeze. The average temperature during this time is between 12°C-25°C. However, the eastern region of Maharashtra receives slight rainfall with the temperature varying between 12°C-34°C. The winter in North Western regions and hill stations in Nasik is cold and dry.
- The temperature varies from 4°C 28°C. In cities including Mumbai, winds blowing from North are cold and provide a chilling effect during the winter with the day temperature of 27°C and the night temperature of 15°C.

- □ In the month of January, the climate becomes foggy. While cities like Pune experience extreme cold, areas like Nagpur too experiences chilling cold with the temperature going down to 12°C.
- □ However, south western regions like Kolhapur experience pleasant winter compared to Pune and Nasik.

□ Spring

- □ Though not in the real sense of the term, the duration between the middle of January to March are regarded as the spring in Pune and in the nearby hill stations like Lonawala and Khandala.
- □ During this time, the area witness pleasing weather and bright and warm sunrays. The temperature and the climate are moderate with a slight but negligible humidity.

1.9. RAIN SHADOW ZONE OF MAHARASHTRA

A **rain shadow zone** is a dry area on the leeward side of a mountainous area (away from the wind). The mountains block the passage of rain-producing weather systems and cast a "shadow" of dryness behind them.



Fig: Rain shadow zone

The above diagram shows the incoming warm and moist air is drawn by the prevailing winds (windward direction) towards the top of the mountains, where it condenses and precipitates before it crosses the top. When the air, without much moisture left, advances further to the other side of the mountains it is almost dry without any moisture and so the other side is called as the "rain shadow" region as it hardly receives any rain. The Maharashtra: Major Relief Features, Rivers and Climate part of Maharashtra that lies to the east of Sahayadri is known as rain shadow zone as the amount of rainfall is very low here.

As Maharashtra is situated in the west coast of India it receives rainfall from the south west monsoon winds during the months June to September. Normally south west monsoon reaches Maharashtra in the first week of June. The south west monsoon comes from the Arabian Sea from the south west direction and hence there is heavy rainfall in the entire Konkan region of Maharashtra. But the amount of rainfall decreases as we move from south to north.

The monsoon winds while moving towards east are obstructed by the hill ranges of Sahyadri. These winds are then forced to rise up along the western hill slopes of the Sahyadri. Temperature decreases as air rises in the upward direction and condensation takes place. As a result clouds are formed which give heavy rainfall at the hill tops of Sahyadri for e.g. Amboli (750 cm), Mahabaleswar (620 cm), Matheran (510 cm)

When the monsoon winds cross the Sahyadri air descend in the downward direction and become warm. As a result its capacity to hold moisture decreases and so the amount of rainfall decreases to 25 to 30 cm.

The rain shadow zone of Maharashtra includes part of Pune, Ahmadnagar, Satara, Sangli, and Solapur, districts. These districts receive about 25 to 30 cm. Monsoonal rainfall being unreliable and uneven this region experiences acute shortage of water.

From the rain shadow zone the Monsoon winds move towards east to Vidarbha-Nagpur. The amount of rainfall is slightly more about 150 cm. Winds coming from the Arabian Sea and Bay of Bengal converge at Vidarbha and so the amount of rainfall increases in this region.

1.10. SUMMARY

After going through chapter we have learnt that the state of Maharashtra lies to the western coastal state of India. It is surrounded by Goa and Karnataka states in south, Telangana in southeast, Gujarat, Dadra and Nagar Haveli, and Madhya Pradesh in north, Chhattisgarh in east, and the Arabian Sea in west. Maharashtra has an extensive mountain range running parallel to its 840 km long coastline. This range is geographically part of the Sahyadri's in the Western Ghats which forms a crest along the western edge of the Deccan plateau separating it from the coastal Konkan belt. Throughout its extent it bears some renowned peaks, hill stations and valleys. Parts of the Western Ghats have been designated as the Hottest Biodiversity Hotspots.

Dominant physical trait of the state is its plateau character which is formed by volcanic eruption and covered by basalt rock. Physiographically this state may be divided into three natural divisions - the coastal strip (the Konkan), the Sahyadri or the Western Ghat and the plateau. The Konkan region consists of steep slopes and deep valleys with undulating low lands and presence of numerous creeks and rivers. The major physical characteristics of the state include many small plateaux and river valleys.

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The rivers of Konkan rise from the cliffs of Sahyadri and have a short swift flow into the Arabian Sea. Some important rivers are Ulhas, Savitri, Vashishthi and Shastri.

Main Rivers of the state are Krishna, Bhima, Godavari, TapiPurna and Wardha-Wainganga. These rivers have carved the plateau in alternating broad river valleys and intervening highlands. Maharashtra is known for its tropical monsoon climate due to which the summers are really hot and humid starting from March with the monsoons arriving during the month of June. The state receives a heavy rainfall of 400 cm owing to the western sea clouds. Even the windward side of the Konkan region is responsible for the heavy rainfalls that make the atmosphere pleasant. In Sahyadri region, the rainfall is limited to only 70 cm with the Solapur-Ahmednagar being the dry regions. The Marathwada and Vidarbha areas receive the rainfall a little later in the season.

1.11 CHECK YOUR PROGRESS/ EXERCISE

1. State whether the following statements are true or false.

- a) The Maharashtra State receives its rainfall chiefly during the south west monsoon.
- b) It is surrounded by Goa and Karnataka states in north.
- c) The most interesting part of the topography of Maharashtra is the presence of the Western Ghats and the Deccan Plateau.
- d) The Maharashtra plateau is hilly, narrow, highly dissected with transverse ridges of the Western Ghats and at many places extending as promontories, notches, sea caves, embayment, submerged shoals and offshore islands.
- e) The important peaks in Konkan are Terekhol, Vijaydurg, Rajapuri, Raigad, Dabhol, Daramthar, Thane and Vasai.
- f) Maharashtra is traversed by river systems draining into the Bay of Bengal and the Arabian Sea.
- g) There is concordance between underlying structure and drainage of Maharashtra region.

2. Fill in the blanks

- a. Tapi and its tributary Purna flow towards west through a valley.
- b. The rivers of Konkan flow generally ______ to each other.
- c. Wardha is the tributary of River

- d. Maharashtra is surrounded by in southeast, Dadra and Nagar Haveli, and Madhya Pradesh in north.
- e. is the western coastal region, between the Western Ghats and the sea.
- f., which was a part of the princely state of Hyderabad until 1956, is located in the south-eastern part of the state. is the main city of the region.
- g. Maharashtra State is bounded by North latitude ______and

and East Longitudes 72°30' and 80°30'.

3. Multiple choice questions.

a. The slopes of the Sahyadri gently descend towards

I.The east and south-east. II.The north and north-east III.The south and south- west IV.The east

- b. Most of the rivers in Maharashtra originate in the I.Eastern Ghats
- II.Sahyadri

III.Deccan plateau

IV.Satpura hills

c. The Ghats are a succession Lof Steep plateaus

II.of steep ridges

- III.of steep hills
- IV.of steep valleys
- d. The coast line of Maharashtra is dissected by I.river creeks and branches of the Sahyadri II.rivers and plateaus

III.river creeks and rift valleys

IV.river creeks and branches Satpura hills

e. The Western Ghats are not true mountains, but are I.the faulted edge of the Deccan plateau

II.the faulted edge of the coastal plain

III.the faulted edge of the Godavari basin

IV.the faulted edge of the Eastern Ghats

4. Answer the Following Question

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- 1. State major relief features of Maharashtra and describe any one of them.
- 2. Write a short note on mountains and mountain peaks of Maharashtra
- 3. What are the major rivers of the Konkan in Maharashtra?
- 4. What are the major river basins of Maharashtra? Describe the course and tributaries of any one of them.
- 5. What type of climate is found in Maharashtra? What is the influence of physical features on climate of Maharashtra?
- 6. Describe rainfall distribution in the state of Maharashtra.

1.12. TASK

- 1. In a map of Maharashtra locate the Sahyadri, the Maharashtra Plateau and the Konkan coast.
- 2. In a chart state the mountains and mountain peaks of Maharashtra.
- 3. In a map of Maharashtra point out
- (i) river Godavari (ii) river Tapti (iii) Mahabaleswar, Mumbai, Thane and Nasik

1.13 GLOSSARY

- **Ghats:** The **Ghats** are a succession of steep hills, periodically bisected by narrow roads.
- **Coastline** : outline of the coast
- **Drainage Basin:** The area of land that is drained by a river and its tributaries.
- Watershed: The boundary of a river basin is called the watershed
- Estuary: A drowned river valley in a coastal lowland area. Occurs near or at the mouth of a river, where the tide meets the current and the fresh and salt waters mix.
- **Tributary:** A stream or river that feeds into a larger watercourse.
- Upstream: Opposite to the currents flow towards the source of the river
- **Rain:** Precipitation in the form of liquid water drops that have diameters greater than 0.5 mm, or, if widely scattered, the drops may be smaller.

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- **Southwest Monsoon:** The south-westerly wind flow, occurring over most parts of India. The Indian Seas give rise to southwest monsoon over India from June to September.
- **Temperature:** The temperature of a body is the condition which determines its ability to communicate heat to other bodies or to receive heat from them. Meteorologists are interested in the temperature of the air, of the soil and of water bodies. Temperature is measured by means of a thermometer.
- **Plateau:** A topographic feature consisting of a large flat area at a relatively high elevation with steep sides.

1.14. ANSWERS TO THE SELF LEARNING QUESTIONS

1 .c. true

1 .d.false, coastal region

1.e. false. Creeks

1.f. true

1.g. true

2.a. rift

2.b. parallel

2.c. Godavari

2.d. Andhra Pradesh, Gujarat

2.e. Konkan

2.f. Marathwada, Aurangabad 2.g. 15°40' and 22°00'

3.a.I. 3.b.II 3.c.III 3.d.I 3.e.I



MAHARASHTRA SOIL AND NATURAL VEGETATION

After going through this chapter you will be able to understand the following features.

Unit Structure:

- 2.1 Objectives
- 2.2 Introduction
- 2.3 Subject- Discussion
- 2.4 Definition of Soil
- 2.5 Characteristics of Soil in Maharashtra
- 2.6 Classification and Distribution of Soils in Maharashtra
- 2.7 Problems related with soils of Maharashtra.
- 2.8 Methods of Conservation of Soil in Maharashtra
- 2.9 Natural vegetation
- 2.10 Functions of Forest
- 2.11 Classification of forest
- 2.12 Problems associated with forests of Maharashtra.
- 2.13 Summary
- 2.14 Check your Progress/ Exercise
- 2.15 Answers to the self learning questions.
- 2.16 Technical words and their meaning
- 2.17 Task
- 2.18 References for further study

2.1. OBJECTIVES

By the end of this unit you will be able to –

- Understand the definition of soil.
- Know the Characteristics of soil.
- Know the classification, distribution and problems related with soil of Maharashtra.
- Understand the functions of Forest and classification, distribution and problems of Maharashtra forestry

Geography of Maharashtra

2.2. INTRODUCTION

In this chapter we will learn the components of soil and soil physical properties of soil. We will also study about the natural vegetation of Maharashtra and of the state. The problems and measures of soil conservation are also covered in this chapter.

2.3. SUBJECT DISCUSSION

Soils form the uppermost layer of the earth's crust. It is a mixture of loose rock particles and humus (organic matter). Soil serves as a source of food and moisture for plants. The technical term used for soil formation is **paedogenesis.** The type of soil and its fertility is determined by the following factors:

- a) Parent rock material.
- b) On the process of denudation that determines the texture, and size of rock particles.
- c) Relief and Climatic conditions that influence the degree and type of vegetation associated with its habitat.
- d) Consolidated effect of above mentioned aspects produces different types of soil, its degree of fertility, its composition and thickness of soil layer.

Forests form the repositories of invaluable gifts of nature in the form of biodiversity and by destroying these we are going to lose the biodiversity that may lead to ecological disequilibrium. Some of these species have marvellous economic or medicinal value. These storehouses of species which have evolved over millions of years would get lost due to soil pollution or destruction of forest by deforestation.

2.4. SOILS OF MAHARASHTRA

2.4.1 Introduction:

Soils form an important natural resource for agricultural and associated economic activities that favours economic development of a region. Agricultural development and food processing, pasture lands-livestock and dairying, forests and forest-based industries are all directly or indirectly dependent upon the availability of soils, its type, thickness and fertility levels.

Various geographical factors like the parent rock, climatic conditions, natural vegetation and its habitat, amount of organic material and presence of micro organisms determine the formation and type of soil. Soil provides nutrients to the plants. Plants are capable of taking nutrients from the soil through their roots.
Maharashtra Soil and Natural Vegetation

The relief and climate of Maharashtra is varied that has subjected 96.4 per cent of the states geographic area different degrees of erosion. A cross section of soil profile reveals that incidence of severe erosion is highest in the Western Ghats (53.1 percent) and relatively less in other lower parts of Maharashtra (11.5 percent).

2.5. CLASSIFICATION OF SOILS IN MAHARASHTRA

- The soil and vegetation of Maharashtra are related to the climate and the geology.
- Shallow, medium and deep-black soils are mostly found in the state of Maharashtra.
- The soil status of Maharashtra is residual, derived from the underlying basalts.
- In the semi-dry plateau, the regur (black-cotton soil) is clayey, rich in iron and moisture-retentive, though poor in nitrogen and organic matter.
- When re-deposited along the river valleys, the kali soils are deeper and heavier, better suited for Rabi crops.
- Further away, with a better mixture of lime, the morand soils form the ideal Kharif zone.
- The higher plateau areas have pather soils, which contain more gravel.
- In the rainy Konkan, and the Sahyadri Range, the same basalts give rise to the brick-red laterites, which are productive under a forest-cover, but readily stripped into a sterile varkas when devoid of vegetative cover.
- By and large, the soils of Maharashtra are shallow and of somewhat poor quality.



Fig: Maharashtra Types of Soil

Geography of Maharashtra **2.1. Broad classification of soils of Maharashtra**

No	Type of Soil	Region
1	Black cotton or Regur	River valleys of Godavari, Krishna and Bhima
2	Laterite	Sahyadri hill range of south Konkan in areas of Ratnagiri and Sindhudurg.
3	Coastal sandy alluvial soil	North Konkan coastal areas Palghar, Thane and Raigad districts
4	Red- Yellowish brown soil	In eastern Maharashtra areas of Chandrapur, Bhandara, and Sahyadri hill ranges
5	Coarse soil	Central Plateau region of Ajantha and Balag hat.
6	Brown, grey soil	River valleys of Wardha and Wainganga.
7	Saline Marshy soil	Along Creeks of Coastal region of Maharashtra.

2.6. DIFFERENT TYPE SOILS OF MAHARASHTRA

1. Black cotton or Regur soil:

- This type of soil is mainly found in the river valleys and plateau region to the east of the Sahyadri mountain range.
- Thick layer of this type of soil is mostly found in the river valleys.
- This soil is found at various districts viz. Jalgaon, Amravati, Vidarbha, Vardha and Gondia district. It is also found in the valley between Parbhani and Nanded district and in Krishna valley.
- The soil in the Deccan plateau, on the "Desh" region is made up of black basalt soil.
- The colour of this rock is black due the presence of magnesium and iron in it.
- Weathering of this rock has lead to the formation of black coloured soil i.e. Black soil or Regur soil.
- This type of soil is rich in humus.
- This soil is highly fertile. Soils found on hill tops are composed of sandy and stony material with murum.

- This soil is shallow natured and the thickness ranges from few to 50 cm.
- The soil is commonly known as the black cotton soil because it is best suited for the cultivation of cotton.
- The volcanic action which had taken place in the Deccan region has given rise to the soil texture and composition.
- These igneous rocks break down into the black soil which is very fertile.
- Black cotton soil is found in the regions having less than 100 cm of rainfall.
- In some of the regions of Western Maharashtra black cotton soil has been converted into Saline soil or Chopan soil due to excessive irrigation.
- This soil contains greater percentage of calcium and magnesium carbonate but lacks in nitrogen, potash, phosphate and organic matter.
- This soil is sticky and has the capability of retaining water for a longer period of time. Black cotton soil possesses peculiar characters such as, when it gets wet, it swells and become very sticky in nature while, when dry, it shrinks.
- This type of soil has a natural resistance to wind and water erosion because it is rich in iron and granular in structure. A very important advantage of this type of soil is that it can retain moisture. This makes the soil very reactive to irrigation.
- So, excessive irrigation is very harmful to this type of soil because the salts of the soils get deposited in the top layer hence making the soil salty. This again makes the soil useless for agriculture.
- Black cotton soil covers about 26.3 % of the areas of the Maharashtra state (Challa <u>et.al.</u>, 1995).

2. Laterite Soil

- Lateritic soil is formed by lateritic rock in high elevation.
- This type of soil is developed in the region having heavy rainfall followed by extensive dry period.
- This soil is very stony because of the presence of weathering fragments or iron concentration with acidic pH ranging 4.5-6.0.
- Lateritic soil possesses seldom organic matter.
- Lateritic soil is found in Mahabaleshwar, southern part of Mahabaleshwar, around Bhima Shankar and Matheran.
- It is useful for horticulture crops like mango, cashew, jackfruit etc.

Geography of Maharashtra

- The blocks of this type of soil are soft when they are extracted from the Laterite mines but become hard after they are exposed in the open air.
- These are known as "Chira" in Konkan and are used to construct houses and forts.

3. Coastal Sandy or Alluvial soil:

- Alluvial soils are formed by alluvium found at upstream region or nearby relief.
- Alluvial soil is dark brown in colour and several meters in depth.
- Rivers of Konkan originate in the western hill slopes of Sahyadri and move towards the west along the coast of Konkan to join the Arabian Sea. The alluvium brought by these rivers is deposited at their mouth along the coast and is known as the Coastal Sandy or Alluvial soil.
- It is also formed by erosion of sand bars and sedimentary platform rock by water wave, tide and heavy rain fall.
- The proportion of sand and mud is more in this type of soil.
- This soil is useful for the cultivation of food crops like rice. It is also used for coconut plantation and horticulture crops like mango, cashew etc.

4. Red-Yellowish brown soil

- Red-Yellowish brown soil is formed as a result of disintegration of granite, gneiss rocks along with basalt due to heavy rain.
- Soils are light to pale yellowish to in red colour as it contains greater proportion of sand and iron oxide.
- Soils are stony and non fertile.
- They are found in eastern Maharashtra especially in Wardha and Wainganga basins in Vidharbha and hill tops of Sahyadri in Palghar, Thane, and Raigad districts in Western Maharashtra.

5. Coarse soil

- The soil is found along the western part of the Deccan plateau where the amount of rainfall is more about 600 cm.
- The soil is also found Ajantha plateau, Balaghat and Mahadeo ranges.
- As the weathered material is washed away from the mountain top the thickness of the soil is less to the eastern side than the west. This type of soil is acidic in nature and has a low water retention capacity.

- For the above stated reason crops which require less amount of water like bajra, nachani etc. are grown in this soil.
- As this type of soil has low humus content it is not very fertile.

6. Brown-Gray Soil

- This type of soil is found in Wardha and Wainganga basins and formed due to disintegration of granite and gneiss rocks.
- The proportion of iron and potash is less but carbonate is more found in this soil.
- The soil is best suited for the cultivation of inferior type of millets.

7. Saline – marshy soil

- This soil is found in the creeks and coastal region.
- It is alkaline and proportion of salts is more.
- In semi arid climate of Maharashtra such as, Sangli, Satara, Solapur and Ahmadnagar we fine saline, alkaline and saline-alkaline soils.

2.7. PROBLEMS RELATED WITH SOILS IN MAHARASHTRA

Soil, one of the most valuable gifts of nature to mankind, should be utilized carefully. However, most of our present environmental problems originate from population explosion, unscientific and inappropriate technological applications, human greed that has caused ecological disturbances. The resultant impact of this human act is change in the physical and chemical properties of soils getting degraded as noticed below:

2.7.1. Problems associated with soils in Maharashtra: Deforestation and removal of top soil cover by soil erosion in uplands and siltation in lowlands, over-cultivation, overgrazing, and use of chemical fertilizers and salanization or alkalization of soils, insecticides and pesticides, industrial and automobile emissions of air-pollutants and acid rain are the major problems associated with soils of Maharashtra.

- Soil erosion by water is a major factor in Maharashtra.
- It is greater in the regions receiving short periods of heavy rainfall and is also accelerated by the absence of vegetation and undulating topography.
- □ Of total degraded land area accounts for about 198 lakh ha of which about 176 lakh ha is water eroded soils, and 16 lakh ha degraded forests remaining is salt affected, water logged soils, etc.

 \Box Being a coastal state, it is further susceptible to land degradation due to **the action of sea waves** and increased soil salinity as a result of the ingression of salts from coastal waters.

ii) Salinity

- □ The extent of **saline and alkaline soils** in Maharashtra has been estimated by the Agricultural Department and about 5.34 lakh ha of soils in the state are salt-affected.
- □ The satellite data reveals the existence of salt affected lands to the tune of 45,532 ha in Raigad, Kolhapur, Sangli and Thane districts.

iii) High deficiency in nutrients

□ Maharashtra's soils are highly deficient in nutrients when compared with the soils of other Indian states. They are lacking in phosphorous (P), potassium (K) and nitrogen (N), mainly because farmers in rainfed areas use very little fertilisers.

iv) Excessive use of water for irrigation

 \Box Further, excessive use of water for irrigation also leads to increasing salinity of soils. For example, in the Kolhapur region, due to the location of sugar mills, farmers started cultivating sugarcane which is a highly water intensive crop. However, the region's fine-grained black soils do not allow penetration of water, leading to a continuous build up of salt levels. It is estimated that after a single harvest of sugarcane, the soil salinity increases by 20 to 25 tonnes/ha. Excess salinity in the soil reduces the productivity of land.

- v) **Deforestation:** Tree roots hold soil particles and thus prevent soil erosion but deforestation increases soil erosion.
 - Desertification The spread of desert like conditions in the state due to man's influence or climatic change may be defined as Desertification
 - $\hfill\square$ Excessive cultivation
 - $\hfill\square$ Excessive and unbalanced use of fertiliser
 - \Box Wrong method of crop cultivation
 - □ Other factors like increase in urbanisation, industrial expansion, rural and urban migration, development of airport, highways, port, tourist places etc., are also responsible for the encroachment on the agricultural land.
 - Soil erosion caused by the open cast mining through its overburdens is a common phenomenon in the Western Ghats.

2.7.2. Conclusion

- As per the soil survey conducted by the National Bureau of Soil Survey and Land Use Planning (NBSSLP), about 94 percent of Maharashtra's geographic area is prone to water induced soil erosion.
- Water induced soil erosion cause **top-soil erosion** amounting to approximately 775 million tonnes / year in the state, thereby severely affecting the rural economy.
- The survey has revealed that over 86 percent land area in the Western Ghats and 75 percent in the Konkan Coast suffers from strong to severe soil erosion, resulting in annual soil loss of 20- 40tonnes/ha.

2.8. SOIL CONSERVATION

- Soil conservation is the prevention of soil loss from erosion or from its reduced fertility caused by over usage, acidification, salanization or other chemical soil contamination.
- Afforestation: The best way to conserve soil is to increase area under forests. By afforestation soil erosion may be checked as the trees keep the soil tight with their roots. In this method unplanned cutting of trees has also been checked.
- Scientific methods of cultivation: This method has been implemented in a number of areas to check soil erosion by unscientific cultivation. Contour farming is also introduced.
- Changes in our agricultural practices: We can save lot of our valuable soil by bringing about certain changes in our agricultural practices.
- **Grass filters:** This method is used to conserve soil and to reduce soil erosion along hill slopes. Trenches about 3 ft width are dug along the hill slopes. Grass is planted in these trenches which act as filters and obstruct moving of soil particles. Moreover, obstruction by grass also reduces the velocity of water which in turn controls soil erosion.
- **Contour trenches:** These trenches are dug along the contours of hill slopes. Here also, grass that is planted in these trenches along the contours act as filters and obstruct moving of soil particles in one hand and reduces the velocity of water which in turn controls soil erosion on the other. As these trenches are parallel to each other and along the contour lines they control soil erosion.
- **Control on gullies:** Barren slopes of the mountain are responsible for gully formation as well as erosion of land. This can be controlled by planting grass on the hill slopes. Grass roots hold soil particles and thus prevent soil erosion.
- Cultivation of grass: As growth of grass is faster and spreads over large areas it is planted along the slopes to prevent soil erosion.

- Planting trees near the banks of rivers and small streams: Karanj, Teak, Bamboo, Arjun etc. are planted near rivers and small streams to check soil erosion.
- **Terracing:** Hill slopes are cut into terraces or step like structures and trees are planted along the steps. These areas are again used for cultivation. Terracing has many advantages like greater percolation of water, soil conservation etc.
- Role of Maharashtra Government: The state's Agricultural department provides valuable information to the farmers about crops, seeds, conservation of water, soil etc., Plants are provided at concessional rates. Farmers are advised to take the advantages of these facilities.

2.9. NATURAL VEGETATION OF MAHARASHTRA

2.9.1. Introduction:

Forests play an important role in many aspects of human wellbeing. We know that the forests are one of the most **important natural resources** of the earth and about 1/3rd of the earth's total area is covered by the same. In India 02% of the country's geographical area is now under green cover (as per 2009 data) whereas the total forest cover in India is 6,90,899 km2.

2.9.2 Functions of forest.

- Sustainably managed forests fulfil a range of functions to the benefit of both ecology and economy of man.
- Forests are not only important as suppliers of wood but also play a vital role as protectors of soil, water, and climate. Forest's role as a protector flora and fauna is important too.
- As areas for recreation and relaxation for human beings, forests are important source of revenue earnings
- Forests are indispensable for the functioning of ecosystems.

2.9.3. Forests in Maharashtra

- Forests cover less than one-fifth of the state, Maharashtra. It is mainly confined in the Western Ghats, to their transverse ranges, the Satpura Range in the north, and the Chandrapur region in the east. On the coast and adjoining slopes, plant forms are rich with lofty trees, variegated shrubs, and mango and coconut trees.
- The forests yield teak, bamboo, myrobalan (for dyeing), and other woods.
- Thorny savannah-like vegetation occurs in areas of lesser rainfall, notably in upland Maharashtra.

- Subtropical vegetation is found on higher plateaus that receive heavy rain and have milder temperatures. Bamboo, chestnut, and magnolia are common.
- In the semiarid tracts, wild dates are found. Mangrove vegetation occurs in marshes and estuaries along the coast.
- The national parks of Maharashtra are full of variety of plant species that include Jamun, Palas, Shisam, Dhawada, Kalam, Saja/Ain, Bija, Shirish, Mango, Acacia spp, Awala, Kadamba, Moha, Acacia spp, Terminalia spp, Hedu, Ficus spp and many more.



Fig: Vegetation in Maharashtra

• Wild animals include tigers, leopards, bison, and several species of antelope. The striped hyena, wild hog, and sloth bear are common. Monkeys and snakes occur in great variety, as do ducks and other game birds. The peacock is indigenous. Many of those animals can be viewed at the state's national parks at Tadoba, Chikhaldara, and Borivli. The state's abundant marine life in the waters off the western coast remains largely unexploited.

2.10. CLASSIFICATION AND DISTRIBUTION OF NATURAL VEGETATION

1. Tropical evergreen forests:

• These are found in the regions having rainfall more than 200 cms. particularly in the hill tops of Sahyadri, Mahabaleswar and surrounding regions along the western slopes of Sahyadri. Various types of tall trees along with bamboos, creepers are found here.

Geography of Maharashtra **2. Tropical semi- evergreen forests:**

• These are found in the regions having rainfall 160 to 200 cms. in the border region of evergreen forests. A combination of deciduous and evergreen type of trees is found here.

3. Tropical monsoon forest or humid deciduous forest:

- These are found in the regions having rainfall 120 to 160 cms.
- These forests receive rainfall from monsoon between June and September. As a result availability of water in the forest is mainly for four months.
- Deciduous type of trees is found here.
- Trees shed their leaves in December and January and new leaves start growing on the onset of monsoon
- These types of forests are found in the Vidarbha Chandrapur, hills of north Konkan, Mahadeo range, Harishchandra range and Satmala range.
- Useful and valuable trees like teak, Indian rose wood, dalbergia, latifolia, crenulata are found in the monsoon forests.

4. Temperate evergreen forests:

- These are found in the regions having rainfall more than 100 cms. With cold climatic conditions.
- These are found in hill tops of Mahabaleswar, Panchagani, and Gavilgad hills.
- Trees like mango, jamun, hirda, behada and anjan are found in these forests.

5. Dry- deciduous forest:

- These are found in the regions having rainfall between 80 to 120 cms. especially in the Dhule district, Satpura hill ranges, and in the lower section of the Ghat.
- This forest appears green in the monsoon season but appears barren and leafless during winter.

6. Thorny forests:

- These are found in the regions having rainfall less than 80 cms.
- Tall grass and bushes along with the thorn trees are mainly found in these forests. For example, Khair, Babhool, Neem.

7. Mangroves and swamps:

- These are found in the coastal areas especially in the tidal range (zone between high and low tides).
- These plants can survive in the saline water of the sea.
- As these plants grow in the marshes, some roots of these plants grow in the upward direction and appeared scattered around the main tree.

• These fingers like roots are known as breathing roots.

- Mangroves are very useful as they protect coastal areas from erosion by reducing the impact of tidal waves.
- They also protect the bio-diversity of the coastal region.
- These are found in Bordi, Dahanu, and Thane creek near Mumbai.

2.11. NATIONAL PARKS AND WILD LIFE SANCTUARIES

- Maharashtra is the land of rich floral and faunal diversity. From ever green forests of Western Ghats to deciduous forest of Vidarbha, each region is bestowed with unique natural beauty.
- The tiger reserves like Tadoba, Melghat, Pench and Sahyadri may be considered as jewels in the crown. Tigers, Leopards and Wild dogs are found in Tadoba-Andhari Tiger Reserve. Nilay Lake and Chanditibba tower in Nagzira are equally famous. Mysterious Melghat is awesome.

2.11.1. The state of Maharashtra has six national parks, forty seven wild life sanctuaries and four reserved areas for conservation.

No.	National Park	Area in sq Km.	District
1	Chandoli	318	Sangli
2	Gugamal	361	Amaravati
3	Navegaon	134	Bhandara
4	Tadoba	625	Chandrapur
5	Sanjay Gandhi National Park	104	Mumbai
6	Pench	257	Nagpur

Table 2.2. Maharashtra: National Parks

2.11.2. Characteristics of the national parks and sanctuaries

- These national parks and sanctuaries are home to many rare species of flora and fauna. The state government has safeguarded and tried to upgrade these national parks and sanctuaries every year to attract foreign and domestic tourists.
- Modern amenities such as jeep rides, night safaris, library and audiovisual facilities, comfortable accommodation and efficient transport are also available at these parks at a nominal charge. Most of the sanctuaries and the park have lakes with serene beauty.
- National Parks and wildlife sanctuaries are designed to get multiple benefits. The main objective is to provide protected natural environment to the wildlife for their conservation.

• There is a rapid decrease in the number of tigers. In order to conserve tigers a number of sanctuaries have developed in different districts of Maharashtra.

2.12. MAJOR WILDLIFE SANCTUARIES AND RESERVES OF MAHARASHTRA

- **1. Anerdam Wildlife Sanctuary: Located** In Shirpur Tehsil of Dhule District Maharashtra
- Location: The sanctuary is situated on south-western range of Satpura range in Shirpur Tehsil of Dhule District.
- It shares boundaries with Yawal sanctuary other sanctuaries in Madhya Pradesh.

Fauna:

- Once very rich in wildlife, the sanctuary, is now trying to regain its previous status.
- Common animals found in this area are Barking Deer's, Chikaras, Hares, Porcupines and Jungle Cats.
- Common Reptile Monitor Lizard is the common reptile in this sanctuary.
- Migrant Animals Hyenas, Jackals, Wolves and Wild boars are the common migrant animals find found here.
- Common resident birds These include Peafs, Qualis, Partridges, Egrets, Herons, Cormorants, Corts, Spot Bills, Eagle Hamers, and Owls etc.
- Variety of birds, which migrate, can be seen in this area. Significant among them are Brahming Ducks, Cranes, Stokes and many Waders.
- 2. Bhamragarh Wildlife Sanctuary: Located Chandra District Maharashtra
- Location: This sanctuary is located in Chandrapur district in the Vidharba region of Maharashtra.
- Majority of the area is under thick forest that is woodland, with small patches of grass lands distributed over the entire protected area.
- Even wetlands in the protected area can be found. Notable among them are Pamalgautam and Parlkota rivers, which runs through the protected area.



Fig: National Parks, Maharashtra

Fauna:

- □ Bhamragarh Wildlife Sanctuary is well known for its variety of wild animals.
- □ The endangered animals in this area are Leopard, Jungle Fowl, Wild Boar, and Sloth Bear.
- □ **Other animals** like Barking Deer, Blue Bulls, Hare, Mongoose, Peacock, and Flying Squirrel are also found in this area.
- 3. Bhimashankar Wildlife Sanctuary: Western Ghats of Maharashtra
- □ **Location:** The sanctuary is **located** in the northern part of the Western Ghats.
- □ It is spread over the **three districts Pune**, **Thane and Raigad**.
- □ Two major **tributaries** of river Krishna namely **Bhima and Ghod** originate from this area.
- □ The valley is a **splendid combination** of floral and faunal life.

Fauna:

- □ Since there is variety of forest types in the sanctuary, the area is rich in fauna.
- □ The wild life found here includes Leopards, Barking Deers, Sambar, Wild Boar, Langur, and Hyena.
- □ Among the birds, Malabar Grey Hornbill, Quaker Babbler, Malabar

Whistling Thrush, Green Pigeon, Black Eagle, Grey Jungle Fowl and many more are found here.

□ The great butterfly brigade may be seen here. Moreover, Malabar Giant Squirrel, one of the largest of tree squirrels, well over three feet long, is found over here,.

4. Bor Wildlife Sanctuary: Hingni in Wardha - Maharashtra

- □ Bor Wildlife sanctuary is **located** in Hingni in Wardha of Vidarbha region.
- □ This area includes 3,237 hectares of Reserve Forest, 2,213 hectares of Protected Forest, and 660 hectares of Unclassed Forest.
- □ Many villages surround the sanctuary.

Fauna

- Wild animals found in this sanctuary are Tigers, Panthers, Bisons, Blue Bulls, Chitals, Sambars, Peacocks, Barking Deers, Chinkara, Monkeys, Wild Boars, Bears and Wild Dogs
- 5. Chaprala Wildlife Sanctuary: Chandrapur District Maharashtra
- Location: This sanctuary is located in Chandrapur district in the Vidharba region of Maharashtra.
- Majority of the area is under thick forest that is wood land, with small patches of grass lands distributed over the entire protected area.

Fauna

- Chaprala Wildlife Sanctuary is a home of variety of wild animals.
- Endangered animals: Out of 23 species of mammals recorded in this area, there are 4 species of mammals, which are of endangered status, namely Tiger, Leopard, Jungle cat, Sloth Bear, and Wild dog.
- Endangered Bird species: There are 131 species of avifauna recorded in the Protected Area of which as many as three bird species are of endangered status.
- Endangered Reptiles: There are 2 species of reptiles, which are of endangered status namely Indian Python, and Common Indian Monitor.
- Others include: Black Buck, Wild Boar, Spotted Deer, Sambar, Barking Deer, Blue Bull, Common Langoor, Harep, Jackal, Mungoose, Peacock, Jungle Fowl, and Flying Squirrel.
- 6. Chikhaladara Wildlife Sanctuary: Vidarbha Region Maharashtra

- Location: Chikhaldara Wildlife Sanctuary is located in Amravati district of Vidarbha region.
- The only hill station in the Vidarbha region offers one an abundance of wildlife<u>viewp</u>oints, lakes and waterfalls. This sanctuary is named after "Keechaka" of Mahabharata.
- This is the only coffee growing area in Maharashtra.

Fauna

- Panthers, Sloth Bears, Sambar, and Wild Boar are found here. One can even spot Wild Dogs over here.
- Close by is the famous Melghat Tiger Project in DhakanaKolkaz National Park, a natural habitat centre for about 82 tigers.
- 7. Dajipur Bison Sanctuary: Border of Kolhapur District -Maharashtra
- Location: The Dajipur Bison Sanctuary is situated on the border of Kolhapur and Sindhudurg districts near the backwaters of the Radhanagari dam.
- **Rugged mountains and thick forests** abundant in wildlife surround this jungle resort.
- The sanctuary is completely **cut-off from human habitat.**

Fauna

- Bison, Wild Deer, Chital, Gawa, etc are found here.
- Apart from these one can spot other spectacular wild animals and birds over here too.
- 8. Melghat Tiger Reserve : Amaravati District Maharashtra
- Location: Melghat Tiger Reserve is located in Chikhaldara and Dharni tehsils of Amaravati district in Satpura hill range.
- The Melghat Tiger Reserve was **constituted in 1974** and the Directorate of Project Tiger, Melghat **started functioning from 22nd Feb 1974.**
- This is one of the last remaining habitats of Indian tiger in Maharashtra.
- In view of the ecological, floral and faunal significance of the region, on 5th Sep 1975, the Melghat Tiger Reserve was designated a sanctuary.

Geography of Maharashtra Fauna:

• Wild mammals: The area is rich in wild mammals which includes Tiger, Panther, Sloth Bear, Wild Dog, Jackal, Hyena, Chausinga, Sambar (largest Deer on earth) Gaur, Barking Deer, Ratel, Flying squirrel, Cheetal (type of Deer), Nilgai, Wild Boar, Langur, Rhesus Monkey, and Macaque.

9. Jayakwadi Bird Sanctuary: Aurangabad District Maharashtra

- Location: Jayakwadi Bird Sanctuary is situated in Aurangabad and Ahamadnagar district in Marathawara region.
- The presence of the Nathsagar Lake in the sanctuary, make the surrounding areas rich in aquatic flora and fauna.

Fauna:

- **Birds:** Many species of **resident and migratory birds** are found in this sanctuary.
- Nearly **200 species of birds** are found in this area, which includes more than 70 species of **migratory birds** out of which 45 major species are of **international migration**.
- **Migratory birds:** Notable amongst migratory birds is Cranes, Flamingos, Brahmany Duck, Pochards Teals, Pintails, Wigeon, Shovellar, God Wit, Shauces, Glossy Ibis, etc.
- It is a habitat for resting of local resident birds.

10.Jijamata Udyan Zoo: Byculla District - Maharashtra

- Rani Jijamata Udyan Victoria Gardens lay out in 1861 houses the Mumbai's Zoo.
- The gardens boast of scores of trees, some of which are really old.

Fauna

- It houses many of the **rare and endangered species** of animals and birds.
- The gardens are spread over 48 acres in Byculla, on the central side of Mumbai.

11. Kalasubai Harischandragad Wildlife Sanctuary: Ahmednagar District - Maharashtra

- Location: The sanctuary area **spreads** from Kalasubai to Harischandragad in Akole Tehsil of Ahmadnagar district.
- The area is part of Sahyadri hill ranges.

- Kalasubai is the highest (1646 m) peak of Western Ghats in the Maharashtra State.
- The Kalsubai sanctuary, situated in the most rugged, hilly area is difficult to get accessibility by the trekkers.

Fauna:

- A wide variety of mammals, reptiles and birds may be found by the tourists.
- **Mammals:** The mammals found here are Leopard, Jungle cat, Palm civet, Mongoose, Hyena, Wolf, Jackal, Fox, Wild Boar, Barking Deer, Sambar, Hare, and Bats etc.
- The most **attractive animals** are Indian Giant Squirrel and Porcupine.
- **Reptiles:** The reptiles found in this sanctuary are Monitor Lizard, Fan-Throated Lizard, Turtles and many species of snakes.
- Birds: Among the birds is the common hill and grass land birds.
- Water birds such as White Necked Storks, Black Ibis, Herons, Egrets, Cormorants, Water hen's, etc. may also be spotted.
- 12. Karnala Bird Sanctuary: Panvel Taluka of Raigad District Maharashtra
- Location: Karnala Bird Sanctuary is situated in Panvel Taluka of Raigad District of Konkan Region.
- This sanctuary is located at the bottom of the Karnala fort, which lies between Pen and Panvel.
- The sanctuary is around 25m high from the sea level, while the fort itself is 370 m from the sea level.

Fauna:

- **Bird Life:** Rich with natural habitats the sanctuary abounds in bird life with various kinds of **resident and migrant birds.**
- Around 150 species of birds of resident and 37 species of migratory birds that visit the sanctuary during winters may be found here.
- It has two distinct seasons for bird watching.
- In the monsoon season one can watch Paradise Flycatcher, Shama or Magpie, Robin, and the Malabar Whistling Thrush, which are some of the most melodious avian songsters.
- A variety other birds Racket-Tailed Drongo, Red Vented Bulbul, Horn Bill, Myna, Owl, Ashy Rain War Blur, and two rare birds Ashy Minimet and Spotted heart Woodpeckers have been sighted here.

Geography of Maharashtra 13. Katepurna Sanctuary: Akola District – Maharashtra

- Location: The sanctuary is located in Akola district in Vidarbha region.
- It is in proximity of Akola and is mostly the catchment area of Katepurna reservoir which mostly attracts water birds.

Fauna

- Animal: The sanctuary is famous for Four-horned Antelope and Barking Deer.
- Other animals are Black Buck, Wolf, Leopard, Hyena, Wild Boar, Nilgai, Hare, Jungle Cat, Monkey, etc.
- **Birds:** Many species of common grassland and wetland birds are seen.
- Peafowl is the common bird spotted by tourist.

14. Koyna Wildlife Sanctuary: Satara District – Maharashtra

- Location: Sanctuary is located in Satara District in Western Maharashtra. Koyana wildlife sanctuary includes Eastern and Western catchments of Koyana dam which is a major hydroelectric project centre in the Western Maharashtra.
- The sanctuary is well protected by the large extent of Shivasagar reservoir and steep Slopes of Western Ghats on both the sides.
- A vegetal cover corridor of Chandoli connects this protected area.
- It is bounded by Radhanagari wildlife sanctuary in south.

Fauna:

- Animals: Tigers, Panthers, Gaurs, Sloth Bears, Sambars, Barking Deers, Mouse Deers, Dholes, Gaint Squirrels, Otters, Common Langoors, Pythons, and Cobras are the animals found in this sanctuary.
- **Birds:** Among the birds are Heart Spotted, Rufous and Brown Capped Woodpeckers, Goshawk, Long Tailed Nightjar and Fairy Bluebird.
- These are found very rarely in other parts of Western Ghats.

15. Malvan Marine Sanctuary – Maharashtra

- Location: Malvan is the only marine sanctuary in Maharashtra. It is located in Malvan Taluka of Sindhudurg district in Konkan region.
- The sanctuary is rich in coral and marine life.
- The golden sands and casuarinas plantations at the Malvan coast form a scenic view and it's a feast to eyes.

16.Nagzira Wildlife Sanctuary: Tirora Range Of Bhandara Forest – Maharashtra

- Location: Nagzira Wildlife sanctuary lies in Tirora Range of Bhandara Forest Division, in Bhandara district of Vidarbha region.
- The sanctuary is enclosed in the arms of the nature and adorned with exquisite landscape.
- The sanctuary consists of a range of hills with small lakes within its boundary. These lakes not only guarantee a source of water to wildlife throughout the year, but also greatly heighten the beauty of the landscape.

Fauna:

- Ideal conditions of harbourage to a variety of birds and animal are provided by the forests.
- Animals : The animals commonly spotted are Tigers, Panthers,

Leopards, Bison's, Sloth Bears, Sambar, Four-Headed Antelope, Blue Bull, Chital, Barking Deers, Mouse Deers, Civet Cats, Jackals, Jungle Cats, Spotted Hyena, and Hare.

- **Birds:** Among the **birds** that are prominent and commonly seen are Peafowl, the Grey Jungle Fowl and the Red Spur Fowl.
- The habitats of sanctuary include 34 species of mammals, 166 species of birds, 36 species of reptiles, 4 species of amphibia, and number of fishes.
- The **invertebrate fauna** includes, besides a number of insects and ant species, 49 species of butterflies.

17. Nandur Madhmeshwar Bird sanctuary – Maharashtra

- Location: Nandur Madhmeshwar Bird Sanctuary is located in Niphad Tehsil of Nashik district in Western Maharashtra.
- The water level is always fluctuating in Nandur Madhameshwar Lake.
- The water released from Gangapur and Darana water reservoirs is stored at Nandur Madhameshwar and subsequently released from here through canals for irrigation.
- Silts and organic matter that are carried away with water flow are accumulated in the lake, and as a result islands and shallow water ponds have been created.
- This enriched the biological conditions and aquatic vegetation has been stabilised.
- Consequently the site has turned into good wetland habitat aptly described as 'Bharatpur of Maharashtra''.

Geography of Maharashtra

- Fauna:
- Birds: Nandur Madhmeshwar Bird Sanctuary is a harbour for thousands of beautiful and migratory birds.
- There are more than 230 species of birds, out of which 80 are migratory species.
- The migratory birds found in this sanctuary are White Stork, Glossy Ibis, Spoonbills, Flamigo, Goose Brahminy Duck, Pintails, Mallard, Wigeon, Gargenery Shoveller, Pochardds, Cranes Shanks, Curlews, Pratincole Wagtails, Godwits, Weavers, etc.
- The resident birds include Black Ibis, Spot Bills, Teals, Little Grabe, Cormorants, Egrets, Herons, Stork, Kites, Vultures, Buzzards, Harriers, Osprey, Quails, Patridges, Eagles, Water Hens, Sand Pipe, Swifts, Grey hornbill, Peafowl, etc

18. Navegaon National Park: Navegoan, Gondia – Maharashtra

- Location: The Navegaon National Park located in Navegoan, Gondia is one of the most popular forest resorts in the Vidarbha region.
- A picturesque lake with crystal clear water, stretches over an area of 11 sq. Kms. It is set in the midst of hill ranges and can be approached through a series of winding trails.
- Strategically located, watch towers enable the visitor to Navegaon to catch a glimpse of the region's varied wildlife.
- It consists of a deer park, an aviary and three beautifully landscaped gardens.

Fauna:

- Navegaon is better known as a bird sanctuary but a number of wild • animals may be seen here.
- Tigers, Panthers, Bisons, Sambars, Nilgais, Chitals, Wild boars, Sloth Bears, and Wild Dogs are main wild life species in this national park.

19. Pench National Park (Project Tiger Reserve) – Maharashtra

- Location: The Pench National Park on the border of Madhya Pradesh • and Maharashtra has been known through the ages for its rich flora and fauna.
- It is **named after** the river that flows nearby.
- Pench was declared a Wildlife Sanctuary in 1983, though it had been declared a notified area in 1972.
- This park is the 25th Tiger Reserve in the country and takes pride in its tigers and other wildlife.

- The total area under the Pench Tiger Reserve comes to about 758-km, out of which a core area of 299-sq-km is the National Park and 464-km the buffer area.
- In summer the river retains water in pools strewn along its bed, locally known as 'Doh'.
- To the east lies Golia Pahar about 670m above the main sea level, which is the highest hill in Nagpur district.

Fauna:

• **Common animals:** Common animals in this sanctuary are Common Langur, Jackal, Wild dog, Sloth bear, Indian Grey Mongoose, Striped Hyaena, Tiger, Leopard, Jungle cat, Wild Boar, Spotted Deer, Sambar, Barking Deer, Indian Bison, Nilgai, Chausinga, Large Brown Flying Squirrel, Porcupine and Pangolin.

20. Peshwe Udyan: Pune – Maharashtra

- Location: The Peshwe Udyan Zoo is located next to Saras Baug in Pune.
- **Maintenance:** It is maintained by the Pune Municipal Corporation and houses a variety of species of wild animals.
- When Pune Municipal Corporation came into existence it built a garden and a Zoo in this place and gave it the name Peshwe Udyan.

Fauna:

• In this zoo there are all animals, from birds to big animals like elephant. For children this zoo is another venue for fun and learning. It has toytrain ride a very special attraction for kids, a beautiful lake with boating facilities, animal rides and a Play Park.

21. Phansad Wildlife Sanctury: Raigad District – Maharashtra

- Location: The Phasand wildlife sanctuary is located in Murud and Roha Talukas of Raigad district in Konkan region.
- The sanctuary represents a Coastal Woodland Ecosystem of Western Ghats, which makes the habitat very rich and offers highly peaceful atmosphere to the visitors.

Fauna:

- The wild animals found in this sanctuary are Panther, Sambhar, Wild boar, Barking deer, Hyena etc.
- 22. Radhanagri Wildlife Sanctuary Dajipur: Kolhapur District Maharashtra

Geography of Maharashtra

- Location :Radhanagari wildlife sanctuary is located in the between the areas of the major reservoirs viz. "Shahu Sagar"and "Laxmi sagar" in Kolhapur district.
- The entire protected area is undulating with steep escarpments with reddish and lateritic soil.
- High percentage of bauxite ore is found in Plateaus or "Sadas".

Fauna:

- It is well known for Bison (500), which is the tallest and the most splendid of living Wild Oxen.
- Tourists can spot bull and calf running with its mother or a large herd grazing in the jungles, which is a treat to the eyes and one can recall with delight years later.
- Other animals, sheltered in the sanctuary are Leopard, Sloth bear, Wild Boar, Barking Deer, Mouse Deer, Sambar, Giant Squirrel, Wild Dogs, counted among some of the major animals found in the protected area.

23. Sagareshwar Sanctuary – Maharashtra

- Location: Sagareshwar Wildlife Sanctuary is at trifurcation of three Tehsils namely Khanapur, Walva and Palus Tehsils of Sangli district.
- The significance of this sanctuary is that it is a man made sanctuary.
- Sagareshwar is an artificially cultivated forest without perennial supply of water.
- Here most of the wildlife species are artificially introduced.
- It was first brought under the category of park. Then the status of the area progressively upgraded. It became Sagaroba game reserve in 1980 and thereafter, in 1985, it became Sagareshwar Wildlife Sanctuary when approximately 52 animals were set free in the area.

Fauna:

- Major animals found in this sanctuary are Sambar, Blackbucks, Wild Boar, Barking Deer, Peacocks, Cheetal, etc.
- There are no major carnivorous species like tiger and panther in the Sanctuary.
- Small carnivores like Hyena, Fox and Porcupines are found in the protected area.
- Quite a large number of insects, birds and reptiles are also found in the sanctuary.

24. Tadoba National Park: Near Chandrapur – Maharashtra

- Location : The oldest National Park in the state of Maharashtra, it is also a Project Tiger reserve, since 1993.
- The rich **deciduous forest** mainly consists of teak trees.
- Tadoba is also referred to as 'The Jewel of Vidarbha'.

Fauna:

- Although the major attraction is the Tiger, large herds of Chital, the stately Sambar, the elusive Barking Deer, the fleet footed Chausinga, the majestic Gaur, the robust Nilgai, the shy Sloth Bear, the whistling Wild Dogs, the omnipresent Wild Boar, and the stealthy Leopard make lasting impressions on the visitors to this Reserve.
- The lake attracts many water birds like Cattle Egrets, Purple Moorhens and Jacanas. It also has marsh crocodiles at the breeding farm.

25. Tansa Wildlife Sanctuary – Maharashtra

- Location : Tansa wildlife sanctuary is located in Wada, Shahapur and Mokhada Talukas of Thane district.
- The wildlife sanctuary at Tansa comprises the catchment area of Tansa Lake and the surrounding forests of Shahapur, Khardi, Vaitarna and East Wada Ranges in Shahapur Tehsil of Thana district.
- Tansa Lake is a perennial source of water to wild life in the sanctuary.

<u>Fauna:</u>

- This Wildlife Sanctuary hosts a wide range of species.
- There are around **50 species of animals** and about **200 bird species** in this area.
- Major wild animals are Panther, Barking Deer, Mouse Deer, Hyena, Wild boar, Leopard, Jackal, Four-Horned Antelope, Chital, Sambar, Hare, Common Langur, etc.

26.The Sanjay Gandhi National Park: Borivali, Mumbai – Maharashtra

- Location: Borivali, Mumbai, Maharashtra
- Fauna:
- One can have encounters with several species including Spotted Deer, Black Naped Hare, Barking Deer, Porcupine, Palm Civet, Mouse Deer, Rhesus Macaque, Bounet Macaque, Hanuman Langur, Indian Flying Fox, and Sambhar.

- The reptilian world has 38 species to show off.
- Tourists can see crocodiles in the Tulsi Lake, and Pythons, Cobras, Monitor Lizards, Russell's viper, Bamboo Pit Viper and Ceylonese Cat Snake here.

27.Tipeshwar Sanctuary: Pandarkawada Tehsil Of Yavatmal District Maharashtra

- Location : Tipeshwar wild life sanctuary is located in Pandarkawada Tehsil of Yavatmal district of Vidarbha region covering an area of 148.63-sq-km.
- Many villages surround the sanctuary and due to this there is a tremendous pressure on sanctuary resources for timber, firewood, and bamboo.

Fauna:

• The major animals that are found here are Hyena, Black Buck, Blue Bull, Chital, Sambar, Peacock, Hare, Snake, Monkey, Wild boar, Bear, Wild cat, Wolf, Jackal, etc.

28. Wan Sanctuary: Amaravati District – Maharashtra

- Location: Wan sanctuary is located in Melghat area of Amravati District.
- It is an extension to the Melghat Sanctuary on south-eastern part.
- The hilly rugged terrain possesses Tropical Dry Deciduous forests.

Fauna:

- This area is part and parcel of Melghat and is rich in floral and faunal biodiversity.
- The sanctuary is rich in Tigers, Leopards, Hyena, Wild Dogs, Bison, Sambar, Barking Deer, Wild boar are major herbivorous species.

29.Yawal Sanctury: Jalgaon District – Maharashtra

• Location : Yawal sanctuary is located in Yawal Tehsil of Jalgaon district along river Anner and Manjal towards north at the border of Madhya Pradesh.

Fauna:

- **Mostly found species** in the reserve are Tiger, Leopard, Hyena, Jackal, Fox, Wolf, Sambar, Chinkara, Nilgai, Wild boar, Barking deer, Jungle cat, Palm civet, Wild dog, Sloth bear, Flying Squirrel, etc.
- Common grass, land birds and hill birds dominate the avifauna.
- Few kinds of **wetland birds** are also commonly seen over here.
- A lake called "Suki", located within the sanctuary, attracts large number of migratory birds.

2.13 PROBLEMS ASSOCIATED WITH FORESTS OF MAHARASHTRA

Considerable forest lands have been deforested in the last couple of decades for various reasons.

- **The biggest problem** in the forest of Maharashtra is inadequate and fast dwindling forest cover.
- Forest cover is seriously threatened by the increasing **demand** for major and minor **forest products.** These products are widely needed for fuel, building and as raw material for large number of forest based industries.
- Vast forest tracts have been cleared for agriculture.
- Illicit tree felling: In 2011-12, cases of illicit tree-felling registered in the state- 14,574
- Lack of proper transport facilities. We know that the major product of the forests is timber which is a cheap and bulky commodity so a well developed transport facility must be available at or near the forest.
- Large tracts of **forest cover suffer from plant diseases**, insects and pests which lead to considerable loss of forest wealth. For example, thousands of hectares of sal forests are being threatened by sal borer for which no remedial measures have been adopted so far.
- **Obsolete methods of lumbering, sowing** etc. are practised in the forest area. This system leads to a lot of wastage and low forest productivity.
- Lack of scientific techniques of growing forests is also another major problem. Only natural growth of forests takes place in the state.
- Low Productivity: Productivity compared to some other countries is very low.
- **Increase in population** has increased the demand for forest products resulting in cutting of large number of trees.
- Encroachment on the forest land: Considering the urgency of distribution of land to landless people, the government has been regularizing such encroachment. In 2011-12, area under encroachments in forests in the state- 86,213 hectares.
- Another most important cause of depletion has been **unauthorized cultivation by local people.**
- The scientists have accounted for the decrease in forest area due to the increase in spatial extent of plantations and agricultural fields.
- Urbanization and industrialization is also another problem: Industrialization and Urbanization needs land, so this has led wide

spread deforestation which again creates harmful effect on environment and forest ecological balance.

- For Construction of dam reservoirs, large scale devastation of forests took place in the state breaking the natural ecological balance of the region. Floods, droughts and landslides become more prevalent in such areas.
- **Depletion of Natural Vegetation:** Tourism development has put pressure on natural vegetation. Forests often suffer negative impacts of tourism in the form of deforestation caused by fuel wood collection and land clearing.
- Mining has led to deforestation also. Human beings have used minerals almost ever since they existed. The ages of human development have coincided with the use of minerals. The modern urban industrial economy cannot survive without minerals and metals, so we cannot wish away mining. Some major open cast mining activity has significant negative impact on the natural vegetation.
- **Grazing** Effective policies are urgently needed to discourage expansion of livestock production in forest areas and promote sustainable grazing systems that will halt the cycle of degradation and abandonment on cleared forest lands.

2.14. CONSERVATION OF FOREST

The National Forest Policy 1952 stipulates retention of a minimum of 33% of the country's land under forest cover. The state forest department statistics reveal that the area under encroachments in forests has increased from 80,108 hectare in 2005-6 to 86,213 hectare in 2011-12. A total of 14,574 cases of illicit tree felling have been registered in 2011- 12. Current area under forest covers in Maharashtra- 19.94 percent. In 2011-12, the geographical area under forests in the state- 61,358 sq km. At present there is an urgent need of Conservation of forest operations on a large scale.

This can be done through the following measures:

- 1) We must **stop reckless cutting** of forests. Intensive development schemes for **afforestation** should be adopted.
- 2) High yielding varieties should be planted in suitable areas.
- 3) We should plant the trees and grass on the land wherever possible.
- 4) Must select the local species at the time of plantation.
- 5) **Improved techniques** of logging and extraction should be used.
- 6) We should carry the timbering scientifically and **the mature trees** should be cut.

- 7) **Proper transport facilities** should be provided to remote and inaccessible forest areas.
- 8) Saw mills should get **uninterrupted power supply**.
- 9) **Latest techniques** of seasoning and preservation are necessary to avoid wastage.
- 10) Proper **arrangements to save forests** from fires and plant diseases can go a long way to solve several problems.
- 11) A **thorough inventory of forest resources** is necessary to make an accurate assessment of our forest resources and make plans for their proper use.
- 12) **Tribal's** depending on shifting type of cultivation should be provided with alternate sources of livelihood.
- 13) People associated with forest protection should be properly trained.
- 14) To make efforts to use gobar gas in spite of using fuel wood for domestic use in rural areas.
- 15) We should practice the animal rearing, considering the capacity to graze the land.
- 16) Seeds of trees should be sown in remote areas through air services.
- 17) **The people should be educated** about the environment, its importance and conservation.
- 18) Legal prohibition on agricultural encroachment on forest land must be there.
- 19) Agro forestry and social forestry must be given priority.
- 20) **Plantation of trees should be incorporated** in the various government and social programmes.

2.15. SUMMARY

Soils that form the uppermost layer of the earth's crust are the loose rock material containing the remains of plants and animals.

The soil and vegetation of Maharashtra is related to the climate and the geology of the state. Shallow, medium and deep-black soils are mostly found in the state of Maharashtra. The soil status of Maharashtra is residual, derived from the underlying basalts.

Forest cover in the area has been steadily coming down over the last several decades. The major causes have been many developmental projects like the paper industry, hydro projects and even a nuclear power plant which have been responsible for the disappearance of a large chunk of forests.

Deforestation causes incalculable environmental damage, releasing billions of tonnes of carbon dioxide into the atmosphere and driving thousands of species of life to extinction each year.

2.16. CHECK YOUR PROGRESS/ EXERCISE

1. State whether the following statements are true or false.

- **a**. Temperate evergreen forests are found in the regions having rainfall more than 100 cms.
- b. The soil status of Maharashtra is residual, derived from the underlying limestone.
- c. The technical term used for soil formation is paedogenesis.
- d. Thorn forests are found in the regions having rainfall more than 100cm
- e. Alluvial soil is best suited for the cultivation of inferior type of millets.
- f. Soil erosion by water is a major factor in Maharashtra.

2. Fill in the blanks

- a. Excessive use of water for ______ leads to increasing salinity of soils.
- b. Black soil or Regur soil is rich in_____
- c. In some of the regions of Western Maharashtra black cotton soil has been converted into ______ or _____ due to excessive irrigation.
- d. _____ of soil develops in the region having heavy rainfall followed by extensive dry period.
- e. Nandur -Madhmeshwar Bird Sanctuary aptly described as .
- f. _____ are found in the coastal areas especially in the tidal range (zone between high and low tides).

3. Multiple choice questions.

- **a.** The Pench National Park, known through the ages for its rich flora and fauna is located on the border of
- I. Madhya Pradesh and Maharashtra
- II. Madhya Pradesh and Karnataka
- III. Karnataka and Maharashtra
- IV. Madhya Pradesh and Chattishgar

b. The trenches dug along the contours of hill slopes are known as:

- I. Slope trenches
- II. Contour trenches
- III. Grass trenches
- IV. Mud trenches

c. The regur or black-cotton soil is _____

- i) Light to pale yellowish to red in colour as it contains greater proportion of sand and iron oxide.
- ii) Formed as a result of disintegration of granite, gneiss rocks along with basalt due to heavy rain.
- iii) Clayey, rich in iron and moisture-retentive, though poor in nitrogen and organic matter.
- iv) developed in the region having heavy rainfall followed by extensive dry period
- **d.** The prevention of soil loss from erosion or reduced fertility caused by over usage, acidification, salinization or other chemical soil contamination is known as
 - I. soil conservation
 - II. forest conservation
 - III. resource conservation
 - IV. crop conservation
- e. Maharashtra, a coastal state, is susceptible to land degradation due to
 - i) the action of sea waves
 - ii) the action of wind
 - iii) the action of glacier
 - iv) the action of river

4. Answer the Following Question

- i) What is soil? Classify soils of Maharashtra and describe any two of them.
- ii) Write a short note on Regur soil.
- iii) What are the major forest types in Maharashtra?
- iv) What are the major problems of soil in Maharashtra?

- v) 5. What are the major problems in forestry in Maharashtra?
- vi) 6. What are the different measures taken for forest conservation in the state of Maharashtra.

2.17. TASK

- 1. In a map of Maharashtra locate the different soil types of the state
- 2. In a chart state the Wild life sanctuaries and their location in Maharashtra
- 3. In a map of Maharashtra point out
- (i) the areas under black soil (ii) Laterite soil (iii) Mangrove and evergreen forest

2.18 TECHNICAL WORDS AND THEIR MEANING

- **Organic matter** The plant or animal residue at varying stages of decomposition in the soil.
- □ **Parent material** The unconsolidated mass of mineral or rock from which the upper layers of the soil profile is formed.
- □ Agroforestry A collective name for land-use systems and practices in which trees and shrubs are deliberately integrated with non-woody crops and (or) animals on the same land area for ecological and economic purposes.
- **Conservation** The management or control of human use of resources (biotic and abiotic).
- **Deforestation** The long-term removal of trees from a forested site to permit other site uses.
- **Degradation** The erosional removal of materials from one place to another, which lowers the elevation of streambeds and floodplains.
- **Depletion** The use or consumption of a resource at a rate greater than the resource can be replenished within a defined time period.

2.19. ANSWERS TO THE SELF LEARNING QUESTIONS

1.a. true

- 1.b. false, basalts.
- 1 .c. true
- 1 .d.false, less than 80 cms.
- 1 .e. false. Brown Gray Soil

1.f. true

1.g. true

- 2.a. irrigation
- 2.b. humus.
- 2.c. Saline soil or Chopan soil
- 2.d. Lateritic soil
- 2.e. "Bharatpur of Maharashtra".

- 2.f. Mangroves
- 3.a.I.
- 3.b.II
- 3.c.III
- 3.d.I

Maharashtra Soil and Natural Vegetation

MAHARASHTRA AGRICULTURE, LIVESTOCK, FISHING, MINERAL AND POWER RESOURCES

After going through this chapter you will be able to understand the following features.

Unit Structure:

- 3.1 Objectives
- 3.2 Introduction
- 3.3 Subject-Discussion
- 3.4 Definition of Agriculture
- 3.5 Characteristics of Agriculture in Maharashtra
- 3.6 Cropping Pattern of Agriculture in Maharashtra
- 3.7 Problems related to Agriculture in Maharashtra
- 3.8 Livestock resources of Maharashtra
- 3.9 Fishing meaning and types
- 3.10 Distribution fisheries in Maharashtra
- 3.11 Problems and solutions related to fisheries in Maharashtra
- 3.12 Mineral and power resources of Maharashtra
- 3.13 Summary
- 3.14 Check your Progress/ Exercise
- 3.15 Answers to the self learning questions.
- 3.16 Glossary
- 3.17 Task
- 3.18 References for further study

3.1. OBJECTIVES

By the end of this unit you will be able –

- To understand the definition of Agriculture.
- To know the Characteristics of Agriculture in Maharashtra.
- Know the cropping pattern and problems related to Agriculture in Maharashtra
- To understand the Livestock resources of Maharashtra

• To know the types, distribution, problems and measures related to fishing in Maharashtra

Maharashtra Agriculture, livestock, fishing, mineral and power resources

• To know the Mineral and power resources of Maharashtra

3.2. INTRODUCTION

- In this chapter we will learn about Agriculture in Maharashtra which is highly dependent on south west monsoonal rain. The cropping pattern in different seasons has also been discussed in the following chapter. Moreover the states livestock resources have also been taken into consideration. The distribution of fisheries, its problems and solutions are also discussed. The states mineral and power resources are also explained.
- Land Utilization Pattern: As per Agriculture Census 2011-12, out of the total 307.58 lakh hectares geographical area in the State, the Gross Cropped area was 231.06 lakh hectares, net area sown was 173.86 lakh hectares, (56.57%), area under forest was 52.11 lakh hectares (16.96%), land not available for cultivation was 31.78 lakh hectares (10.33%), other uncultivated land was 24.13 lakh hectares (7.9%) and fallow land was 25.70 (8.31%) lakh hectares.

3.3. SUBJECT DISCUSSION

- Agriculture is an art and science of practicing farming, including cultivation of the soil for the growing of crops and the rearing of animals to provide food, wool, and other products. By **Agriculture**, we mean, the production of crops, livestock, or poultry.
- Although Maharashtra is a highly industrialized state of India, agriculture continues to be the main occupation of people in the state. Agriculture and allied activities during 2014-15 had average share of 11 per cent in GSDP (Gross state Domestic production) at current prices.
- Agriculture Production Prospects 2015-16: Due to low intensity and deficit monsoon, the production of major crops in all regions of the state has been decreased substantially during the year 2014-15 and 2015-16. Total rainfall in the State during 2015 was deficient i.e. 59.4 per cent of the normal rainfall. Out of 355 talukas (excluding talukas in Mumbai City & Mumbai suburban districts) in the State, 278 talukas received deficient, 75 talukas received normal and two talukas received excess rainfall. During kharif season of 2015, sowing was completed on 141.46 lakh ha, which was six per cent less than the previous year (150.97 lakh ha). This and deficient rains resulted in expected decline of 18 per cent in production of total food grains and marginal decline of two per cent in oilseeds production for kharif crops. Due to deficient rains in kharif season 2015, area under rabi crops decreased by 16 per cent as compared to the previous year

resulting in expected decline of 27 and 50 per cent in total food grains and oilseeds production respectively

- Principal crops grown in the State are rice, jowar, bajra, wheat, tur, mung, urad, gram and other pulses. The State is also a major producer of oilseeds. Groundnut, sunflower, soya bean are major oil seed crops. Important cash crops are cotton, sugarcane, turmeric and vegetables. In Jalgaon cotton is one of the major crops. The state has huge areas, under fruit cultivation of which mangoes, bananas, grapes, and oranges are the main ones
- Agriculture in Maharashtra is mainly **dependent on south west monsoonal r**ain so any fluctuations in the time distribution, spatial distribution or quantity of the monsoon rains may lead to conditions of floods or droughts causing the agricultural sector to adversely suffer.
- Agriculture is the backbone of Indian economy. There are several problems in the agricultural sector of Maharashtra but to maintain ecological balance there must be sustainable development of agriculture sectors.
- Livestock are defined as being useful animals reared for financial gain.
- India is the second largest fish producer in the world after China and accounts for nearly 6% of global fish production. Over 8,000 kilometers of coastline, 4 million hectares of reservoirs, 2 million hectares of brackish water and nearly 51,000 square kilometers of continental shelf area offers a plethora of opportunities for the growth of marine and fish industry of India. Maharashtra, a coastal state, endowed with a coastline of 720 km and a continental shelf of 87,000 sq. Km has a great contribution in the fishing industry of India.
- With average annual marine fish landings of 3.6 lakh ton during 2001-10, Maharashtra is one of the major fish producing states ranking 4th in the country.
- Minerals are found in eastern and southern part of Maharashtra.
- Iron ore is a mineral substance which, when heated in the presence of a reductant, will yield metallic iron (Fe). It almost always consists of iron oxides, the primary forms of which are magnetite (Fe3O4) and hematite (Fe2O3).
- With the dawn of industrial era, the sources of energy came into prominence. Among the conventional energy wood fuel was confined only to domestic use and that too in the rural area.
- Use of Coal, natural oil also increased.

• Likewise, the use of hydroelectricity also increased in the areas where running water and needed technology was readily available. All these sources of energy are known as conventional sources of energy.

Maharashtra Agriculture, livestock, fishing, mineral and power resources

- These sources of conventional energy, like minerals are exhaustible. Hence they need to be used judiciously and conserved for future use.
- On the other hand, with increasing demand for energy and with fast depleting conventional sources of energy such as coal, petroleum, natural gas, etc. the non-conventional sources of energy such as energy from sun, wind, biomass, tidal energy, geo-thermal energy and even energy from waste material are gaining importance.
- In this scenario solar energy proves to be an abundant energy source which can be put to use.
- Electricity generation from solar energy at present is no more a new concept to the world. Solar electricity being clean (pollution free), silent, limitless and free will play a great role in the times to come in the present energy driven civilization.

3.4. DEFINITION OF AGRICULTURE

The art and science of growing plants and other crops and the raising of animals for food, other human needs, or economic gain is known as agriculture.

3.5. CHARACTERISTICS AGRICULTURE IN MAHARASHTRA:

- Although Maharashtra is a highly industrialized state of India, agriculture continues to be the **principal occupation of the people in the state.**
- It is observed that the primary occupation of nearly two thirds of the working population in Maharashtra.
- About **65 per cent of the total workers** in the State depend on agriculture and allied activities.
- Agriculture in Maharashtra is mostly intensive subsistence type.
- Both food crops and cash crops are grown in the state.
- Since most of the cultivable land is still rain-fed, the Southwest Monsoon season, between June and September, is critical to the food sufficiency and quality of life in the state.
- The agricultural calendar of Maharashtra and other parts of India is governed by Monsoon.
- **Irrigation facilities** are being extended so that agriculture could be made less dependent upon rain water.

Geography of Maharashtra

- Despite having the largest number of Dams in India, the net irrigated area in Maharashtra totals only 33,500 square kilometers or about 16% of cultivable land.
- Here the **productivity of land is low.**
- About 60% of the area of Maharashtra is under cultivation and no part with the exception of Wainganga valley on the east and the Sahyadri zone on the west has less than half the land devoted to agriculture.
- Large portion of Godavari, Krishna, Bhima river valley are under cultivation.
- Irregular terrain, thin soil of the plateau inadequate rainfall in greater part of the region and dearth of irrigation facilities (only 7-10% of the land is under irrigation) account for low yields which is in fact lower than the national average for most crops except sugarcane.
- The main **food crops** of Maharashtra are wheat, rice, jowar, bajra, and pulses.
- Cash crops include groundnut, cotton, sugarcane, turmeric, and tobacco.
- The main **fruit crops** mangoes, grapes, bananas, oranges,
- The State has an area of 12.90 lakh hectares under various fruit crops like mango, banana, orange, grape, cashew nut, etc.
- Most of the Growers of Cash crops such as sugarcane and cotton in the state belong to **farmer's cooperatives**. For example, most of the sugar production in Maharashtra takes place at mills owned by local cooperative societies.
- Of the total cultivable area about 70% is under food crops and 30% covered with oil seed, cotton and other fibre and fodder crops.
- 7.5.1. The following table shows the land utilisation in Maharashtra (%)

No.	Land utilisation	In percentage
1	Forest	17.64
2	Barren and cultivated	5.88
3	Land put to non agriculture	2.31
4	Cultivable waste	2.92
5	Land under tree crops	0.61
6	Permanent grassland	4.56
7	Current fallow	3.81
8	Other fallow	3.73
9	Net sown area	58.54
3.6. CROPPING PATTERN OF MAHARASHTRA

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- Jowar Bajra, Wheat and Rice are the four important food crop of the state.
- Out of total cultivable land in Maharashtra about **60% land is under food grain crops**, and Maharashtra contribute only 5.8% production of food grains in India because Jowar is dominating crop but its yield is low (583 kg/ha).
- Maharashtra is major producer of Jowar and Arhar contributing 46.09 and 29.11 %, respectively to the total production of India.
- It is second largest producer of Cotton (22.21%), Soybean (28.14%), and total cereals (13.56%) in the country

Nature of cropping	Type of crops raised
Rain fed (Kharif)	Paddy, Nagali, Kharif. Jowar, Niger, Groundnut, Bajra, Urad
Single cropping	Wheat, Gram, Lentil, Peas, Rabi Sorghum
Double Cropping (Kharif-Rabi) (Rain fed only	Paddy, Paddy-Gram/lentil/Peas, Paddy- mixed pulses like lentil, Paddy-wheat, Urad/Mung- Rabi Sorghum, + Tur Irrigated
Kharif – Rabi-Summer	Paddy – Wheat, Paddy-vegetables, Jowar, Groundnut
Annual Crops (Irrigated conditions)	Sugarcane, Banana, Mango, Cashew, Guava

3.6.1. Major Crops & Cropping Pattern:

3.6.2. Food crops in Maharashtra

1. <u>Jowar</u>

- Jowar is the most important occupying 6.32 million hectare and accounting for more than 60% of the total cultivated area of Maharashtra.
- Distribution of jowar crop **reflects** the effects of **climatic and soil condition**.
- It is grown in the areas of moderate rainfall between 350 mm to 1000 mm.
- In fact jowar cannot be grown in the heavy rainfall areas.
- Although it can be grown on variety of soils it grows better in **regur** soil.
- Jowar is not grown in Konkan region.
- **Osamabad** has more than half of its area under jowar cultivation.

- Jowar can be grown **both as Rabi and kharif crop** in winter and monsoon respectively.
- Rabi jowar crop is thus prevalent in the valleys of Godavari, Krishna and Bhima and their tributaries.
- On the other hand **kharif jowar occupies** the thin soil cover of upland in Vidarabha region where the deeper soil is given to cotton and wheat.

2. <u>Bajra</u>

• Bajra another **variety of millet** generally considered inferior to jowar grows in the same areas Rabi jowar but **occupies thin and infertile soil** that cannot support kharif jowar because of inadequacy of rain.

3. <u>Wheat</u>

- Wheat, the next important crop of the region is highly diffused and does not show any marked concentration.
- About 30% of the agricultural area is under wheat cultivation.
- Wheat is generally grown in **North West Maharashtra** where irrigation facility is available.

4. <u>Rice</u>

- Rice with its need of higher rains is confined to Wainganga valley where about 60% of the cropped area is under paddy.
- Rice is also an important crop in Konkan.
- Infact, **60% of the total agricultural land in the Konkan area** under rice cultivation.
- Rice also grown in the extreme eastern part of Maharashtra in small quantities with the help of irrigation.

3.6.3. Cash crop

- The Cash crops include cotton, sugarcane, turmeric, and several oil seeds including groundnut, sunflower and soya bean.
- Sugarcane, groundnut, cotton are the major important Cash crops of Maharashtra.

1. Ground nut

• Ground nut the **principal oilseed of Maharashtra** is more common in dry area and infertile soils

• <u>Sugarcane</u>

Sugarcane **cultivation** is confined to the area receiving adequate and timely irrigation.

• Godavari valley, Ahmednagar district, Baramati-Indapur area in Pune district, Krishna valley in Satara, Kolhapur in Sangli district is the main pocket of sugarcane cultivation.

2. <u>Cotton</u>

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- Cotton is grown in Tapi valley.
- **Cotton** is largely confined to Tapi valley, the districts of Khandesh and Vidarbha with maximum concentration in Jalgaon.
- About 14% of the other total cropped area of the region is under cotton with an annual production of 2.84 lakh of tons of cotton.

7.6.4 Fruit Production

- Maharashtra is also famous for its fruit production.
- The major fruits produced in the state are: mangoes, bananas, grapes and oranges.
- Nagpur and Nasik are the major producers of fruits.

3.7 PROBLEMS OF AGRICULTURE IN MAHARASHTRA

1. Subsistent in Character

- Maharashtra agriculture is subsistent in character.
- The cultivators and farmers grow crops mainly for the family consumption.
- 2. Small Size of Holdings and Fragmentation of Fields :
- The main reason for fragmented land holdings is our inheritance laws, and other socio-cultural and economic factors.
- Small Size of Holdings is uneconomical.

3. Heavy Pressure of Population

- This has created great demand for land.
- Every bit of land has been brought under the plough.

4. Seed:

• It is very unfortunate that good quality seeds do not reach majority of the farmers, especially small and marginal farmers, mainly because of exorbitant prices of better seeds.

5. Inadequate Irrigation Facilities:

- By and large the irrigation facilities available in Maharashtra are far from adequate.
- 6. Yield per hectare is low in Maharashtra despite large area under cultivation.
- 7. Agriculture is not technologically developed

8. Traditional means of agriculture:

- Farmers till today continue **unscientific cropping** pattern using primitive tools and implements.
- Low quality seed are used.
- Absence of use of fertlisers and pesticides which again lead to low productivit.y
- 9. Soils of Maharashtra is poor and rocky

10. The rivers of Maharashtra are seasonal

11. Unreliable rainfall:

- Most of the farmers of Maharashtra largely depend on the monsoon rain or water for cultivation.
- They are at the mercy of the monsoons, which can sometimes bring heavy rain and then becomes the cause of floods.
- On the other hand irregularity of monsoon may lead to drought condition creating various problems in the agricultural field in the state.
- For two consecutive years 2014 and 2015 the State received deficient rainfall of 70.2 and 59.4 per cent respectively of the normal rainfall. In 2015 out of 355 talukas (excluding talukas in Mumbai City & Mumbai suburban districts) in the State, 278 talukas received deficient, 75 talukas received normal and two talukas received excess rainfall.

12. Soil erosion:

- In the areas of heavy rain like Konkan coast, removal of natural vegetation can be disastrous leading to very heavy soil erosion.
- Fertility of soil in such areas is declining at an alarming rate, reducing yield of many many crops.

13. Poverty:

- It is a very serious problem of farmers of Maharashtra for developing agriculture.
- Farmers even today are burdened with inherited debts. Hence they cannot afford to use modern equipment and better seeds.

14. Crop security

• Farmers have no security against failure of crops because of failure of monsoon, floods,drought even spread of pests and diseases.

15. Pollution of land or soil

• Besides soil erosion, land or soil today, suffers from contamination. Pollution of land or soils is alregly result human activities.

Agriculture, industries and mining are the major activities responsible for the land or soil contamination.

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Agriculture Measures: The '**Jalyukta Shivar Abhiyan**' launched by the State primarily aims at making Maharashtra 'a drought-free state by 2019'. It involves deepening and widening of streams, construction of cement and earthen stop dams, works on nullahs and digging of farm ponds. The target is to make 5,000 villages free of water scarcity every year

3.8 LIVESTOCK RESOURCES IN MAHRASHTRA

Livestock are integral part of farming system in Indian Agriculture contributing manifold to the growth and development of agricultural sector.

It includes animal husbandry, dairy and fishery sectors. Its role in the rural economy is also very important. It is an integral component of Indian agriculture supporting livelihood of more than two-thirds of the rural population

3.8.1. Livestock Management In Maharashtra

Objectives

- Conservation and upgradation of recognized breeds of the state.
- Monitoring breeding policy.
- Training to the farmers and professionals.
- Strengthening of semen stations.
- Organization of infertility camps.
- Encouragement to NGO's for livestock development.
- To deliver breeding inputs at farmers door steps.
- To setup strict quality control of services and inputs.

3.8.2. Development of livestock in Maharashtra

Farm animals are regarded as asset. Livestock are domestic animals that are raised in an agricultural setting to produce commodities such as food, fibre and labour. Livestock includes cattle, sheep, goats, horses, pigs and poultry.

In Maharashtra livestock plays an important role in impoving the social – conomic conditions of the rural masses in Maharasghtra.

The major animal resource are cattle buffalo,,sheep, goats, horses, pigs and poultry.

1. Cattle

• Cattle found in Maharashtra is mostly of very poor quality.

- The average milk per cow is of i litre per day whereas in advanced countries like Newzealand and Denmark it is about 30 to 40 litres per day.
- For the above reason an Indian cow is often called **tea-cup cow**
- The breed **Sindhi** is generally found in Maharashtra.
- Buffaloes are the main source of milk Maharashtra

2. Sheep

- In Maharashtra, sheep is mainly raised for mutton and not for wool.
- 3. <u>Goat</u>
- Goats are called as **poor mans cow**.
- They are **found** in almost all houses of rural areas.
- The goats in Maharstra is "Desi"

4. Horses, pigs, donkeys are also found here.

3.8.3. Livestock Products

- Livestock provides us with a variety of products useful in our lives.
- Animal products help in increasing the National Income hence livestock products play a very important role in the economy of Maharashtra too.

3.8.4.: Poultry Resources: Poultry is one of the fastest growing segments of the agricultural sector in India today. While the production of agricultural crops has been rising at a rate of 1.5 to 2 percent per annum while that of eggs and broilers has been rising at a rate of 8 to 10 percent per annum. As a result, India is now the world's fifth largest egg producer and the eighteenth largest producer of broilers.

Maharashtra is also experiencing tremendous growth in poultry sector during last few decades in the state of Maharashtra.3-4 decades. Maharashtra Ranks third in egg production in the country,

Problems and measures related to poultry in Maharashtra:

* In recent past due to outbreak of Bird flu in Nandurbar and Jalgaon poultry sector was adversely affected in Maharashtra State that resulted in reduction of poultry population for some time.

*Besides, the per capita availability of eggs stands at 40 against the recommended levels of 180 per person per annum in the state today.

*Maharashtra is amongst the leading states for commercial layer farming and broiler farming, but the decline in the egg production in year 2012-13 was due to substantial increase in the feed cost, fluctuations in prices of meat and eggs and breakout of diseases. *Disorganised markets and lack of infrastructure are some of the constraints that have adversely hit poultry farming in state.

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Measures:

*To fill this gap between requirement and supply side the government has taken decision to promote poultry farming in tribal and backward regions of north Maharashtra and Marathwada. This would increase production of eggs and also provide a credible alternative to small farmers especially in tribal regions and backwards regions of the state.

* In order to increase poultry farming in the state, the state government has decided to provide estimated credit projections of \$80 million (Rs 500 crore) for the year 2015-16 for poultry sector works.

*The state government is also looking to bring eggs into the schools midday meals programme, which would also increase egg consumption in the state

* The state government is looking to rope in financial institutions for financing their poultry farming initiatives that will help in spending million in the tribal and rural areas. This will also include setting up cold chains and strong marketing chains to market their products, not only in the state but also across the country

State infrastructure for Poultry Development:-

There are four Central Hatcheries in the State located at Pune, Aurangabad, Kolhapur and Nagpur respectively. Rhode Island. Red (RIR) and Black Austrolarp (BA) poultry breeds are reared at these hatcheries. These breeds are sturdy in nature and able to resist the disease pathogen as compared to other varieties of commercial poultry birds. Day old chicks and hatching eggs are supplied as per demand from poultry keepers. Commercial poultry farmers procure chicks from commercial hatcheries. But for the small farmers at village, taluka or even at district level to facilitate them the availability of improved variety of deshi chicks or hatching eggs these hatcheries are established.

There are 16 Intensive Poultry Development Blocks, namely, Solapur, Satara, Bhilvadi, Dist Sangli, Nasik, Kopargaon, Dist A.Nager, Dhule, Yeotmal, Amravati, Palghar, Dist Thane, Chiplun, Dist. Ratnagiri, Osmanabad, Ardhapur, Dist. Nanded, Beed, Parbhani in the Maharashtra State.IPD blocks procure chicks as per requirement from the concerned Central Hatchery and day old chicks and hatching eggs are supplied as per demand to the small farmers and backyard poultry keeping beneficiaries.

Poultry sector training is imparted to the small poultry owner or new poultry keepers at four central hatcheries besides Amravati, Murud, and Dist Latur & Kankawali Dist Sindhudhurg. Duration of training is 15 days, one month & six months.

Under the scheme "Central Assistance to State Poultry Farm (80:20)," Govt. of India had accorded administrative sanction to 4 Central Hatcheries and 1 Duck breeding farm in the state of Maharashtra amounting to Rs. 340.00 Lakh (80% Central Share 68.00 Lakh / Institutes and 20 % State Share 17.00 Lakh per institute). Evaluation of this scheme is done by NABCONS pvt. Ltd. But their report is awaited.

As per the mandate of the scheme, in addition to Rhode Island Red and Black Austrolap, CARI (Central Avian Research Institute) approved low input technology birds such as Giriraja, Vanraj and Kadaknath are reared on experimental basis in 4 Central Hatcheries and Intensive Poultry Development Blocks. From these central hatcheries and IPD Blocks day old chicks and hatching eggs are supplied to the small and marginal farmers, agriculture labourers and landless labourers according to their demand.

Maharashtra is also stressing on availing the funds from centre for financing cold chain for poultry products, transport cost and small outlets for marketing across urban, semi-urban and large villages across state.

3.9 FISHING IN MAHARASHTRA

3.9.1 Introduction: The State has a coastline of 720 km with 173 fish landing centres and the area suitable for marine fishing is 1.12 lakh sq km. There are 15,686 marine fishing boats in operation, of which 12,831 are mechanised. In addition to this, the area suitable for inland and brackish water fisheries in the State is 3.17 lakh ha and 0.10 lakh ha respectively. There are 30 fish seed production centres in the State with 2,414 lakh spawn production capacity per year for catering to inland fishing. During 2014-15, State's contribution in marine, inland and total fish production (provisional) of India was 13.1 per cent, 2.2 per cent and 6.0 per cent respectively.

3.9.2. Development of fisheries in Maharashtra

- * Reasons for the Development of fishing in Maharashtra
- Maharashtra State, endowed with a coastline of 720 km, has a continental shelf of 87,000 sq. km.
- The shelf up to **40 fathoms with an area of 44,000 sq. km possesses** rich fisheries potential and almost the entire present fishing activity is restricted to this zone.
- The harvest at the potential of this zone is estimated at 3.74 lakh tonnes.
- The shelf between 40 and 100 fathoms, measuring 43,000 sq. km., has harvestable potential of 0.80 lakh tonnes.
- So, fishing is a well **developed economic activity in the state.**

• Maharashtra is also **famous for its varied fresh water resources**, including lakes, tanks and rivers so both **fresh water** and **deep sea fishing** is practised in Maharashtra.

The **Konkan coast is favourable** for fishing. Fishing activity is well developed at the creeks, where rivers of Konkan join Arabian Sea.

- Arabian Sea being in Tropical belt has a large variety of fish.
- As about 70% of the population of Maharashtra prefers fish there is an **increasing demand** in the major cities like Mumbai.
- Development of fishing in the state has also been facilitated by the availability of efficient system of transportation of fish.
- Cold storage facilities are also developed in many places in the state.
- Fishermen use **modern techniques** and hence yield in this field has increased.
- Fresh water fishing is well developed in the interior part of Maharashtra, i.e. in river, lakes and dams.
- Development of fishing in the state has been more after it became a **co-operative society activity**.
- The state Government provides many facilitites to the fishermen and banks provide loans for the development of fishing.

3.9.3 Types of fishing

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- 1. Coastal of deep sea fishing it is also termed as the 'salt water fishing'.
- 2. Fresh water fishing includes fishing in river, lakes and dams.

Out of the total Marine fish catch in Maharashtra about **90% fish catch is from the coastal areas only 10% is from deep sea fishing**. Total fish catch in Maharashtra in the year 2011-2012 was about 5.80 lakh tonnes out of which about 4.35 lakh tonnes were from marine fishing.

3.9.4 Saltwater or marine fishing

- Marine fishing is practised along the western coast of Maharashtra i.e. near Arabian sea in the coastal strips of Konkan.
- The marine fishery along the coast of Maharashtra is **multi-species**, **supported by tropical species with relatively smaller size**, **fast growth**, almost continuous breeding and low volume (biomass) nature with rapid turnovers.
- Generally Konkan is divided into two parts as north Konkan and south Konkan.

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- It includes following districts from north to south Palghar, Thane,Mumbai suburbs, Mumbai city, Raigad, Ratnagiri and Sindhudurg district.
- Various fishing centres or ports in these areas are as follows:

I. North Konkan

1. Palghar – Thane - Length of coastline is about 127 kms **Fishing centres**: Dahanu, Satpati, Dativare, Arnala, Vasai

2. Greater Mumbai: – Length of the coastline is about 114 km. **Fishing centres:** Manori, Madh, Versova, Mahim Sasoon Dock

II. Central Konkan:

1.Raigad- Length of coastline is about 122 kms. **Fishing centres-** Alibag, Murud, Dighi Srivardhan, Mhasale

III. South Konkan:

1. Ratnagiri- Length of coastline is about 220 kms **Fishing centres** – Harne, Dabhol, Jaigad, Ratnagiri, Purngad, Jaitapur

2. Sindhudurg- Length of coastline is about 180 kms.

Fishing centres- Vijaydurga, Devgad, Malvan, Vengurla, Achare, Shiroda, Redi.

For the better develoment of fishing it is essential to have modern fishing ports with necessary infra-structure facilities.

- At present there are only three modern ports, such as:
- a) Sasoon Dock
- b) Ferry Warf (Bhaucha Dhakka) in Mumbai
- c) Moirkarwalad at Ratnagiri
- Government has **planned to construct modern fishing ports** at the following location:
 - I. Agrav (Alibag Raigad)
 - II. Satpati (Palghar)
 - III. Harne and Sakharinata (Ratnagiri)
 - IV. Sarjekot and Anandwadi (Sindhudurg)

3.9.5. Type of Marine fish

Pomfret, Mackerel, Bombay duck, Sardine, Lobstar, Prawn, Catfish.

3.9.6 Fresh Water fisheries:

• About 20% production of fish in Maharashtra is derived from fresh water fishing which is carried out in lakes, dams, and other water bodies.

Fresh water inland fisheries in Maharashtra contribute to over 1 lakh MT fish catch each financial year and generate around 600-800 Crores for dependent fisher folks.

As per the economic surveys (2011-12) for Pune region i.e. Pune, Satara, Sangli, Solapur and Kolhapur districts, there are over 20 thousand fisher folks supported by inland fisheries generating 8,722 Lakh for the fishing community in the entire Pune region.

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District	length of the river stretches (km)	Total area under inland fisheries (including river, lakes, and dams)- ha	Inland fisheries production (MT)
Pune	1252	24721	22000
Solapur	772	27200	3000
Satara	676	14504	1950
Sangli	392	4678	1547
Kolhapur	955	4266	2285
Total=	4047	75369	30782

• Status of Inland fisheries in Maharashtra, Pune region

• Selected major centres of fresh water fisheries are as follows:

- 1. Pune Varvand and Shirasphal
- 2. Satara- Mayani and Pingali
- 3. Nagpur Ramsagar
- 4. Chandrapur Tadoba, Asolmendha, Shindevahi and Dhodazari
- 5. Bhandara Chandpur and Shivni
- 6. Gonda Navegaon, Bodalkasa, Chorakhmara, Sangrampur and Umarzari
- Government prpvides large water bodies like lakes, dams on lease for the development of fishing.
- Small size file were brought from Kolkata in the past but at present it is available in Maharashtra itself.

Catfish, Rohu, Katla, Prawns etc.

3.9.8 Fresh water fishing is associated with rice cutivation

Characteristics:

- Rice is grown in Konkan and Vidarbha where the amount of rainfall is more.
- Rice requires high amount of water and water remains stagnent in the rice field for long time.
- So, fresh water fish like 'Jitada', catfish and carp are grown here.
- Long deep tench is built around the agricultural field so when the level of water in the agricultural field reduces variety of fish can survive in the trenches.
- This type of fish production is practised in Raigad and Thane districts.
- This is a supplementary activity which is very beneficial to the farmer.
- Fish in the agricultural field consume unwanted and harmful insects and thus protect agricultural yield.
- Farmers get additional income and customer gets fresh fish through the sell of the same.

✤ Fish Farming:

- Fish Farming can be practised in the agricultural field by construction artificial pond for fish.
- The normal length of artificial pond for fish breeding and development is about 100 m, width 40m and depth about 2m. The minimum depth of water should be at least 1m.
- Water pumps are used fro removal of dirty water from the pond that provides nutrients to the agricultural crops.

3.9.9 Fish Processing Industry

1. Preserving fish

- **Preserving fish** by the process of drying and using salt as preservative.
- This activity is carried out at various places like Palghar, Dahanu, Vasai, Alibag, Murud, Ratnagiri, Malvan, Vengurla, Shiroda and Devbag.

2. Export of fish

The industries involved in export of fish are located at Mumbai, Agriculture, livestock, fishing, • Alibag and ratnagiri

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3. Extracting oil from fish

This industry is located at Ratnagiri

3.9.10 Problems Related with fisheries in Maharahstra:

The fishery in Maharashtra is facing crisis since late nineties owing to overfishing, urbanization, domestic and industrial pollution and habitat degradation.

1. Reduction in the fish catch

- a) It is the rivers which forms the backbone of the nutritional and economic security of over 10 million marginal fisher folk in India. But across India, the potential of riverine fisheries is decreasing rapidly There is a chronic downplaying of riverine fisheries sector and concentration of attention on aquaculture and marine fisheries.
- b) Due to extensive fishing many types of fish species are on the verge of extinction.
- c) Varieties like pomfret and bombil have been overfished to the extent that their future is in doubt.
- d) Major causes of the reduction in the fish catch are as follows:
- i) Modern equipment used for fishing : Modern fishing nets catch fish even of very small size which do not have any commercial value. These activities have hampered the process of fish growth.
- ii) Fishing carried out throught the year : Sometimes fishing is carried out throught the year which has an adverse effect on breeding of fish and their life cycle.
- iii) Death of Fish and marine oraganisms: Fish and marine oraganisms die due to increasing pollution, spreading of oil due to leakage and accidents etc.
- iv) Increasing Urbanisation and Loss of breeding grounds due to reclamation of low-lying mangrove lands: Much of lowlying mangarow lands near the coast and reas of fish farming, especially in the paddy fields in Thane and Raigad districts, is decreasing due to encroachment by slum settlements, dumping of solid waste and other elements of urbanisation and indutrial growth.
- v) Regulating and conrolling river flow by creating reservoirs and constructing dams: This has resulted in decrease in seasonal floods and depositon of nutrient organic matter on regular basis that was

favouring 'plankton growth' and so food for fish. Decrease in of plankton is a major cause of decline in fish

- vi) Inadequate infrastructural faciliies such as cold-storage, fish processing industries, transportation and marketing of fish and fish products.
- vii) Lack of Fishery institutes, extension and research centres.
- 3.9.11 Solutions to the problems related to fishing activity:

✤ To solve the problems related to fishing the following solutions amy be suggested

- 1. Total ban on fishing during the monsoon season.
- 2. Use of appropriate size of fishing nets so that small size fish can escape during fish-catch operation.
- 3. Financial help to small fisherman.
- 4. Better infrastructural faciliies for storage, transportation and sell of fish and fish products.
- 5. Provision of instituional training and encouragement for inland fisheries development
- 6. Guidance and help for export fish and fish products

3.10 MINERAL AND POWER RESOURCRES IN MAHARASHTRA

Maharashtra is rich in mineral deposits. A wide variety of them are found many parts of the state.

The entire area of the State forms a part of the "Peninsular Shield", which is composed of rocks commencing from the most ancient rocks of diverse origin, which have undergone considerable metamorphism. More than 80% area of the State is covered by this Deccan trap, which have concealed geologically older formations. The most important economic minerals such as coal, iron ore, manganese ore, limestone, etc. are found in the geologically older formations.

3.10.1. The State of Maharashtra encompasses on area of 307713 sq.km. **Out of which likely mineral bearing area is about 58465 sq.km. i.e. 19% of the total area of the State.**

Divisionwise distribution of mineral bearing area is as under:

1)	Nagpur	-	60%
2)	Amravati	-	10%
3)	Konkan	-	20%
4)	Aurangabad	-	5%
5)	Pune	-	3%
6)	Nasik	-	2%

3.10.2. IMPORTANT MINERALS IN MAHARASHTRA

* Mineral Resources

- Maharashtra is the second largest producer of kyanite and the third largest producer of manganese ore.
- The principal mineral-bearing belts in Maharashtra are Vidarbha in the east and Konkan in the west.
- The important minerals occurring in the State are Coal, Iron ore, Manganese, Limestone, Bauxite, Dolomite, Silica sand, Kyanite & Sillimanite. The other minerals occurring are Barytes, Ilmenite, Clay, Feldspar, Copper, Chromite, Graphite, Fluorite, Tungsten etc.

• Mineral reserves in the district of State are given below:

S.N.	District	Minerals found
1	Nagpur	Coal, Limestone, Manganese Ore, Copper Ore, Tungstone Ore, Zinc Ore, Clay, Chromite, Dolomite, Granite
2	Chandrapur	Coal, Limestone, Iron Ore, Pyrophyllite, Clay, Baryte, Fluorite Copper Ore, Chromite, Granite
3	Bhandara	Manganese Ore, Iron Ore, Kyanite – Sillimanite, Pyrophyllite, Chromite, Quartz, Granite
4	Gadchiroli,	Limestone, Iron Ore, Baryte , Granite, Dolomite, Quartz
5	Yavatmal	Coal, Limestone, Dolomite
6	Wardha	Coal
7	Gondia,	Vanadium Ore, Quartz
8	Buldhana	Agate (Semiprecious Stones)
9	Amravati	Clay
10	Sindhudurg	Iron Ore, Silica sand & Sea sand, Clay, Graphite, Chromites, Feldspar, Granite, Soapstone (Talc)
11	Ratnagiri	Bauxite, Silica sand & Sea sand, Ilmenite
12	Raigad	Bauxite
13	Thane,	Bauxite, Clay, Granite
14	Kolhapur	Bauxite

15	Satara,	Bauxite
16	Sangli	Bauxite
17	Nanded	Limestone, Quartz, Granite,
18	Ahmednagar	Limestone
19	Aurgangabad,	Agate (Semiprecious Stones)
20	Jalna	Agate (Semiprecious Stones)
21	Jalgaon,	Agate (Semiprecious Stones)

3.10.3. Important mineral occurrences are as follows

1. IRON ORE

• Iron ore is the primary source of iron for the world's iron and steel industries. It is therefore essential for the production of steel, which in turn is essential to maintain a strong industrial base. Almost all (98%) iron ore is used in steelmaking. Steel is required in various manufacturing processes from ordinary pin to rockets.

• <u>There are four types of iron ore.</u>

- a. **Magnetite**: Magnetite ore has a higher iron content than hematite ore, but often occurs in lower concentrations. It is black in colour and contains more than 70% of iron ore.
- b. **Haematite**: Hematite gets its name from the Greek word for blood, haima, because of its reddish color. This is one of the types of iron ore that has very high iron content, and the iron content of hematite itself is lower than that of magnetit. It contains about 70% of iron.
- c. **Limonite:** The Mineral, Limonite is an Iron Ore mineral and accounts for a small percentage of the iron mined. Contains 60% iron.
- d. Siderite: Siderite is yellowish iron ore which contains 48% of iron.

* Areas of iron ore deposits in Maharashtra

- 1. Eastern part of Maharashtra Iron Ore is found in Eastern part of Maharashtra in Chandrapur, Gadchiroli and Gondia districts
- 2. Southern part of Maharashtra Iron Ore is found in Southern part of Maharashtra in Sindhudurg district.
- Iron Ore (Hematite) deposits are found in Chandrapur, Gadchiroli and Sindhudurg districts. Kalne is Maharashtra's only major iron ore extracting mine located in Sindhudurg, a region estimated to hold large amount of state's reserves of iron ore.

• Iron Ore (Magnetite) in Gondia district

- Other Iron ore mines are located in the following areas:
- **a.** Lohara: Lohara has about 65 million tonnes of iron ore deposit and the quality of ore found here is extremely good.
- **b.** Asola: good quality iron ore.
- c. Pimpalgaon: good quality iron ore is deposited here.
- **d.** Gadchiroli: This district has concentration of iron ore deposits at Deulgaon, Bhamragad, Surjagad, Fuser etc. Inspite of heavy concentration of iron ore in this district mining is not well developed here.
- e. Gondia: It has about 6 million tonnes of iron ore deposits. Iron ore is found at Ambe, Talao and Khursipar.
- **f.** Nagpur: Iron ore is found in Bhivapur. The quality as well as the quanrity of iron ore found in this district is very low.
- **g.** Sindhudurg: There are about40 million tonnes of iron ore deposits are in this district which is found in Vengurle, Redi, Bundpeta and Dodamarg.

2. BAUXITE

- Bauxite, an aluminium ore, is the world's main source of aluminium.
- Aluminium metal is used in many ways for eg:
- a. In transportation (automobiles, aircraft, trucks, railway cars, marine vessels, bicycles, spacecraft, etc.)
- b. as sheet, tube, and castings.
- c. Packaging (cans, foil, frame of etc.).
- d. Food and beverage containers, because of its resistance to corrosion.
- Maharashtra has about 9 crore tonnes of Bauxite deposits.
- Out of the total production bauxite in India about 10% production comes from Maharashtra itself.
- Bauxite is found in the southern part of Maharashtra in Kolhapur, Raigad, Ratnagiri, Satara, Sangli, Sindhudurg & Thane districts
- I. **Kolhapur districts** Good quality Bauxite is found in Radhanagari, Dhangarwadi, Gargoti, Panhala, Vishalglad,Udgiri,Rangewadi, Kasarwada.
- II. Satara districts Mahabaleswar anad Patan river valley of Koyna.
- III. Sangli districts River valley of Krishna.
- IV. Thane districts Tungareshwar hills.

V. Raigad districts - Srivardhan, Murud, Roha, Mahad.

VI. Ratnagiri districts – Mandangad, Dapoli

VII. Sindhudurg districts – Amboli.

3. CHROMITE

Chromite is found in Bhandara, Chandrapur, Nagpur & Sindhudurg districts

4. COAL

Coal is found in Nagpur, Chandrapur & Yavatmal districts.

5. DOLOMITE

Dolomite is found in Chandrapur, Nagpur & Yavatmal districts.

6. FIRECLAY

Fireclay is found in Amravati, Chandrapur, Nagpur & Ratnagiri districts

7. FLUORITE & SHALE

Fluorite & Shale in Chandrapur district.

8. KYANITE

Kyanite in Bhandara & Nagpur districts.

9. LATERITE

Laterite in Kolhapur district.

10. LIMESTONE

Limestone in Ahmednagar, Chandrapur, Dhule, Gadchiroli, Nagpur, Nanded, Pune, Sangli & Yavatmal districts.

11. MANGANESE

- Manganese has important industrial metal alloy uses, particularly in production of stainless steels. It is also used in dry cell batteries. Manganese dioxide is used as a black-brown pigment in paint.
- About 8% of the deposits of Manganese found in India are in Mahrashtra.
- Manganese ore is found in eastern part of Maharashtra in Bhandara, Nagpur & in southern part in Sindhudurg and Ratnagiri districts.
- I. **Nagpur district** Good quality manganese ore is found at very low depth in the river valleys of river Kanhan and river Pench. It is also found at Mansar in Ramtek Taluka, Kodegaon, Gumgaon, Khapa and Ramodongari in Savner Taluka.
- II. **Bhandara** In Bhandara manganese ore is found at Kurmuda, Chikhala, Dongri, and Sit Savangi of Tumsar Taluka.
- III. Sindhudurg Good quality manganese ore is found at Dingane, Netarde, Sasoli and Banda of Sawamtwadi Taluka and Ponda in Kanakacali Taluka.

12. CORUNDUM & PYROPHYLLITE

Corundum & Pyrophyllite in Bhandara district.

13. QUARTZ & SILICA SAND

Quartz & Silica Sand in Bhandara, Chandrapur, Gadchiroli, Gondia, Kolhapur, Nagpur, Ratnagiri & Sindhudurg districts and quartzite in Gondia & Nagpur districts.

14. SILLIMANITE

Sillimanite in Chandrapur district.

15. CHINA CLAY

China Clay in Amravati, Bhandara, Chandrapur, Nagpur, Sindhudurg & Thane districts

3.10.4. Other minerals that occur in the State are

- I. Barytes in Chandrapur & Gadchiroli districts;
- II. Copper in Bhandara, Chandrapur, Gadchiroli & Nagpur districts;
- III. **Felspar** in Sindhudurg district; gold in Bhandara & Nagpur districts;
- IV. **Granite** in Bhandra, Chandrapur, Dhule, Gadchiroli, Nagpur, Nanded, Nasik, Sindhudurg & Thane districts;
- V. Graphite & Mica in Sindhudurg district;
- VI. Lead-Zinc & Tungsten in Nagpur district;
- VII. **Marble** in Bhandara & Nagpur districts; ochre in Chandrapur & Nagpur districts; sil
- VIII. Ver & Vanadium in Bhandara district;
 - IX. Steatite in Bhandara, Ratnagiri & Sindhudurg districts;
 - X. Titanium minerals in Gondia & Ratnagiri districts

3.10.5. Minerals and their industrial use in Maharashtra

No.	Mineral	Industrial Use
1	Copper	Electrical equipments, Utensils
2	Illuminate	Industrial.
3	Chromite	Metal, Chemical of the precious stones
4	Dolomite	Iron-Steel
5	Kyinite	Glass, Chemicals, Electrical equipments, Cement, Diamond

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6	Byrites	Colour, Paper, Rubber
7	Silica	Glass, Electrical equipments
8	Limestone	Cement, Iron-Steel, Cloth, Chemicals
9	Asbestos	Cement
10	Tungsten	Military equipments
11	Mica	Electrical equipments
12	Venadium	Industrial use
13	Basalt, Granite and Laterite	Construction

3.11 POWER RESOURCES OF MAHARASHTRA

We get energy from various sources like coal, crude oil, atomic energy etc.

Energy is used in the industries as well as in our daily activities. It is necessary for the sustainable development.

3.11.0 POWER RESOURCES

- ***** Power resources can be classified into two main type:
- Conventional
- Non-Conventional.

3.11.1.CONVENTIONAL SOURCES:

- Power resources which have been in common use for a long time are called conventional resources, e.g. firewood, fossil fuels like coal, crudeoil natural gas.
- **CONVENTIONAL energies are as follows**

1. Firewood:

Firewood is the major source of power in rural Maharashtra. It is used as kitchen fuel and also for heating purposes.

- 2. Coal:
- Coal is the most abundant fossil fuel.
- Coal is used as a domestic fuel and also in industries.
- Most of the thermal power plants use coal as a fuel.
- Coal was formed from giant ferns and swamps which got buried under the earth.
- Hence, coal is also called the Buried Sunshine.

Advantages of Coal:

• It is widely available. It is highly efficient in terms of electricity generation.

Disadvantages of Coal:

• Coal is bulky to transport and creates lot of pollution.

* Types of Coal

There are four types of coal:

- **a. Peat:** often not listed as a type of coal since the use of it as an energy source is limited today. Percentage of carbon is less than 40%. It is used mainly for domestic purpose. It's a very soft brown coal.
- **b.** Lignite: is a soft brown coal that contains a high amount of water. Lignite has a higher heat content than peat but is still not the most desired form of coal. However, lignite makes up almost half of our known coal reserves. Percentage of carbon is about 40
- **c. Bituminous:** is widely used in the United States and across Europe. Percentage of carbon is 70 to 80 percent.
- **d.** Anthracite: is a metamorphic rock and is considered the highest grade coal. It's hard and dark black in color. It has a very light weight when compared to other forms of coal as there is very little water present in anthracite. As a result, anthracite has the highest heat content. Percentage of carbon is about 95%.

Coal deposits in Maharashtra:

- Maharashtra's coal reserves account for only 3.44% of India's total coal reserves but contribute 9.29% to national output.
- These deposits currently supply power plants located in Trombay, Chola, Khaperkheda, Paras, Bhusawal, Ballarshah, Nahik, and Koradi.

* The three main coal fields are located:

- 1. The Wardha valley field near Chandrapur, Ghughus and Warora.
- 2. The Kamptee coalfield in Nagpur district
- 3. The **Bander** coal field.
- All three coal fields have relatively low grade coal with high ash content.

* Coal deposits in Maharashtra are mainly concentrated in the

- I. Chandrapur district
- II. Nagpur district
- III. Yavatmal district.
- Chandrapur district Largest deposits in Maharashtra. (about 70%)
- In Chandrapur district coal is found in the following in Talukas
- a) Chandrapur Taluka Chandrapur, Ghugus, Bellarpur
- b) Rajura Taluka Sasti
- c) Bhadravati Taluka Manjari
- d) Varoda Taluka Varoda

II. Nagpur district

- In Nagpur district coal is found in the folowing areas
- a. Umred
- b) Kamthi
- c) Savner
- d) Silewara
- e) Patsavangi
- f) Vokhara

III. Yavatmal district - I

- In Yavatmal district coal is found in the folowing Talukas
- a) Vani Taluka- Vani and Rajur
- b) Maregaon Taluka Astona
- c) Digras Taluka Chincholi
- d) Umerkhed Taluka Dhanki

3. Petroleum:

- Hydrocarbons of liquid and gaseous states varying in chemical composition, color, and specific gravity are collectively known as petroleum resource.
- Petroleum is found between layers of rocks.
- It is extracted by drilling deep bore wells.
- Oil extracted from the wells remains in crude oil form and contains many impurities; hence, it needs to be extracted in oil refineries.
- Petroleum is sent to refineries to make various petroleum products; like diesel, petrol, kerosene, wax, plastics and lubricants.
- Petroleum industries produce various by-products; for example, fertilizer, synthetic rubber, synthetic fiber, medicines, vaseline, lubricants, wax, soap, and cosmetics.
- Located 160 km off Mumbai, Mumbai high, an offshore oilfield was discovered in 1973. Production of petroleum at the field was started in 1976.
- About 50% of crude oil used in India comes from this oil field.
- Oil from this field is brought to Chembur refineries through pipelines, and is processed here to get various by-products.
- New deposits are found in Arabian Sea near Uran Raigad districts.

Advantages of Petroleum:

- Petroleum is easier to transport.
- It forms the backbone of petrochemicals industry.

4. Natural Gas:

- Natural gas is found along with petroleum deposits.
- It is used in the chemical and fertiliser industries and in the thermal power stations.
- It is also used as domestic fuel.
- India has largest deposits of natural gas in 'Bombay High'
- This gas is stored at Uran port.

* Advantages of Natural Gas:

- It is easier to transport and can be transported through pipelines
- It is much cleaner and cheaper than oil.

Drawbacks of Fossil Fuels:

- Fossil fuels are exhaustible in nature.
- Our increased consumption of fossil fuels has resulted in depletion of fossil fuels at an alarming rate.
- Burning of fossil fuels produces toxic pollutants.
- We are over-dependent on fossil fuels but they are going to be exhausted very soon.
- Hence, there is a pressing need for searching some alternate sources of energy.

3.11.2 NON-CONVENTIONAL SOURCES OF ENERGY

- Sources of energy which are fairly new in usage are called nonconventional energy sources.
- Scientists are trying to develop non-conventional sources of energy for certain objectives.
- We need newer energy sources to reduce our dependency on fossil fuels.
- Moreover, we also need environment-friendly sources of energy which could be renewable as well.

1. Hydel Power:

- The energy in moving water can be tapped to produce electricity.
- Electricity generated in this way is called hydroelectricity or hydel power.
- For harnessing hydel energy, rain water or river water is stored in dams. A
- fter that, water is allowed to fall from heights.
- The motion of the falling water moves the blades of the turbine.

- The movement in turbine produces electricity.
- One-fourth of the world's electricity is produced by hydel power.

Advantages of Hydel Power are as follows:

- I. It is non-polluting and cheaper than thermal power.
- II. Can be transported easily
- III. Hydel power projects also promote fisheries and irrigation

Disadvantages of Hydel Power:

- I. It is highly costly to set up a hydel power project.
- II. Vast areas of low lying land are submerged due to construction of dam.
- III. It leads to large scale displacement of people.

Hydel Power stations in Maharashtra

- I. **Raigad** Khopoli (first Hydel power station in Maharashtra), Bhivpuri, Bhira
- II. Kolhapur Tillari
- III. Aurangabad Jaikwadi
- IV. Hingoli Yeldari
- V. Ahmednagar Bhandardara
- VI. **Pune** Fagane
- VII. Nagpur Pench

2. Thermal Power

- Electricity which is generated by burning coal or crude oil is termed Chandrapur Ballarpur, Durgapur
- Major Thermal Power stations of Maharashtra are as follows:
- a) Nagpur Khaperkheda and Koradi
- b) Akola Paras
- c) Jalgaon Fekari (Bhusaval)
- d) Nasik Eklahare
- e) Thane Chol and Turbhe

3. Atomic power:

Atomic power is obtained from the atomic reactions related to the radio active munerals like, Uranium, Thorium, Radium, Lithium,Plutonium. etc. Atomic power is the fourth-largest source of electricity in India after thermal, hydroelectric and renewable sources of electricity. As of 2013, India has 21 nuclear reactors in operation in 7 nuclear power plants.

Atomic power stations in Maharashtra is located in Palghar district at

Tarapur. It is the first atomic power plant in India. With a total capacity of 1400 MW, Tarapur is the largest nuclear power station in India.

4. Solar energy

- Solar energy is our earth's primary source of renewable energy.
- It is a form of energy radiated by the sun, including light, radio waves, and X rays, although the term usually refers to the visible light of the sun.
- Solar energy is the conversion of sunlight into electricity.
- <u>It is derived in two different ways</u>
- **a.** By **directly using photovoltaics (PV),** in which Photovoltaics convert light into an electric current using the photovoltaic effect.
- **b.** By **indirectly using concentrated solar power** (CSP). Concentrated solar power systems use lenses or mirrors and tracking systems to focus a large area of sunlight into a small beam. Eg. Solar cooooker, water heater etc.

* Advantages of Solar Energy:

• Non-polluting and inexhaustible.

***** Disadvantages of Solar Energy:

- It is costly at present as technology is uneconomical...
- Solar energy may not be harnessed in all areas and throughout the year especially durign rainy reason and during winters in north India.

CURRENT SCENARIO OF SOLAR FIELDS ENERGY IN MAHARASHTRA

- It is observed that among the renewable sources of energy, solar energy has a huge potential for power generation in Maharashtra.
- There are 250-300 days of clear sun with an available average radiation of 4 to 6 kWh/sq.metre over a day.
- There is a capacity to generate 1.5 million units/MW/year through solar photovoltaic systems & up to 2.5 million units/MW/ year through solar thermal systems.
- In Maharashtra these projects are well developed in Nagpur and Aurangabad.

5. Tidal Energy:

- Tidal Energy is the only form of energy which is derived directly from the relative motions of the Earth–Moon system, and to a lesser extent from the Earth–Sun system.
- The tidal forces produced by the Moon and Sun, in combination with Earth's rotation, are responsible for the generation of the tides.

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- The tidal energy can be harnessed by building dams at narrow openings of the sea.
- The movement of water during a high tide helps in turning the turbine; which produces electricity

* Advantages of tidal energy:

• Non-polluting and renewable.

Disadvantages of tidal energy:

- Can be harnessed at select locations only.
- Tidal energy plants have the potential to damage the coastal ecosystem.

TIDAL ENERGY in Maharashtra

- Maharashtra has a 720-kilometer-long coastline and according to Maharashtra Energy Development Agency (MEDA), the State has the potential of producing around 1000 MW from the sea waves.
- The Maharashtra Govt is setting up a small tidal power plant in 2 coastal villages in Ratnagiri district.(near Guhagar on Ratnagiri coast)
- The turbine is expected to generate 15-20 KW of power.

6. Wind Energy:

- Windmills have been in use since ages.
- At first, during historic times, they were used for running flour mills or saw mills while now-a-days, windmills are being used to generate electricity.
- The rotor of the windmill is attached with a turbine which produces electricity.
- A large cluster of windmills for electricity generation is called wind farm.

* Advantages of Wind Energy:

• Non-polluting and renewable.

Disadvantages of Wind Energy:

- Initial cost of set up is very high.
- Rotors of windmills create noise pollution. They are also dangerous for the birds and hence for the ecosystem.
- Cost of repair and maintenance is high.

Wind Energy in Maharashtra

• Maharashtra is one of the prominent states considering the installation of wind power projects second to Tamil Nadu in India.

• As on 30/09/2014, installed capacity of wind energy is 4167.26 MW.

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- There are 50 developers registered with state nodal agency "Maharashtra energy Development Agency" for development of wind power projects.
- All the major manufacturers of wind turbines including Suzlon, Vestas, Gamesa, Regen, Leitner Shriram have presence in Maharashtra.
- Projects develped in the sate are as follows:
- a. **Sindhudurg district** Vijaydrug and Jamsande (Devgad)
- b. Satara district Vankusvade Gade (Panchgani)
- c. Ahmednagar district Shanjapur (Parner)

7. Biogas:

Biogas Plants are specially designed using high quality material and advance technology. It is mainly used for biologically breaking down organic matter, in the absence of oxygen. These biogas plants are able to properly recycle biomass, sewage & municipal waste, energy crops, manure and green waste. The biogas produced from plants could be further used for cooking, and generating electrical and mechanical energies.

- Organic waste can be utilised to produce biogas.
- Biogas is ideal for villages.
- Farmers can install biogas plants; often known as gobar gas plants.
- The bacteria decompose the farm waste in the biogas plant and biogas is produced in the process.
- Biogas is a very good fuel. It can be used as kitchen fuel and also for lighting.
- The organic manure which is a byproduct is highly beneficial for farmers.

* Advantages of biogas:

• Low cost source of energy, renewable and has the potential to solve energy need in rural areas.

Disadvantages of biogas:

• Biogas is a greenhouse gas and can lead to global warming.

3.12 SUMMARY

From the above chapter we have learnt that agriculture is the mainstay of the state of Maharashtra. The major crops grown in the state include rice, Jowar, Bajra, wheat, pulses, cotton, sugarcane, several oil seeds including sunflower, groundnut and soybean, turmeric, onions and other vegetables. Sugarcane, cotton, ground nut are the principal cash crops of Maharashtra. Maharashtra state, endowed with a coastline of 720 km stretched across five maritime districts, namely Thane, Greater Mumbai, Raigad, Ratnagiri and Sindhudurg. The northern coastal waters along Thane, greater Mumbai and Raigad districts are rich in fish resources of Bombay duck, non-penaeid prawns, golden anchovy, silver pomfret, eels, lobster, ribbon fish, horse mackerel, large sized croakers (Ghol and Koth) and threadfins (Rawas and Dhara), some of which are very characteristic of the region. They are mainly exploited by bag nets, surface drift and bottom set gill nets, large trammel gill nets introduced recently and hooks and long lines. The southern coastal waters of Maharashtra along Ratnagiri and Sindhudurg districts abound with the mackerel and sardines in addition to penaeid prawn, seer fish, black pomfret and catfish resources which are caught by shore seines (Rampani), gill nets and hooks and lines.

Amon the energy resources the tidal energy turbine for the first project will come up near Guhagar on Ratnagiri coast. Biogas is another energy source for rural families.

All these sources are renewable or inexhaustible and do not cause environmental pollution. More over they do not require heavy expenditure.

Besides the aspect of social and economic security in undertaken by government by providing National Crop Insurance scheme, Livestock insuranace scheme, National Remote Sensing Agency is providing crucial inforamtion area- to- area regardung the area affected by any natural disaster. Besides installation of numerous Automatic Weater system (AWS) is providing micro-climatic changes that help micro-advisors to update the farmers with the nature of cropping and other agriculture related inforamtion well before time to safeguard the crop and productivity.

3.13 CHECK YOUR PROGRESS/ EXERCISE

- 1. State whether the following statements are true or false.
- a. Anthracite coal is a metamorphic rock and is considered the highest grade coal.
- b. The main fruit crops are apple, banana, pear, watermelon.
- c. Sugarcane cultivation is confined to the area receiving adequate and timely irrigation.
- d. Fishing in Maharashtra is mainly **dependent on south west monsoonal r**ain
- e. In Maharashtra Cotton is grown in Son valley.

- f. 60% of the total agricultural land in the Konkan area under rice cultivation.
- g. India is the second largest fish producer in the world after China

2. Fill in the blanks

- a. Ground nut the principal ______ of Maharashtra is more common in dry area and infertile soils.
- b. By_____, we mean, the production of crops, livestock, or poultry.
- c. Rice is an important crop in _____ region of Maharashtra.
- d. Maharashtra, a coastal state, endowed with a coastline of
- e. Indian cow is often called
- f. _____coal is a metamorphic rock and is considered the highest grade coal
- g. _____are called as **poor mans cow**.

3. Multiple choice questions.

- a. Cash crops in Maharashtra include
- I. groundnut, cotton, sugarcane, turmeric, and tobacco.
- II. groundnut, rice, sugarcane, wheat, and tobacco.
- III. groundnut, wheat, rice, mango, and tobacco.
- IV. groundnut, turmeric, tobacco, apple, rice
- b. Bauxite is
 - I. A source of nuclear energy
- II. An aluminium ore.
- III. An Iron ore
- IV. A variety of fish
- c. Non-conventional sources of energy include
- I. energy from coal, petroleum, tidal energy, geo-thermal energy and even energy from waste material
- II. energy from sun, coal, biomass, petroleum energy
- III. energy from sun, wind, biomass, tidal energy, geo-thermal energy and even energy from waste material
- IV. energy from, tidal energy, geo-thermal energy and even energy from coal.
- d. Khopoli
- I. first Hydel power station in Maharashtra
- II. first Atomic power station in Maharashtra
- III. first Solar power station in Maharashtra
- IV. first Tidal power station in Maharashtra
- e. Atomic power is obtained from the atomic reactions related to the radio active munerals like,
- I. Uranium, Thorium, Radium, Lithium, Plutonium. etc
- II. Coal, Thorium, iron, etc.
- III. Uranium, coal, petroleum. etc

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Geography of Maharashtra **4.** Answer the Following Question

- 1. State major characteristics of agriculture of Maharashtra.
- 2. Write a short note on mineral resources of Maharashtra.
- 3. What are the major food crops of Maharashtra?
- 4. Examine the importance of livestock resources in the economy of Maharashtra.
- 5. What are the problems associated with livestock activity in Maharashtra?
- 6. What efforts/ measures are undertaken by the state government to improve the situation of livestock economy in the state?
- 7. Explain the significance of poultry resources in the economy of Maharashtra.
- 8. What are the problems faced by poultry industry in the state? What measures are undertaken by the state government to improve the issues related with poultry farming in the state?
- 9. What are the major types of fishing of Maharashtra? Describe salt water fishing.
- 10. How is fresh water fishing associated with rice cultivation in Maharashtra?
- 11. What are the problems and solutions related to fishing in Maharashtra?
- 12. Classify energy resources. Explain any one of them with examples.
- 13. What are the major Thermal and Hydel power stations of Maharashtra?
- 14. What are the advantages and disadvantages of solar energy?

3.14. TASK

1. In a map of Maharashtra locate the Atomic power plants.

2. In a chart state the different power resources.

- 3. In a map of Maharashtra point out
- (i) Tarapur (ii) rice producing region (iii) coal producing region

3.15 GLOSSARY

- **Minerals** are inorganic substances, meaning that they do not come from an animal or a plant.
- Cash crop: what a farmer raises, crop or livestock, to sell for money
- Livestock: animals raised on the farm
- **Fishery** the geographical area that the fishing is taking place or the actual fish species in the water itself.

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- **Freshwater** The term freshwater refers to any natural water with low levels of salt this includes lakes, rivers, streams and even ponds!
- **Habitat** A habitat is the natural environment or area where an animal or plant normally lives.
- **Marine** The term marine refers to the oceans and anything that can be found within them.
- **Renewable Power Sources** Renewable energy is a source of energy that can never be exhausted.
- Wind Power is energy energy that is produced directly from the wind by using a wind turbine. Not only is this resource free and renewable, it also emits no harmful greenhouse gases.

3.16. ANSWERS TO THE SELF LEARNING QUESTIONS

1.a. true

- 1. b. false, mangoes, grapes, bananas, oranges.
- 1. c. true
- 1. d. false, Agriculture
- 1. e. false. Tapi
- 1. f. true
- 1.g. true
- 2. a. oilseed
- 2. b. Agriculture
- 2. c. Konkan
- 2. d. 720 km.
- 2. e. tea-cup cow
- 2. f. Anthracite
- 2.g. Goats
- 3.a.I.
- 3.b.II
- 3.c.III
- 3.d.I
- 3.e.I

MAHARASHTRA INDUSTRIES: INDUSTRIAL REGIONS OF MAHARASHTRA, RECENT DEVELOPMENTS IN INDUSTRIAL SECTOR, DEVELOPMENT OF TRANSPORT AND COMMUNICATION IN MAHARASHTRA, MUMBAI METROPOLITAN REGION

After going through this chapter you will be able to understand the following aspects.

Unit Structure

- 4.1 Objectives
- 4.2 Introduction
- 4.3 Subject- Discussion
- 4.4 Industrial Regions of Maharashtra
- 4.5 Recent developments in Industrial Sector
- 4.6 Development of transport and communication in Maharashtra
- 4.7 Mumbai Metropolitan Region
- 4.8 Summary
- 4.9 Check your Progress/ Exercise
- 4.10 Answers to the Self Learning Questions.
- 4.11 Glossary
- 4.12 Task
- 4.13 References for Further Study

4.1. OBJECTIVES

By the end of this unit you will be able to -

- □ To understand the relationship of industrial development with agriculture, minerals and energy
- To examine the factors affecting the localization of industries
- To understand spatial distribution of some major agro-based and mineral based industries in Maharashtra
- To locate and identify selected industries on the map of Maharashtra

- To Understand the recent development in the industrial sector of Maharashtra
- To explain the role of different policies in augmenting industrial development in Maharashtra
- To establish the relationship between industrial development and regional development
- To understand the development of transport and communication in Maharashtra
- To know formation and importance f the Mumbai Metropolitan Region

4.2. INTRODUCTION

In this chapter we will learn about the location of industries in Maharashtra. The industrial regions of Maharashtra have also been discussed in the following chapter. Moreover the state's recent development in industrial sector has also been taken into consideration. The distribution of industries, its problems and solutions are also discussed. In addition to all these, the transport and communication in Maharashtra and the need for formation of Mumbai Metropolitan Region is also studied.

4.3. SUBJECT DISCUSSION

It is known that economic development of any state is directly linked with the stage of industrial development. Before independence, Maharashtra was industrially less developed. But with five year planning policies of independent India from 1960's which emphasized development in the field of agriculture, industry, energy and water sectors facilitated Maharashtra to become leading industrial state contributing 13% of national industrial output and employing 64.14% of the people in agriculture and allied activities in India. Almost 46% of the GSDP is contributed by industry. The resultant fact therefore is, Mumbai' the state capital is also a financial capital of the country with concentration of tertiary, administrative, defense and few industrial activities. Mumbai was once known as an industrial city due to concentration of textiles, light engineering, chemicals and pharmaceutical etc. Industrial development in the state was largely concentrated in and around the peripheral areas of Mumbai. But with passage of time, changing policies and technology the land-use and land-value also changes. Same is true of Mumbai as well. Industries in and around Mumbai are cotton textiles, chemicals, refineries, machinery, automobiles, construction, electrical, transport and metallurgy. These industries also provide employment to a considerable number of people.

Agro-industries are well developed in Maharashtra. Sugarcane being major crop in the state it produces about one fourth of the total sugar production of India. Major sugar mills are located at Nasik, Pune, Ahmadnagar, Satara, Sangli, Kolhapur and Sholapur. Pharmaceuticals,

Maharashtra Industries: Industrial Regions of Maharashtra, Recent Developments In Industrial Sector, Development of Transport and Communication in Maharashtra, Mumbai Metropolitan Region Geography of Maharashtra petrochemicals, heavy chemicals, electronics, automobiles, engineering, food processing, and plastics are some of the major industries of the state. Small scale industries have also come up in a big way in the state.

Maharashtra also has got good rail and road connectivity with all the other regions of India. The Central Railway and the Western Railway zones of the Indian Railways are headquartered in Mumbai, at Chhatrapati Shivaji Terminus and Churchgate respectively. Until 1960's trams existed in Mumbai. The State has 5,983 km rail length running between 4 railways. Spreading across 267,452 kilometers, the road network of Maharashtra is the largest in the country. The six neighbouring states of Maharashtra are connected via 17 National Highways. Maharashtra also has a huge state highway network with a total length of 3688 kilometres. As of March 2010, 97.5 per cent of the villages in the state were connected by roads that can withstand all weather conditions. In April 2002, India got its first fully operational access controlled toll road, the Yashwantrao Chavan Mumbai-Pune Expressway connecting the city 'Pune' which is educational and industrial hub to Mumbai city through Yashwantrao Chavan Mumbai-Pune Expressway.

4.4. INDUSTRIAL REGIONS OF MAHARASHTRA

4.4.1. Introduction

- Maharashtra has been in the forefront in sustaining industrial growth and in creating environment conductive to industrial development.
- Friendly industrial policies, excellent infrastructure and a strong and productive human resource base have made it a favoured destination for manufacturing, export and financial service sectors.
- Maharashtra being India's leading industrial state contributes 13% of national industrial output.
- It is found that 64.14% of the people are employed in agriculture and allied activities. Almost 46% of the Gross State Domestic Product (GSDP) is contributed by industry.
- Maharashtra's gross state domestic product (GSDP) accounted for 12.98 per cent of India's gross domestic product (GDP) in 2014- 15, the highest among all states.
- The principal industrial zone in Maharashtra is the MumbaiThane-Pune zone belt. This zone accounts for about 60% of the state's output.
- Efforts are being made to promote other industrial areas like, Nagpur, Nashik, Aurangabad, Sholapur, Jalgaon, Raigad, Amravati, and Ratnagiri by building necessary infrastructure and creating an environment conducive to industrial development.

4.4.2. Industrial Regions: Industrial regions of Maharashtra are mainly concentrated in the prosperous agricultural regions, mining areas of mineralized zones and along the main transport arterial routes. Based on these aspects major industries of Maharashtra are concentrated and developed in the following industrial regions:

- a) M umbai-Thane industrial region.
- b) Pune-Pimpri- Chinchwad industrial region
- c) Aurangabad-Jalna industrial region
- d) Nagpur industrial region
- e) Nasik industrial region
- f) Kolhapur industrial region
- g) Sholapur industrial region

a) **Mumbai-Thane-Raigad Industrial Region:** This is the largest industrial region of Maharashtra.

- Industrial centres of this region are Thane, Ghatkopar, Bhandup, Mulund, Kurla, Ulhasnagar, Ambernath, Kalyan, and Bhiwandi – Nizampur - Chembur, Vashi, Panvel, Navi Mumbai, Dahanu and Tarapur.
- **Major industries found here are** Electrical and electronics, automobile, oil refineries, Soap, Handlooms, Fertilizers, Rubber, Plastic, Glass, Chemicals, Textiles, and Film industry
- Main reasons for the development of industries in this region are as follows:
- i) This region owes its origin to the British rule in India.
- ii) Mumbai developed as major international port during British period. Mumbai was connected to the rest of Maharashtra and India through roads and railways which helped in the import of finished products and export of the raw material. These infrastructures of Mumbai have helped in the development of industries in and around Mumbai at a later stage.
- iii) Industrial development in Mumbai started during the Second World War. In this period the export of Mumbai port was stopped due to war.
- iv) Mumbai is known to have settled skilled workers from the historical times during the era of King Bhimdev with Mahikavati at Mahim as his capital. The king brought skilled workers from Surat, Desh, Konkan, Andhra and Karnataka. Even today the trend continues to cover entire India as well as across the country to receive skilled and unskilled labour force to this region.

Maharashtra Industries: Industrial Regions of Maharashtra, Recent Developments In Industrial Sector, Development of Transport and Communication in Maharashtra, Mumbai Metropolitan Region

- v) Supply of electricity from Khopoli, Bhira and Bhivpuri power stations made it possible to have industrial development in the region.
- vi) Large capital investment was provided by Parsi communities and Gujarati, from the era of colonial rule till date in this reigon for the development of industries in this region.
- vii) This region enjoys well developed transport facilities road, railways, airport and ports, which helped in its growth.
- viii) Mumbai is one of the very important international ports which have facilitated imports on a large scale.
- ix) As a result of British contacts Mumbai could easily get modern technology and machinery.
- x) Mumbai, then Bombay was an important administrative centre during British period and its important enhanced in the post independence period.
- xi) Mumbai is considered as the economic capital of India. Many banks, insurance companies and other financial institutions are found in this region.
- xii) Due to shortage of space in Mumbai the industrial development took place along the central and western railway routes i.e. in Kurla, Bhandrup Mulund, Vikhroli, Thane, Panvel, Uran and Navi Mumbai.

b) Pune-Pimpri-Chinchwad Industrial area

- □ **Pune -Pimpri-Chinchwad Industrial area** is another major industrial region of the state. Industrialisation here started in the year 1954.
- □ The Pimpri-Chinchwad is a twin city is located to the North-West of Pune City in Pune district.
- Pimpri-Chinchwad Municipal Corporation (PCMC) encompasses areas of Chinchwad, Pimpri, Nigdi, Nigdi Pradhikaran, Tathawade, Talwade, Akurdi, Bhosari, Ajmera Colony, Sambhaji nagar, Nehru nagar, Sangvi, Hinjewadi, Aundh Annex and Wakad.
- □ Industrial centres of Pune-Pimpri-Chinchwad are Pune, Khadki, Dehu Road, Pimpri, Chinchwad, Hadapsar, Bhosari, Urali. Kanchan, Chakan, Pirangut etc.

□ Main reasons for the development of industries in this region are as follows:

- i) The region is well connected with the Industrial region Mumbai by quick and efficient railways, roads and new expressway transportation.
- ii) Both Pimpri and Chinchwad are well connected by road via old Pune-Mumbai Highway.
- iii) Pune has a central location so roads and railways converge here.
- iv) Supply of Power is assured.
- v) Many educational institutes like the Deccan education society and Symbiosis are in Pune. Presence of these institutions has ensured availability of IT experts. As a result of which IT industries have flourished here.

vi) Both skilled and unskilled labour is easily available here. vii) Many research laboratories are also found in this region.

□ **Major industries in Pune-Pimpri-Chinchwad Industrial area Are** Engineering, Metallurgical, transport equipments, electrical equipments, textiles, pharmaceutical and Chemicals.

c) Aurangabad-Jalna industrial region:

□ **Industrial centres in this region are** Aurangabad, Vaijpur, Paithan, Kannad, Jalna, Ambad, Partur, Walunj, and Chikhalthana.

□ Main factors for the development of industries in this region are as follows:

- i) Availability of water
- ii) Both skilled and unskilled labour is easily available here.
- iii) Electric supply from Jayakwadi power project.
- iv) Availability of extensive land areas at low rates.
- v) Agriculture is well developed in this region so there is greater scope for the Agro-based industries to flourish.
- vi) Government provides additional facilities as this region was under developed in the past.

I. Industries of this region area textiles – Special 'Paithani' saree is weaved here. This is a famous saree of this region, Sugar Industries, Handloom, Oil mills, saw mills, automobiles, two wheelers, engineering goods, Chemicals, Pharmaceuticals, Steel goods, electronic goods, Plastic, Cement pipes, suitcases etc.

d) Nagpur industrial region

□ Industrial centres of this region are: Nagpur, Kamtee, Kanhan, Hingana, Katol, Kamleswar

□ Main factors for the development of industries in this region are as follows:

i) Availability of different kind of minerals due to the presence of mining industries in Nagpur and Bhandara district

- ii) Power is available from Khaperkheda and Koradi thermal power stations
- iii) Nagpur has central nodal location in India. Road, railways and air routes converge here.

I. **Industries of this region are:** Textile mills, Pharmaceuticals, Plastic, Paper, Fertilizers, Sugar, Heavy industry – military equipments, Bidi, Chemical, Cement, Television sets.

e) Nasik industrial region

□ Industrial centres are Nasik, Nasik Road, Ozar

□ Main factors for the development of industries in this region are as follows:

- a. Central nodal location of Nasik in India. Road, railways and air routes converge here.
- b. Electricity is available from Vaitarna power station.
- **c.** Availability of raw material and cheap labour from the surrounding region.
- d. Accessibility of Mumbai port.

□ Industries of this region are: Bidi,, Leather,, Aeroplanes,, Copper utensils, Nylon, Currency notes,, Paint,, Suitcase etc.

f) Kolhapur industrial region

□ Industrial centres are Kolhapur, Shiroli, Kasba, Bawada, Gokul, Shirgaon

☐ Main factors for the development of industries in this region are as follows:

- i) Availability of raw material and cheap labour from the surrounding region.
- ii) Hon. Shahu Maharaj, king of Kolhapur encouraged the industrial development in this region.
- iii) Electricity is supplied from Radhanagari and Koyna power stations.
- iv) Kolhapur is near Karnataka and Goa. It is a nodal town hence transport routes converge here.

□ Industries

I. Kolhapur chappals, Kolhapur Sazz (gold plated ornament), Cement pipes, Oil engines, Cotton textiles , Sugar mills, Agro equipments, Edible oils, Machinery, dairy industry.

g) Sholapur industrial region

□ Industrial centre is Sholapur

□ Main factors for the development of industries in this region are as follows:

i) Central – nodal location

ii) Availability of raw material from the surrounding region. iii) Availability Skilled and unskilled cheap labour from the surrounding region.

□ **Industries found are** Cotton, Hosiery, Milk, Agro equipments, Plastic, Electrical equipments etc.

4.5 RECENT DEVELOPMENTS IN INDUSTRIAL SECTOR:

4.5.1 Reasons behind industrial development in Maharashtra

□ Maharashtra's **strengths** in terms of natural and human resources, connectivity and infrastructure, historical legacy and industrial development five year planning policies of independent India has helped in the growth and development of industries in the state.

 \Box A large, trained workforce with enhanced skill levels is an addition to other important factors like raw material and power etc.

□ Maharashtra is **richly endowed within various minerals** of **industrials importance** like manganese, coal, iron ore, limestone, copper, bauxite, silica sand, and common salt.

- These minerals are found in substantial quantities in the eastern districts with some deposits in the west.
- Bituminous **coal** are found in the in the districts of Bhandra, Nagpur and Chandrapur.
- Undersea oil deposits were discovered in and near Mumbai in the 1970s.
- The mountainous region of the state is a virtual repository of rich timber reserves.

• Establishment of Maharashtra Industrial Development Corporation (MIDC):

- **a.** To attract industries to different areas of the state, the government of Maharashtra established Maharashtra Industrial Development Corporation (MIDC) in 1962.
- b. MIDC provides businesses with infrastructure such as land (open

plot or built-up spaces), roads, water supply, drainage facilities etc.

- c. To date 233 areas have been developed around the state with emphasis on different sectors such as Industrial, IT, Pharmaceutical, and Wine.
- **Connectivity:** Maharashtra is well connected by roads, railways airways, and waterways.

• **Power resources:** Power supply is one of the key drivers of industrial development.

- a) After establishment of <u>Maharashtra</u> state in **1960**, the government of Maharashtra gave priorities to power sector.
- **b)** <u>Maharashtra State Power Generation Company (Mahagenco)</u> is the only State Utility having a very well balanced generation portfolio involving thermal, hydel and gas stations.
- c) The first 500 MW plant to be installed in any State Utility belongs to Maharashtra.
- d) Mahagenco having generation capacity of 11657 MW comprising 8220 MW thermal, 2585 MW hydel, 672 MW gas turbine and 180 MW solar.
- e) The hydroelectricity producing plants are in western areas (koyna) of the state while thermal form of power is in the eastern region.
- f) India's first nuclear plant located at Tarapur in Palghar district is 123 km to the north of Mumbai.

Total electricity generated (including renewable sources) in the state was 89465 million units (MUS) during 2011- 12 which was 7.8% higher than previous year. MAHAGENCO accounted for 53.1% per cent followed by RGPPL and Tata power 12.3%, each JSW energy 7.4%, renewable energy 6.3%, reliance Infrastructure 5%, Wardha Power Company Ltd. (WPCL) 3.3% and others 0.3% of the total generation

4.5.2 Following industries have contributed in the industrial growth and development of Maharashtra:

□ Agro-Based Industries:

a) Cotton textile industry: Rich cotton growing areas and favourable climatic conditions for textile industry and beginning of textiles during British era are the major determinant factors for development of cotton textile industries in the state. Following are some of the important aspects of this industry:

- i) Maharashtra possesses an immense History in textiles.
- ii) Mumbai city was the original home of India's textile mills but of late has very few industries due to its changing urban functions that made it a financial capital of the country.

- iii) Cotton textile industry is the largest and the oldest industry both in terms of production and employment in the state.
- iv) This industry includes textile mills, handlooms and power looms.
- v) Important centres of this industry are located at Mumbai, Nagpur, Sholapur, Akola, Amravati, Ichalkaranji, Malegaon and Bhiwandi.
- vi) Sholapur, an important and largest textile centre of this industry enjoys a prime location being in the cotton growing area. It is also located on the Mumbai-Chennai railway line.
- vii) Nagpur also enjoys a similar position like Sholapur.
- viii)Some small centres of textile are also found in Jalgaon, Dhulia, Kolhapur and Sangli region.
- ix) Hand loomed goods are produced especially in and around Nagpur and Sholapur.

b) Sugar industry: Favourability of natural factors for sugarcane production, political power for foundation of sugar mills and sugar cooperatives, well developed transport connectivity, irrigation, power supply and ready market has flourished this industry in the state. Following are the important aspects associate with this industry in the state:

- i) In Maharashtra, Sugarcane cultivation is mainly concentrated in the irrigated regions of Godavari and Krishna valley. For sugar, warmer climate in needed for better yield and Maharashtra grows thicker variety of sugar cane.
- ii) Black lava soil found in Maharashtra, is fertile, and retains water and good for sugar cane growth.
- iii) Mills use bagasse as fuel and do not need coal for power.
- iv) Mumbai Port helps in export.
- v) Cheap labour also available.
- vi) Location principle of sugar industry is that Sugar mills must be located near the sugar-farming areas because sugarcane is bulky and perishable. Sugarcane contains sucrose and once the sugarcane is cut the sucrose content starts to decline. Hence raw material must be quickly transported. Moreover, Sugar accounts for only 10% of the bulky sugarcane and therefore it is prohibitively expensive to transport sugarcane over long-distance in its original form. Therefore, Sugar mills are located near sugar-cane producing regions.
- vii) Important Sugar mills are found in Western Maharashtra's river valleys, Sangli, Sholapur, Satara, Ahmadnagar, Pune, Nasik
- viii) Sugar industry has made considerable progress especially in the cooperative sector.

Geography of Maharashtra

- ix) Maharashtra is well known for the development of sugar industry on co-operative lines in which the farmers acquire a share in the sugar mills.
- x) Kolhapur, Ahmadnagar, Sangli, and Miraj important centres for sugar refining.

c) Oil Mills: Favourable natural conditions for growth of different types of oil seeds in different regions of the state has provided local raw material for the development of oil mills in the state. Following reasons are responsible for the development of oil mills in the state.

- i) In Maharashtra a large number of farmers and agricultural labours depend upon oilseed farming. Thousands of people are engaged in oilseed production and trading. Thus, from the employment point of view it is one of the most important industries of the Maharashtra state.
- ii) In Maharashtra Solapur, Latur, Jalna and Aurangabad are the four major districts that produce of oilseeds.
- iii) The contribution of these four major districts in the production of oilseeds in Maharashtra is 70%. As a result, numerous oil mills are located in these four districts in Maharashtra. At present there are 98 oil mills and 80 tel-ghani units consisting 160 telghanis in Solapur city.
- iv) Earlier in the beginning of 20th Century safflower seed were crushed at tel-ghanis and groundnut oilseeds were crushed in the oil mills. But at present, maximum edible oil such as groundnut oil, sunflower oil, cotton seed oil, and safflower oil are produced by the oil mill owners rather than telghanis.
- v) Due to shortage of safflower seed production and cut-throat competition in the edible oil business the traditional telghani production is lagging behind in the State.
- vi) There are about 1806 oil mills in 2007-2008 in Maharashtra providing 1.32 million tonnes edible oil.
- vii) Among all states in India, the Maharashtra state has ranked second in the list of production of oilseeds and edible oil. Safflower is the most important Rabi oilseed crop in the Maharashtra state, occupying a pride of place in oilseeds production.
- viii) In general oil mills are found all over the state wherever groundnuts are produced. It is found in Akola, Jalgaon and Dhule (edible oils processing) also.

d) Traditional agro industries:

- □ **Fruit canning and preservation** are important in Nagpur, Bhusaval, Ratnagiri, and Bombay.
- □ Small-scale agro-processing (rice-mills/ flour mills/ poha mills, Spices grinding mills etc), consisting of conversion of food grains, oilseeds, and

other crops into items of daily consumption, is virtually ubiquitous in the state.

□ **Forest based industries:** Forests provide us with different types of forest produce used as raw materials by specific industries. Timber, bamboo, sandalwood, and tendu leaves (for cheap cigarettes) are the important forests produce. Following are the Forest based industries developed in Maharashtra:

a. Paper industries: Maharashtra has 71 paper and paperboard mills accounting for 17% of the country's installed capacity and production.

A variety of raw materials including bamboo/hardwood (Ballarpur), bagasse, rags and imported pulp for paper manufacture and rice straw and bagasse for paperboard production is used. Paper industry is raw-material oriented industry as a lot of weight is lost in processing activity.

□ The paper mills are located at Ballarpur, Kalyan, Khopoli (Mumbai), Bhambhori, Duskheda (Jalgaon), Roha (Kolaba), Pande, Chinchwad (Pune), Kamptee, Malegaon (Nasik), Pravaranagar and Paithan (Aurangabad). The paperboard mills are located at Vikhroli, Goregaon and Kalyan all in Mumbai.

b) Furniture industry: Nagpur, Ulhasnagar are the areas producing variety of and large amount of wooden/ bamboo furniture that is widely marketed within the country as well as abroad.

 \Box Other industries in the state are:

a) Engineering industries

- □ The state's greatest concentration of heavy **Engineering** industry and **high technology** is concentrated in the Mumbai-Pune zone. Heavy machinery. Agricultural implements, oil pumps, lathes, compressors.
- b) The **petrochemical industry** has witnessed a massive growth in the state after the installation of India's off shore oil wells near Mumbai in 1976.
- c) **Oil refining** and the manufacture of such items as rubber products, electric and
- d) Electrical and electronic industries; refrigerators, electronic equipments, Air conditioners and television and radio sets are assuming increasing importance.
- e) Automobile industry: Maharashtra is renowned for the production of three-wheelers, jeeps, commercial vehicles and cars. Pune is emerging as one of the largest automobile hubs in the country.
- f) **Indian film industry:** Mumbai is the capital of **Indian film industry** and is popularly known as Bollywood.

4.5.3 Problems associated with Industrial sector in Maharashtra

The main problems faced by the industries of Maharashtra are that the industries are concentrated in very few urban centres which give rise to regional imbalance. Availability of natural resources, historical legacy and political power are the major contributing factors responsible for concentration and associated problems in sector in the economy. The colonial development of industrial centres near the port cities further got strengthened after independence due to industrial growth policy that was largely responsible for concentration of industrial centres in and around Mumbai region, Pune, Nagpur, Nashik, Kolhapur and Solapur region.

Region wise industrial problem in Maharashtra are as follows:

□ North Maharashtra

- **a**. Loss of agricultural land due to industrial activities and associated non- agricultural activities.
- b. Problem faced due to high power tariff as well as irregular and inadequate power supply
- **c.** Accidents, Traffic, jam, and inadequate transport and communication reduces the economies of scale.
- d. Lack of infra-structure in industrial estates
- e. Entrepreneurs face problems of delay in getting licences and permits issued or renewed from the concerned authorities.
- f. Agitation by workers, frequent strikes and slow-down work cause loses for the industry and the economy.

Western Maharashtra

- **a**. Paucity of skilled labour is a major problem
- b. Unreasonable power tariff hinders industrial growth
- c. Corruption in various government works
- d. Absence of airport

□ Marathwada

- a. Inadequate basic infrastructure is one of the major problems.
- b. Geographical constraints with reference to climate and fresh water availability make planning for development a difficult aspect.
- **c.** Power shortage in the region leads to cancellation of workers shifts. Hence diseconomies of scale in the affects industrial growth.

d. There is lack of higher educational institutes providing skilled manpower equipped with technical skills is other major set-back for industrial development.

🗆 Konkan

- **a**. Most of industrial units are small-scale or cottage industries that lack financial, appropriate processing and marketing support.
- b. Few large scale industries providing jobs to semi-skilled or unskilled local workforce is on contractual basis without any benefits or incentives.
- **c.** Land holdings are very small due to fragmentation and nature of relief. Most of the farmers practice subsistence agriculture that just supports their family.
- d. In spite of rich coastline and fishing activity the region lacks in cold storages and fish processing units.
- e. Most of the development projects have received a setback due absence of involvement in the process of development project of local members.
- f. Transport constraints due to rugged topography, narrow roads, landslides, rock falls, floods and accidents.

4.6. DEVELOPMENT OF TRANSPORT AND COMMUNICATION

4.6.1. Importance of development of transport and communication in the economy of Maharashtra: It is said to be the life-line of any economy that circulates and distributes tangible and intangible goods and services. Maharashtra state was fortunate to have the first-ever Indian railway line inaugurated on 16th April 1853 initially operating between Boribunder (Victoria Terminus) and neighboring Thane. Later The Great Indian Peninsular (GIP) and the Bombay-Baroda and Central India (BB&CI) Railway started in 1860. A regular service of steamers on the west coast was commenced in 1869. The opening up of the Suez Canal in 1869 opened the connections between then Bombay and the rest of the world that made Bombay a major port of India. Thus transport and communication play a pivotal role in industrial development as it helps in the following:

- i) It provides local, regional, national and international markets for the local produce depending upon its quality, supply and demand conditions, rules and regulations.
- ii) It provides a link between the producer and the consumer.
- iii) It helps in the agglomeration as well as dispersal of industries depending upon the nature of produce and product to be procured, processed and marketed.

- iv) It favors productivity in different industries.
- v) It connects rural villages with urban centers.
- vi) Efficient and improved transport and communication provides internal and external economies of scale for the industry. This reduces overall costs and thus lowers the sale price It induces increased demand and sale to increase profits. Increased profitability promotes reinvestment to boost the production in the economy and so the living standards of the people.

4.6.2. Modes of transportation: Maharashtra is bestowed various modes of transportation viz. Roads, Railways, Airways, Waterways, Pipelines and ropeways. Thus availability of different modes of transportation contributes to the prosperity of a nation's Industrial development and the state of Maharashtra is no exception. Let have a brief study of the development of various transport in the state:

a) Road Transport: The 20th century saw the rapid development of comprehensive road transportation systems, such as national highway systems, expressways and village-connect. Road transport further gained more importance due to drastic change in automobile manufacturing that contributed to industrial growth. In the areas where construction of railway is difficult or impossible roadways are the only option left for providing connectivity. Following are the salient features of road transport in Maharashtra:

- i) Spreading across 307713 sq. km area of the state the total road length network of 33,705 km is the largest in the country.
- ii) There are 18 National Highways that connect Maharashtra to six neighboring states Viz: Gujarat, Madhya Pradesh, Chhattisgarh, Telangana, Karnataka and Goa. The length of National Highways in Maharashtra is 3688 kilometres.
- iii) Maharashtra has a large state highway network. It is important to note that 97.5 per cent of the villages in the state are connected by all-weather roads. Some of the major highways in Maharashtra are MH MSH 1, MH MSH 3, MH MSH 6, MH MSH 9, and MH MSH 10.
- iv) National highways no. 3, 4, 6, 7, 8, 9, 13, 16, 17, 44, 69 and few others connect important states of Jammu and Kashmir (Srinagar) Delhi (Agra), Gujarat, West Bengal (Calcutta), Uttar Pradesh (Allahabad), Andhra Pradesh (Hyderabad) Karnataka (Bangalore), Tamil Nadu (Kanyakumari) and other state highways and district roads.
- v) Most of the metro-cities of the state are connected with its important nodes by fly-over's to ease traffic, save time and fuel consumption; save foreign exchange by conserving energy and to reduce pollution in the city. For example in MMR region the important roads and flyovers are J.J. flyover/ Mumbai-Vashi Bridge; Western Express Highway, Eastern Expressway, East-West links (Jogeshwari Vikhroli Link Road (JVLR) and Santa Cruz Chembur Link Road(SCLR))., Bandra-

Worli Sea link. Etc. State and private transport operators serve all routes. Intercity bus services and Volvo are most significant. Following are the important road links in Maharashtra:

□ Expressways in Maharashtra are as follows:

i) Eastern Express Highway: The Eastern Express Highway, or EEH, is one of the busiest roads in Mumbai Metropolitan Area. It is a part of National Highway 3. This highway serves Mumbai city by connecting proper city to eastern outskirts and also to Thane which is a metropolitan area.

ii) Eastern Freeway (Mumbai): The Eastern Freeway is 16.8 km long. It is primarily intended to reduce travel time between South Mumbai and the <u>Eastern Suburbs.</u> It is controlled-access freeway; connecting P D'Mello Road (South Mumbai) to Eastern Express Highway at Ghatkopar. The main aim of the ambitious Eastern Freeway project is to reduce traffic congestion in the busy city of Mumbai, India and also the suburbs.

iii) Mumbai-Pune Expressway: The Yashwantrao Chavan Mumbai-Pune Expressway, the first access controlled toll road project in India was made fully operational in April 2002 and six-lane concrete, high-speed Expressway that spans over a distance of 93 km. It connects important areas of Thane – Panvel, Khopoli, Lonavala-Khandala – Talegaon- Pimpri-Chnchwad with Bhor ghat as an important pass on the route.

iv) Mumbai-Nasik Expressway: Mumbai Nasik Expressway is 150 km long and connects Mumbai to Nasik. It connects important areas of Thane, Kalyan, Bhiwandi, Kasara and Igatpuri with Thal ghat as an important pass on the route.

v) Western Express Highway: Western Express Highway runs in northsouth direction. It is abbreviated to WEH. It is an 8-10 lane arterial road in Mumbai.

b) **Railways:** The first railway in Asia and the country was in the state of Maharashtra from Boribunder to Thane on 16th April1 1853. Following are the salient characteristics of rail network in the state:

- i) Maharashtra, with a railway network spanning 5,983 km between four Railways is well-connected to other parts of the country.
- Western and central railway lines link Mumbai city to other parts of our country. There are also direct trains that link all the major cities and towns of Maharashtra and also with other major cities of India.
- iii) The state has 205 railway stations.
- iv) The state of Maharashtra also consists of Mumbai suburban railway networks with a commuting population 6.4 million passengers each day.
- v) The Nanded division of the South Central Railway caters to the Marathwada region of Maharashtra.

- vi) The Konkan Railway, a subsidiary of the Indian Railways based in CBD Belapur, Navi Mumbai serves the Konkan coastal region south of Mumbai and continues down the west coast of India.
- vii) In addition to this, a monorail and Metro are running and few more are planned for Mumbai Metropolitan Region.
- viii) East-Central-West rail-route link has connected Eastern Harbour, Central Main line and Western main by Panvel-DivaVasai rail service.
- x) Besides shuttle services connecting small towns with respective major urban centres of the State are also provided to facilitate daily commuting of people. Common people are largely benefited by this as many students, working population, small entrepreneurs and local tribals make use of these services. For-example, M iraj-Kolhapur; Virar-Dahanu; Lonavala-Pune etc.
- xi) Meter guage is also available in the plateau region of Maharashtra.
- xii) Narrow guage connecting the foothill railway station of Matheran on Central Railway with the hill –top station of Matheran. It was developed by Britishers as a hill station for them to escape from severe summers of (Bombay) Mumbai. It is mini-train and continues even today. Matheran is today one of the famous historical tourist hill station of the state.

c) Water transport: Water transport is considered to be the cheapest of all other means of transport. In the Konkan region of Maharashtra coastal shipping is very important. Maharashtra is bestowed with a coastline of 720 km, of which Greater Mumbai District has approximately 114 km, Thane District 127 km, Raigad District 122 km, Ratnagiri District 237 km, and Sindhudurg District 120 km. Maharashtra has three major ports at Mumbai (operated by the Mumbai Port Trust), the JNPT lying across the Mumbai harbour in Navi Mumbai, and in Ratnagiri. Mumbai Port and Jawaharlal Nehru Port fully modernised port of Asia (JNPT) at Uran and other minor ports on the western coast are playing a significant role in industrial and trade activities of the state and the country. There are48 Intermediate and small fishing, freight and passenger ports all along 35 creeks on the coast of the state.

c) Pipelines most of which are underground carrying water, gas, oil, chemicals and sewage have contributed immensely for agricultural, industrial and urban development in Maharashtra. For example, a 210 km long double pipeline connects Mumbai with Mumbai High. It provides facilities for transporting crude oil and natural gas. Mumbai-Pune (MPPL) Product Pipeline India;LoniPakni (LSPL) Product Pipeline India;Loni-Pakni (LSPL) Product

Pipeline India-Hazarwadi-Pakni (Solapur).etc. Six lakes namely Tansa, Bhatsa, Vaitarna, Tulsi, Upper Vaitarna and Powai supply water to Mumbai through pipelines. Electricity supply, Communication lines through cables, sewerage lines, chemicals etc. all play important role because of pipelines in different forms carrying these items. **d)** Air transport: There are three International Airports in Maharashtra located at Mumbai (Chhatrapati Shivaji Maharaj International Airport), Nagpur and Pune. There are also 5 Domestic airports at Mumbai, Pune, Nagpur, Aurangabad and Nanded in the State. To reduce congestion in Mumbai International Airport another international is proposed at Panvel. A Specialties of Multi-model International Cargo hub and Air Port (MIHAN) at Nagpur is also proposed. Following are the special aspects of air transport in the state:

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- i) Chhatrapati Shivaji International Airport is among the busiest airports in India.
- ii) With the establishment of Juhu Aerodrome, Civil aviation in Maharashtra began in the 1920s. It was one of the first aerodromes in British India.
- iii) It served as a base for J.R.D. Tata's Tata Airlines in the 1930s.
- iv) In addition to the bigger airfields at Santacruz, Pune and Nagpur built by the Royal Air Force which were also used for civilian operations.
- v) During the 80's and 90's, Vayudoot served as many as ten airports in the state.
- vi) There was an unprecedented growth in air traffic with growing tourism industry and entry of low cost airlines.
- vii) The booming Indian economy, liberalisation of international bilateral agreements and liberalisation of civil aviation policy at the centre down the years also heralded the growth of air traffic.
- viii)Most of the State's airfields are operated by the Airports Authority of India (AAI).
- ix) Currently Reliance Airport Developers (RADPL), operate five non metro airports at Latur, Nanded, Baramati, Osmanabad and Yavatmal on a 95-year lease.
- □ Maharashtra has three international airports:
- □ Mumbai's Chhatrapati Shivaji International Airport (among the busiest airports in India);
- □ Pune Airport with flights to Dubai, Frankfurt and Sharjah;
- □ Nagpur's Dr. Babasaheb Ambedkar International Airport.

4.7 MUMBAI METROPOLITAN REGION

Mumbai Metropolitan Region or in short MMR, with an area of 4,355 km², consist of the metropolis of Mumbai and its satellite towns in Maharashtra. It has seven municipal corporations (Greater Mumbai, Thane, Kalyan, Navi Mumbai and Ulhasnagar) and fifteen smaller municipal councils, 7 non-municipal urban centres, and 995 villages.

Geography of Maharashtra It was developed over a period of about 20 years.

With a population of 20,748,395 it is among the most populous metropolitan areas in the world. It is linked with Mumbai through the Mumbai Suburban Railway system and a large network of roads.

The development of MMR is looked after by the Mumbai Metropolitan Region Development Authority (MMRDA). MMRDA is a Maharashtra State Government organisation and is in charge of town planning, development, transportation and housing in the region. It was established for implementation of the Regional Plan and for Planning, Development and Co-ordination of Development within MMR.

Initially there was no organised development in the areas outside of Brihan Mumbai or Greater Mumbai and Navi Mumbai. Due to rapid urbanisation the region had problems related to haphazard and illegal development like Villages along the NH3 in Bhiwandi Taluka

A Maharashtra Government-owned company, City and Industrial Development Corporation (CIDCO) developed Navi Mumbai, as one of the largest planned cities in the world.

Its administrative limits cover Mumbai city and Mumbai suburban districts and parts of Thane and Raigad districts. This region has 40 Planning Authorities that are responsible for the micro-level planning of different areas.

4.7.1 Physiography of the region

- □ This region, lying on the west of Sahyadri Hills is basically a low land. The terrain has a series of north-south hill ridges in the central and eastern part. The landscape's step like terraces and layered appearance is the characteristics of Deccan Lava Country. This was formed due to successive layers of basalt flow.
- □ This region is drained by five major rivers and their numerous tributaries which empty into the Arabian Sea. All of these rivers are important sources of water in this region.
- □ The region has 167km long coastline which is again highly indented by estuaries, bays and creeks.
- □ Wetlands occupy vast area of land along the coast consisting of mudflats marshes salt pans and mangroves. This covers slightly less than 10% of the geographical area of the MMR.
- The coastal plantations, beaches and hamlets with great-scenic value, along the coastal belt in the north and south have made this region famous.
- Nearly 45% area of MMR is below 20 m above sea level.
- Matheran is one of three ecological hot spots in India that has been designated as Eco-Sensitive Zones.

4.7.2 Climate:

- High temperature associated with high humidity is the climatic characteristics of this region. This has made summer months very oppressive.
- Compared to summer winters are relatively pleasant.
- During monsoon this region experiences heavy rainfall that averages about 2000m per annum.
- Moreover, very heavy rain with intensity of 250 mm in 24 hours is quite common here.



Fig: Mumbai Metropolitan Region

4.7.2 Landuse:

• Agriculture accounts for 42 % of the Region's total area, the largest share of land use in the area.

4.73 Forest:

- The area under forest and scrubland is 31%.
- About 26% is of the area covered by relatively well protected forests.

- The major observed forest types are evergreen, semievergreen, deciduous and mixed.
- MMR has five sanctuaries -
- a. Sanjay Gandhi National Park,
- b. Tungareshwar.
- c. Phansad,

4.7.4 Karnala and Tansa Growth of Mumbai

- Mumbai has a narrow wedge shaped land surrounded by waters on three sides.
- This peculiar geography controlled Mumbai's spatial growth down the ages.
- The early growth of Mumbai took place in the south near the port.
- Later it spread northwards along the suburban rail corridors.
- Till 1968 most of the Region's urban growth was confined to Greater Mumbai's municipal limits though it had begun to occur in Thane, Kalyan and surrounding areas beyond Greater Mumbai.

A study of the post 1968 period urban sprawl indicates that the growth occurred in Mumbai's suburbs along with Thane, Kalyan, Mira-Bhayander, Navi Mumbai and Vasai-Virar areas. Thus the built up area has increased from 234 sq. Km in 1968 to 575 sq km. in 1987.

About 12 % of the Region's total area is urbanised. Most this growth has taken place by converting agricultural land or by reclaiming wetlands.

Table 4.1: Administrative Units of MMR and their Census Population (figures in lakhs)

SN	Municipal Corporations	2001	2011
1	Municipal Corporation of Greater Mumbai	119.78	124.78
2	Thane Municipal Corporation	12.63	18.19
3	Kalyan- Dombivali Municipal Corporation	11.94	12.46
4	Ulhasnagar Municipal Corporation	4.74	5.07
5	Mira -Bhayandar Municipal Corporation	5.20	8.15
6	Bhiwandi-Nizampur Municipal Corporation	5.99	7.11

7	Navi Mumbai Municipal Corporation	7.04	11.19
8	Vasai Virar City Municipal Corporation	4.70	12.21
Mur	nicipal Councils		
1	Ambarnath Municipal Corporation	2.04	2.54
2	Kulgaon-Badalapur Municipal Corporation	0.98	1.76
3	Alibag Municipal Corporation	0.19	-
4	Pen Municipal Corporation	0.30	-
5	Panvel Municipal Corporation	1.04	1.80
6	Uran Municipal Corporation	0.23	-
7	Matheran Municipal Corporation	0.05	-
8	Khopoli Municipal Corporation	0.59	-
9	Karjat Municipal Corporation	0.26	-
	RestofMMR	15.18	
	Total	192.87	

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Note: In order to boost industrial growth, the government has initiated comprehensive measures like reducing the number of approvals for business, single window investor facilitation through MAITRI (Maharashtra Industry, Trade & Investment facilitation cell), creation of e-platform for setting up of industries & new investments, repealing of the river regulation zone policy, additional FSI for industrial development in agriculture zone, etc. The State has focus on expansion of infrastructure & industrial smart cities, connectivity to industrial clusters, development of industrial parks, logistic parks, mega textile hubs, etc

4.8 SUMMARY

After going through this chapter we have learnt many things about Maharashtra's industrial development.

Industries can be classified into different categories on the basis, such as of sources of raw material, ownership, functions, size of industry and weight of raw material and finished products. Maharashtra has developed various agro-based industries such as cotton textile and sugar industry. Cotton textile industry is the largest organised sector industry in Maharashtra. Maharashtra is also endowed with various minerals, enabling the state to establish various mineral based industries such, heavy engineering, automobiles, and petro chemical industry.

We have also learnt about the pivotal role of transportation regarding industrial development.

Formation of MMR in the state and its importance in the state is understood clearly.

4.9 CHECK YOUR PROGRESS/ EXERCISE

1. State whether the following statements are true or false.

- a. The economic development of a state is directly linked with the level of industrial development.
- b. The state capital Mumbai is a financial capita of India.
- c. The important industries in the state are iron and steel, jute, electrical, transport and metallurgy.
- d. Spreading across 267,452 kilometres, the road network of Maharashtra is the largest in the country.
- e. Mumbai-Pune Expressways is known as Shankarrao Chavan expressway
- f. Special 'Batik' saree is weaved in Aurangabad-Jalna industrial region.

2. Fill in the blanks

or EEH, is one of the busiest roads in a. Mumbai Metropolitan Area.

b. The official name of the Mumbai Pune Expressway is_____ Mumbai Pune Expressway.

c. The main aim of the ambitious Western Freeway project is to reduce _______ in the busy city of Mumbai, India and

also the suburbs

d. Mumbai's

Airport is one

of the busiest airports in India.

- e. ______ is one of three ecological hot spots in India that has been designated as Eco-Sensitive Zones.
- f. ______, _____ communities invested huge amount of capital required for the development of industries in Mumbai.
- g. Mumbai is considered as the ______ capital of India.

3. Multiple choice questions.

- a. Maharashtra is the most important state in the peninsular
 - I.India producing about one fourth of the total sugar production in India.

II.India producing about one fourth of the total milk production in India.

III.India producing about one fourth of the total meat production in India.

IV.India producing about one fourth of the total potato production in India.

b. In Maharashtra, Sugarcane cultivation is mainly concentrated

I.in the irrigated regions of Ganga and Yamuna <u>valley</u>. II.in the irrigated regions of Godavari and Krishna valley.

<u>III.in</u> the irrigated regions of Godavari and Brahmaputra <u>valley</u>. IV.in the irrigated regions of Kaveri and Krishna valley.

- **c**. The number of National Highways that connect Maharashtra to six neighbouring states is
- I.27
- II.15
- III.17
- IV.18
- d. Mumbai Metropolitan Region has 167 km long coastline which is again highly indented by
- I. Estuaries, bays and creeks.

II. Tunnels, passes, hills

III.Mud flats, salt pans,

IV.Mangroves, delta

e. Mumbai Metropolitan Region has five sanctuaries -

I.Sanjay Gandhi National Park, Tungareshwar, Phansad, Karnala and Tansa

II.Sanjay Gandhi National Park, Sundarban, Tansa, Corbett, Kan ha

III. Tansa, Gorumara, Sanjay Gandhi National Park, Jaldapara, Corbett

IV.Sanjay Gandhi National Park, Jaldapara, Corbett, Pench, Gorumara

4. Answer the Following Question

- 1. State major characteristics of Mumbai Metropolitan Region of Maharashtra.
- 2. Write a short note on industrial development of Maharashtra.
- 3. What are the major means of transportation of Maharashtra?
- 4. What are the major industrial zones of Maharashtra? Describe any two of them.

4.10. TASK

- 1. In a map of Maharashtra locate the sugar-cane producing regions.
- 2. In a chart state show different means of transportation of Maharashtra.
- 3. In a map of Maharashtra point out
- (i) Mumbai Metropolitan Region (ii) cotton textile industry

4.11 GLOSSARY

- □ Accessibility: The measure of the capacity of a location to be reached by, or to reach different locations.
- □ Airport: An area of land or water that is used or intended to be used for the landing and takeoff of aircraft, and includes its buildings and facilities, if any.
- □ **Railroad:** All forms of non-highway ground transportation that runs on rails or electro-magnetic guide ways.
- □ Waterway: River, canal, lake or other stretch of water that by natural or man-made features is suitable for navigation.
- □ **Plantation:** an estate or a farm used for growing rubber, tea, cotton or sugar etc. for sale

4.12. ANSWERS TO THE SELF LEARNING QUESTIONS

- 1. a. true
- 1. b. true.
- 1. c. false, cotton textiles, chemicals, machinery, electrical, transport and metallurgy.
- 1. d. true
- 1. e. false. Trams
- 1. f. true
- 1 .g. false, 'Paithani'
- 1. a. The Eastern Express Highway,
- 2. b. Yashwantrao Chavan
- 2. c. traffic congestion
- 2. d. Chhatrapati Shivaji International 2.

- 2. f. Gujarati, Parsi
- 2.g. economic
- 3.a.I.
- 3.b.II
- 3.c.III
- 3.d.I
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PRACTICAL - GEOGRAPHY

Concept of Statistical diagrams and Maps: Importance of statistical diagrams in Geography

Statistical diagrams are a diagrammatic representation of numerical form of statistical data. Statistical diagrams represent numerical data into a diagrammatic form which is most illustrative. Statistical diagrams are drawn to scale and so are proportional to the quantity represented.

When these statistical diagrams are superimposed on maps it is known located proportional distribution map which reveals spatial dimensions of location and variations of the given phenomena.

A social scientist is required to represent various types of statistical information on a map that helps to represent spatial distribution and concentration of any particular phenomenon under study. For example, spatial distribution of world population. In the contemporary era the field of social science has got specialized t develop into various branches of Geography, History, Economic, Sociology, Psychology, Political Science etc. The representation of the statistical information has therefore occupied more significance. The real distribution of various spatial elements such as temperature, precipitation, atmospheric pressure, production of agricultural produce, mines and minerals; industries and industrial products, concentration and distribution of population, nature of trade and areas connected; traffic flow of mode of transport etc. on map can be shown very effectively with appropriate statistical diagrams given the availability of data/information. Such maps in which a cartographic representation of certain statistical information is made are more illustrative and comprehensive in nature that creates better understanding and are of great socio-economic interest. They are called as 'Thematic maps'. Such maps are extremely useful, particularly from the view point of laymen, since they give a broad overall picture of entire range of data in a highly compressed form that become easy to compare and distinguish with a number of elements represented in the map.

Cartographic representation of statistical information has however, some limitations. Though cartograms are more easily understood and very impressive to the laymen, they are not so very precise as tabulations. When a wide variety of inter-related data are to be represented by diagrams they become very complex and so are difficult to interpret.

What is Cartography?

Cartography or mapmaking is the study and practice of making maps. Map making involves the application of both scientific and artistic elements, combining graphic talents and specialized knowledge of compilation and design principles with available techniques for product generation.

Modern Cartography like many other fields of "information technology" has undergone rapid changes in the last decade. Rather than merely drawing maps the cartographic process is concerned with data manipulation, data capture, image processing and visual display. The International Cartographic Association defines cartography as the discipline dealing with the conception, production, dissemination and study of maps. Cartography is also about representation – the map. Cartographic representations may appear in printed form or as dynamic images generated on a computer display screen. Computer assisted mapping systems have added a new and exciting dimension to cartographic techniques and traditional methodologies have to be augmented with new skills. The fundamental nature of cartography has changed with the evolving technologies, providing cartographers with new methods for visualization and communication of spatial information.

While representing various types of data on a map or with the help of some diagrams, certain general rules must be observed. Each map and diagram must be represented with suitable **title** in few words, to give the main idea of the **theme** / topic given in a map or a diagram. Besides other elements of a map or diagram it includes:

- i) Scale: it represents the proportions that are quantifiable.
- ii) Index: depicting various aspects shown in the map.
- iii) **Clarity and legibility:** precaution is taken to avoid overcrowding of information so that the given distribution of information is clear and legible.

To represent statistical data a very wide range of diagrams are used. Depending upon the range of the given data (that is difference between the lowest and highest figure) different types of graphs/ diagrams are drawn.

These are classified as follows:

- i) One dimensional or linear diagrams in which the data to be represented is made proportional to the length of the bar. e.g. Graphs and bars.
- ii) Two dimensional or areal diagrams, such as rectangles, squares and circles. In these diagrams, the area of the rectangle / square or circle is made proportional to the quantity represented. Here square roots are considered while determining the scale.
- iii) Three dimensional or volumetric diagrams, such as cubes and spheres. In such diagrams, the volume of the cube or sphere is made proportional to the quantity represented. Here cube roots are considered while determining the scale.

2. LINEAR DIAGRAMS

2.1 Simple Line Graph: Data related to time variable (i.e. Decades, years, months, weeks, days, hours etc.) is normally represented with the help of simple line graph to observe the trend in the growth over a period. For example, the decadal growth of population in Maharashtra from 1961-2011. (Please note one decade = ten years time period).

Formula used is: DGR = (pop.1961 - pop of 1971) * 100

(Pop 1961)

Table 1.

Decadal Growth of Population in Maharashtra (1961 - 2011)

Year	Total Population	Pop. In millions	Decadal Growth rate
1961	39,553,718	39.6	-
1971	50,412,235	50.4	27.5
1981	62,784,171	62.8	24.5
1991	78,937,187	78.9	25.7
2001	96,878,627	96.9	22.7
2011	112,372,972	112.4	16.0

In this data (a) year & (b) population are the two variables. Year (or time) is considered as an **independent variable** and is normally represented along 'X' axis of the graph. Population is considered as a **dependent variable** (as population is dependent or related to time period /year) which is represented along 'Y' axis on graph. The simple graph (figure 1) represents that the population in Maharashtra is growing over the period from 1961 to 2011. However the decadal growth rate of population is decreasing from 1991 to 2011. This may probably be attributed to the fact of decreasing family size, as also may be migration has slowed down due to socio-economic development in earlier low performing states of the country.



Figure 1

2.2 Superimposed / Multiple Line Graph: In this case more than one simple graph are drawn on same axis; hence is called as the superimposed graph. Comparison of two or more graphs is possible in this type of graph.

Table 2.

Maharashtra: Rural – Urban composition of total population (1961-2011)

Year	r Maharashtra Population 1961-2011 (figures in millions)		
	Rural	Urban	Total
1961	28.4	11.2	39.6
1971	34.7	15.7	50.4
1981	40.8	22.0	62.8
1991	48.4	30.5	78.9
2001	55.8	41.1	96.9
2011	61.6	50.8	112.4

Sketch pens of different colours can be used to represent lines representing total, rural and urban population on the graph paper.



Figure 2

Multiple / superimposed line graph depicts the trend (change) in the variables represented. Besides, we can also compare the changes between them. It would thus help in understanding the past and present status and predict the future possible trend under the given conditions. It is important to know the past, present and future for planning policies to meet the development goals in the related sectors. Table 2 depicts the growth and composition of rural and urban population in Maharashtra. It is clear that both rural and urban population is increasing over the period from 1961 to 2011 in Maharashtra. However the rate of growth in urban population is rapid compared to rural population in the state. This proves that Maharashtra state is getting highly urbanized over the period (figure 2).

2.3 Band Graph: Comparison of more than two variables as well as total of any aspect (or variable) can be represented in this diagram. For example following data (table 3) explains the concept of band graph:

Year	Production (in '000 tons)					
	Rice	Wheat	Jowar			
1961	30	60	10			
1971	50	30	20			
1981	70	50	30			
1991	40	80	40			

Table 3:Production of crops (1961-1991 in '000 tons)

Time or independent variable is represented along "X' axis. Dependent variable is represented along *Y' axis. Graph for the first variable is drawn as simple graph. This graph line of first graph is considered as base line for the second graph of second variable. The graph line of second graph is considered as base line for the third graph of third variable etc.

In this example graph of rice will be drawn first. This graph line is considered as base line for the graph of wheat. To simplify this process the original data is modified as follows:

Table 4:

Production of crops (1961-1991 in '000 tons)

Year	Production (in '000 tons)					
	Rice	Wheat	Rice + Wheat	Jowar	Rice + Wheat + Jowar	
1961	30	60	90	10	100	
1971	50	30	80	20	100	
1981	70	50	120	30	150	
1991	40	80	120	40	160	

The graph lines of this band graph are drawn in the following sequence:

- i) Graph for Rice
- ii) Graph for Wheat is Rice + Wheat
- iii) Graph for Jowar is Rice + Wheat + Jowar



Figure 3

The advantage/significance of band graph is we can identify the trend of change in individual element/variable represented in the graph at a glance.

Secondly, we can identify at a glance the dominant variable in the given distribution. Thirdly, we can see total quantity with its changing trend over a period of the given variables (here it is total crop production)) by observing the topmost graph line of the band graph.

We thus notice from figure 3 that overall rice is the most dominant crop followed by wheat while Jowar has relatively less production. However it is also observed that from 1981 to 1991 wheat is dominant crop produce followed by Jowar while the production of rice has decreased. This may be because wheat is largely grown twice a year while rice is generally rain fed. Besides, the failure of monsoon affects rice productivity as the crop needs more water. Thirdly with increasing drought situation Jowar is most suitable crop produce as it requires less rain.

MAP AND ITS MAIN ELEMENTS:

Map may be defined as "a conventional representation of the earth or its part on plane surface with certain scale". Its main elements are (1) Title / Theme, (2) Scale, (3) Direction, (4) Grid / Co-ordinates of latitudes and longitudes (5) lettering size and shape and (5) Conventional signs and symbols.

- 1) **Title/Theme of the map:** Any map is drawn (prepared) to represent a particular aspect/theme/topic. The position of the theme of the map is often given at central topmost part of the map in big size bold letters for example: World: Physical Map / World: Political Map / World: Distribution of Population etc.
- 2) Scale: Actually a map is far smaller in size than the corresponding areaof the earth it represents. Hence, even' map is drawn to the scale, which determines the ratio between the distance of two points on the map and corresponding points on the ground.
- **3) Direction:** Direction is also an essential element of map because it helps in locating a particular place or feature with reference to a known point.
- 4) Grid / Co-ordinates of Latitudes and Longitudes: A map is drawn on a plane surface but the earth's surface is actually curved hence, the correct representation of the earth is on a globe and not on plane paper. The construction of map involves the problem of transformation of spherical surface into a plane, which is solved with the help of map projections that yield co-ordinates of latitudes and longitudes. These co-ordinates help to find exact location and extent of any place.
- 5) Lettering size, shape and spacing: Information depicted in the map by words is based on the importance/ ranking/hierarchy of that aspect represented on the map. Hence different size (font) and shape (bold/normal; italic or gothic etc.) of letters are used. For example: World / Continent/ country/ capital place of country/ important cities/ places of historical importance etc. Thus here 'World' will be written in bigger size with bold letters while continent name

will be slightly smaller and country name will be still smaller in size etc.

- 6) Conventional Signs and Symbols: A map is a conventional representation of the earth's surface. Various features of the landscape are depicted with the help of conventional signs and symbols on maps. Use of conventional signs and symbols help us to depict maximum information of any given areas on a small piece of paper with clarity and legibility.
- 5) Other Important Elements: The index, the title and subtitle of the map, are the other important elements of the map. These elements are very essential for a good map. In other words, these elements are the backbone of maps.
- **Please Note:** You are requested to observe all these element of a map whenever you are viewing any map. You will then understand these map elements more clearly. It is necessary to quote that Department of Geography, University of Mumbai at Vidyanagari campus, kalina, Santacruz has National map Reference Library that may be visited to see and know different types and aspects of a map.

MAP READING

Man-environment relationships with reference to ever increasing population an its complex use of resources, differential levels of development and wide socio-economic disparities; increasing levels of pollution and deterioration of natural resources; scarcity of energy in the world etc. all can be produced through maps. Geographers predominantly, as well as the planners, historians, economists, agriculturalists, geologists, and others working in the basic sciences and engineering, long ago found the map to be an indispensable aid to study these varying distributions an differences at a glance.

A small map of a large region depicting its physical aspects (land formsrelief, geology, drainage, climate, soils and natural vegetation); and cultural aspects (such as distribution of population, settlement patterns, transport and communication routes, agriculture, industry, historical/religious features etc) make available the information required to plan different policies and implement them more effectively. Ecological complexities of the environment can be easily understood with the help of maps. Any changes in the existing landscape require a detailed study which is possible wit th help of physical maps. For example construction of dam site and creation of water reservoir, Hydel power site / road route, ports, ropeway, airports, industrial location settlements etc, requires maps to be prepared to make development successful. Natural hazards can also be well depicted on the map and precautionary mitigation measures can be adopted to minimize or avoid the losses due to disaster. Besides, potential areas having resources can also be identified and mapped for promoting overall sustainable development. Maps of the whole earth indicate generalizations and relationships of broad earth patterns

with which we may intelligently consider the course of past, present and future events.

MAP FILLING

Map filling / marking the details on a map is an art of representing spatial distribution of various natural, cultural, economic and social elements on the outline map of the world, continent, country or any region, with the help of conventional signs, colours and symbols.

Generally, such distribution .shown with the help of point (.) location, line () location, or an area () location by using some shades or colours. For example, location of a town, port, industry etc. are point features shown by point location. A river, road, railways, water ways etc. are linear features shown by line location and distribution of rice, wheat, cotton etc. producing regions occupy area and so are shown by areal features and so are shown by areal diagrams.

In map filling use of certain colours for distribution of certain elements is done conventionally. For example, water bodies are shown in blue colour, natural vegetation in green colour, roads, and settlements etc. in red colour, agricultural land in yellow colour, and areas of high altitude in brown colour etc. These colours are used universally by all the countries while representing these common features on the maps.

Use of symbols is used in map filling to show some specific aspects. These can be represented by symbolic pictures for example, for engineering industry a wheel, for automobile industry a sketch of an automobile or for textile industry sketch of chimney and chemical industry sketch of a drum etc.

Sometimes first letter of a commodity is used to show its distribution. For example, rice producing areas by 'R' or wheat producing areas by 'W etc. Here letter becomes a symbol some time instead of using letter as a symbol.

MAPS

Maps are our friends and guides. They provide us useful information in a very attractive manner with the help o conventional signs and symbols. The subject of geography can be well be understood with the help of study of maps. Hence it is important to know methods and techniques used in the map for reading and interpreting the map.

Map is a picture of the earth's surface

Pictures, illustrations, diagrams and maps are the visual forms of communication which are far more effective than the words or the verbal communication.

In China, it is said that 'one picture is equivalent to thousand words'. What you can not communicate in thousands of words can be effectively communicated with only on e picture or map.

Map is considered as the **mine of information** which can be understood through proper map reading and its interpretation.

How to remember locations represented on the maps?

- **1) Direction:** Determine the direction of the map. Generally the top of the map is north and bottom is south, left side is east and right side is west. Middle part is central.
- 2) **Prominent landmarks/ features:** Identify the prominent features on the map. These may be:
- i) Coastline and ports: Port locations are generally located near the creeks or headlands along the coast, e.g. Dabhol, Jaigad, Ratnagiri, Deogad and hence we get small notch or marking along the coastline which represents that creek or headland. (Figure 4)This peculiar shape' helps us to remember locations.
- **ii)Alignment of the places!** Transport routes and major stations/nodes. Some places are aligned in one straight line hence it becomes easy to remember them if you consider their alignment, e.g. Malad Mulund, Andheri Vikroli, Grant Road Sandhurst Road. The dotted lines joining these places are in the east-west direction, or parallel to the X -axis.
- **iii) Midpoint locations:** Certain places are situated exactly at the midpoint between the other two places, e.g. Harne is midway between Alibag and Ratnagiri.
- iv) Equal distances: Distance between Malvan Ratnagiri, Ratnagiri Harne and Harne Alibag appear to be the same on the map or Pophali is at equal distance from Harne and Ratnagiri (Refer to the Mid-point location map) figure 6.
- v) X Y axis locations: If you consider the imaginary X and Y axis from some prominent landmarks then you find that certain places are situated at the point of intersection of *X' and Y' axis. e.g. Saki Naka is at the point of intersection of "X' and Y' axis drawn on the map of Mumbai. figure 7
- vi) Capital place! head quarter: is generally nodal place of historical significance.
- **vii) Historical place:** Palace/forts/battle fields etc. have unique pattern of settlements. For example on river/coastal island/ confluence of a river, lake, hot spring, hill-top etc.

In relation to these features one may be able to find/locate and remember the places. If you are able to understand and practice these techniques, you will be able to remember place easily and so you will not have problems about the map reading and then you will say **I Love maps.**



figure 4





figure 6

figure 7

Use of conventional colours in the maps: Colours make maps more attractive and memorable. Appropriate / representative colours are used to represent various physical and cultural features. These colours are more representative to the features depicted. It is given in table 4. Besides, the density, gradient, distribution effect is represented by the colour-tin (colour-shades) for that feature. For example the depth of water is shown in different tints of blue shade (where shallow water is light blue colour and blue shade becomes darker with increasing depth of water).

Colours play an important role in our life. World appears more beautiful due to the various colours. Colours also convey specific meaning e.g. red colour is used for traffic signal, which means stop or danger. Green means you can cross the road. Similarly on 'Rose day' roses of different colours are used for different purposes. Conventionally following colours are used in the maps.

Table 5.Conventional colours used in map

Colour	Natural	Colour	Cultural /
	features		Man-made
			features
Sky	Water, river,	Yellow	Agriculture
blue	Sea etc.		
Green	Vegetation	Red	Settlement
Brown	Relief	Black	Railway
	features		

Table 6.Conventional Symbols used in map

			1
Colour	Natural	Cultural	Cultural / Man-
	features	Feature	made features
	symbol	Symbol	
Sky blue	for (+) Spring	R.S.	Railway Station
perennial			
Black	Tidal river	P.S.	Police Station
		P.T.O.	Post and Telegraph
			Office
		P.H.C	Primary Health
			Centre
		R.H.	Rest House
		P.F.	Protected Forest
		R.F.	Reserved Forest

Table 6 represents few conventional symbols used in the map.

Apart from these colours any type of colour can be used in the thematic map by a cartographer (one who is specialized in map-drawing) depending upon the specific purpose of a map.

Children love colouring pictures similarly grown ups like you also like colouring. With this intension, various geometrical shapes (symbols) are used in the maps to represent distribution. You are free to select any appropriate colour for these symbols. Colouring your own map makes the map more attractive and it increases your involvement with the map which enhances knowledge and hence it becomes easy to remember places represented on the map.

B. Distribution Maps: These maps depict spatial distribution of any phenomenon under study. Different types of cartographic techniques are used for such representations. These are:

1) **Choropleth Map:** are drawn when the quantity specified belongs to a particular administrative unit having its defined boundaries.. For example:

- i) Continent wise distribution of population in the world where continent is a boundary
- ii) Country wise distribution of population in the world where international border is a boundary
- iii) State wise distribution of population in a country where state border is a boundary.
- iv) District wise distribution of population in a state where district border is a boundary
- v) Taluka wise distribution of population in a district where Taluka border is a boundary.

Each of these maps has its own purpose and utility. Accordingly based on the study purpose a particular distribution is adopted as the nature of work, time and cost vary with the type of map used.

These data is generally taken from government published census handbooks. The statistical data of the quantity of a particular element is generally available at different levels ranging from continent/ country/state/district/ Tal u ka/ town/village level in such government publications. Then a suitable scale, as shown in the index of the map is selected to map the data indicating variation in densities for he given administrative unit with the help of class-groups. The final data is represented on the map with different colours or patterns. In order to differentiate between the densities, it is desirable that the degree of darkness of colour/shade or pattern should be proportionate to the density represented. Generally higher the density darker the colour shade and the shading effect go on decreasing with decreasing density. Such Choropleth maps are also known as the "Density Maps".

However the limitation of the Choropleth maps is it does not give a true picture of the distribution because the density of the element represented is uniform all over the respective administrative unit Figure 8 and 9. In reality such distribution of density is rarely uniform, as water areas, communication lines, steep slopes and peaks are devoid of any settlements.



Figure 8



Figure 9

2. Isopleth Maps: reveal the direction of and degree of extent of variation of a given phenomenon. Isolines are drawn joining the places having same value. These isolines are drawn by deciding a certain interval 9 which is generally uniform interval / class group) by observing th range (difference between the highest and the lowest value) in the given data. Isopleth maps are thus drawn to show physical as well human phenomenon. Different names are used to identify these phenomenons as explained below:


B] Human Phenomenon

- A] Physical Phenomenon is as under that can be represented by isopleths maps:
- i) Atmospheric Temperature by 'Isotherms' (line joining places having same temperature) figure 10
- ii) .Atmospheric pressure by 'Isobars' (line joining places having same atmospheric pressure).
- iii) Precipitation/rainfall by isohyets (line joining places having same rainfall amount) figure 11.
- iv) Relief height by 'Contours' (line joining places having same height).
- v) Depth of water is Sea : Line on a marine map or chart joining points of equal depth usually in fathoms below mean sea level is represented by 'Isobaths'.
- **B] Human Phenomenon:**

A] Physical Phenomenon

i) Journey Time by isochrones (line joining places requiring equal travel time by a particular transport.

ii)Transport cost by isophores (line joining places requiring same journey transport cost to transport a particular element from source of supply point to place of destination – industry/go down/market).

iii) Stages of development by isostades are the Isolines joining the points of similar stages of development. World - Distribution of Average Temperature by Isotherms



figure 10



figure 11

Map of acid rain (figure 12) represents the location, intensity and distribution of acid rain in the world by isopleth map





Figure 12

The correctness of the isopleth map depends on the isopleth interval. Least the interval most accurate is the representation of the statistical data. In the isopleth map of world distribution of the Acid Rain areas in Europe, N. America and Japan are represented. (Fig. 12) Sometimes the belts between the isopleths are coloured or tinted with a pattern and the degree of its darkness depending on the quantity represented.

3. Dot Map: It is another cartographic technique used for representing distribution of any phenomenon where a particular size of dot is

located at that point of place to represent a particular value of that place. For example, distribution of population in a region / state. Location of dots representing distribution of population is done by using base map of that region (basic information). Base map contains the prominent physical and cultural features. Taking these features into consideration that influences the distribution and concentration of population, number and size of dots are placed (located/marked) accordingly on the map. Care is taken that cluster or overcrowding of dots is not preferred in a dot map. It is therefore avoided by using different sizes of dots to represent different values. When the exact figures of the number of cattle, population, area under, some crops etc. are available, the quantitative distribution of these elements can be satisfactorily shown on the map by dot method. In the map given below (Fig. 13) each dot represents 500,000 catties. In the same way the statistics for each country can be collected and the dot map showing the distribution of catties country wise can be prepared. While preparing the dot map, the following factors are generally taken into consideration.

- i) The drawing of state borders is not necessary to show the distribution
- ii) A suitable value of each dot is selected so that the number of dots required for each country will give a sound effect of the distribution of the element. A few dots do not produce a good effect, while too many dots become a crowd.
- iii) A suitable size of the dot is to be selected. All the dots should be of uniform size, iv) While putting the dots on the map one as to keep in mind the physiography and hydrology of the region, because the distribution of the element is more or less governed by the above two factors.



World - Distribution of Cattle by Dot Map

Figure 14

4. Flow Maps: are drawn to represent the relationship between the areas with respect to any phenomenon that involves movement /

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transfer of living or non-living elements. Flow maps can be drawn into two types:

- i) Ray map: it represents only the connectivity or flow between the areas. Here the amount transferred is not quantified in the flow map.
- **ii)** Flow Map: represents the flow between the areas of people / goods/ services which is quantified. Here the width of the horizontal line (bar) represents the value and the length shows the direction of the areas connected with actual flow. For example movement of crude oil in the world. Flow map helps us to reveal the areas of importance of a region/country at a glance.



Figure 15

Traffic flow cartograms are really very illustrative and at once bring home the vivid picture of business activity or movement of people in the region. They look like the arterial system of our body through which the vital energy continues to flow. This method is also used in atlas maps to show the major shipping routes in accordance with the volume of international trade moving over them.



Figure 16

1.15. REFERENCES FOR FURTHER STUDY

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