CHAPTER 2

Rain and Rivers

All life on the earth is very crucially dependent upon water. As you know over 71% of the earth's surface is covered with water. We depend upon water for growing crops. But we do not get water uniformly over the year. It is also not available uniformly all over the earth. Nor is the quality of water the same everywhere.

Discuss in the class in which months you get rains, in which part of the village or town you have more water or less water, where you get good drinking water and where you get salty or hard water. In the following chapters we will study about the diversity in water availability and its consequences.

PART - I

Sun, Clouds and Rainfall

After the unbearable heat of April, May and June, comes the rainy season which lasts for a few months. Do you know what causes rains? Where do the rain bearing clouds come from? Discuss whatever you know or think about these things in the class.

Evaporation

Pranavi woke up early in the morning. She needed to take bath in hot water, so she heated water in a dish over fire. As the water heated up water vapour touched the lid and with the help of outside cool air, vapour became water drops and stuck to the lid of the dish. When she removed the lid some of the water drops fell down into the dish. By observing this, she realised that the water evaporates and latter it becomes condensed into water by cooling.

The story of rain begins with water vapour. What is water vapour? When you dry your wet clothes in the open, you see

that the water disappears after a while and the clothes dry. Similarly, if you keep some water in a plate, it dries up in a couple of days. Actually, water in the cloth or in the plate becomes water vapour and mixes with the air through a process called '*evaporation*'. So even when water is not boiling there is evaporation.

There are several water bodies on the earth's surface – oceans, rivers, lakes, etc. There is constant evaporation of water from these water bodies. Infact, wherever there is moisture, like on wet cloth, there is evaporation. There is evaporation from our bodies, from trees, plants and soil! The process of evaporation speeds up with the increase in temperature.

- In which season do you think there would be more evaporation – in summer or winter?
- Do you think there is more evaporation during the day or night?
- Look at figure 2.1 and make a list of all places from which evaporation takes place.
- Where do you think maximum evaporation would take place – from plants, rivers, oceans or soils?

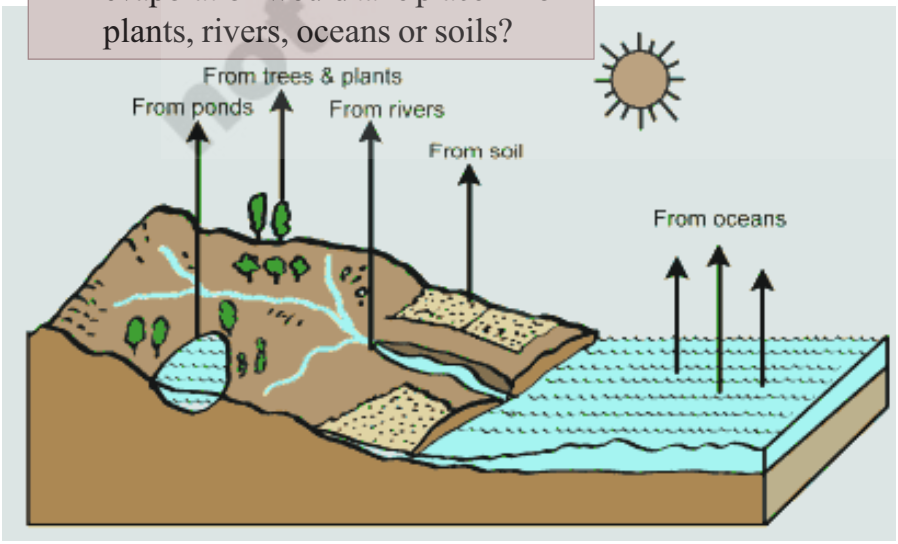


Fig 2.1 Evaporation

Formation of Clouds and Rain

When water vapour rises with hot air and reaches high up in the sky, it gets cooled. This is because it gets cooler as we rise above the surface of the earth. With the cooling, water vapour is transformed into tiny water droplets. These droplets gather around minute dust or smoke particles in the air and gradually increase in size. These small drops of water gather to form the clouds.

- Make a diagram to explain how vapour is transformed into clouds in the box given above. Label your diagram with these terms – earth, sky, rising vapour, cold, dust particles, water droplets, clouds….

As the clouds continue to rise upwards, it gets cooler and more droplets are formed. The droplets get together to form bigger drops. As they get heavier it gets more and more difficult for them to remain in the air and so they begin to fall as rain drops

- Why do you think it is necessary for the clouds to rise in order to cause rain?
- Do you ever observe dew? Where is it formed?
- In which part of the day you will find fog?
- In which season do you have more foggy days?
- Did you ever see snow fall? How is it different from rain fall?
- Have you ever experienced the hail storm?

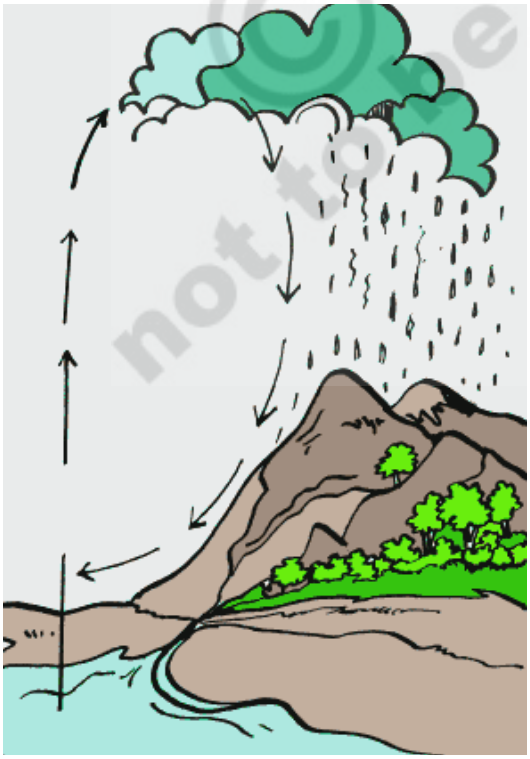


Fig 2.2 Water cycle

Some Important Terms

Evaporation: Change of water into vapour is known as evaporation. The process in which water vapour changes into water is called condensation. Clouds are tiny droplets of water hanging in the air above.

Water Cycle :

The cycle of water evaporating from the seas, becoming clouds in the sky, pouring down as rain and flowing down the slope on the land in the form of rivers and finally joining the sea again is called the water cycle.

Precipitation: Different forms of condensation of water vapour is known as precipitation. This may take place in the form of dew, fog, rain, snow, and hail etc.

Humidity: The amount of invisible water vapour present in the atmosphere is known as humidity. When temperature and humidity are high, we feel uncomfortable. We perspire and the sweat does not evaporate quickly. We feel sticky and such weather is called sultry.

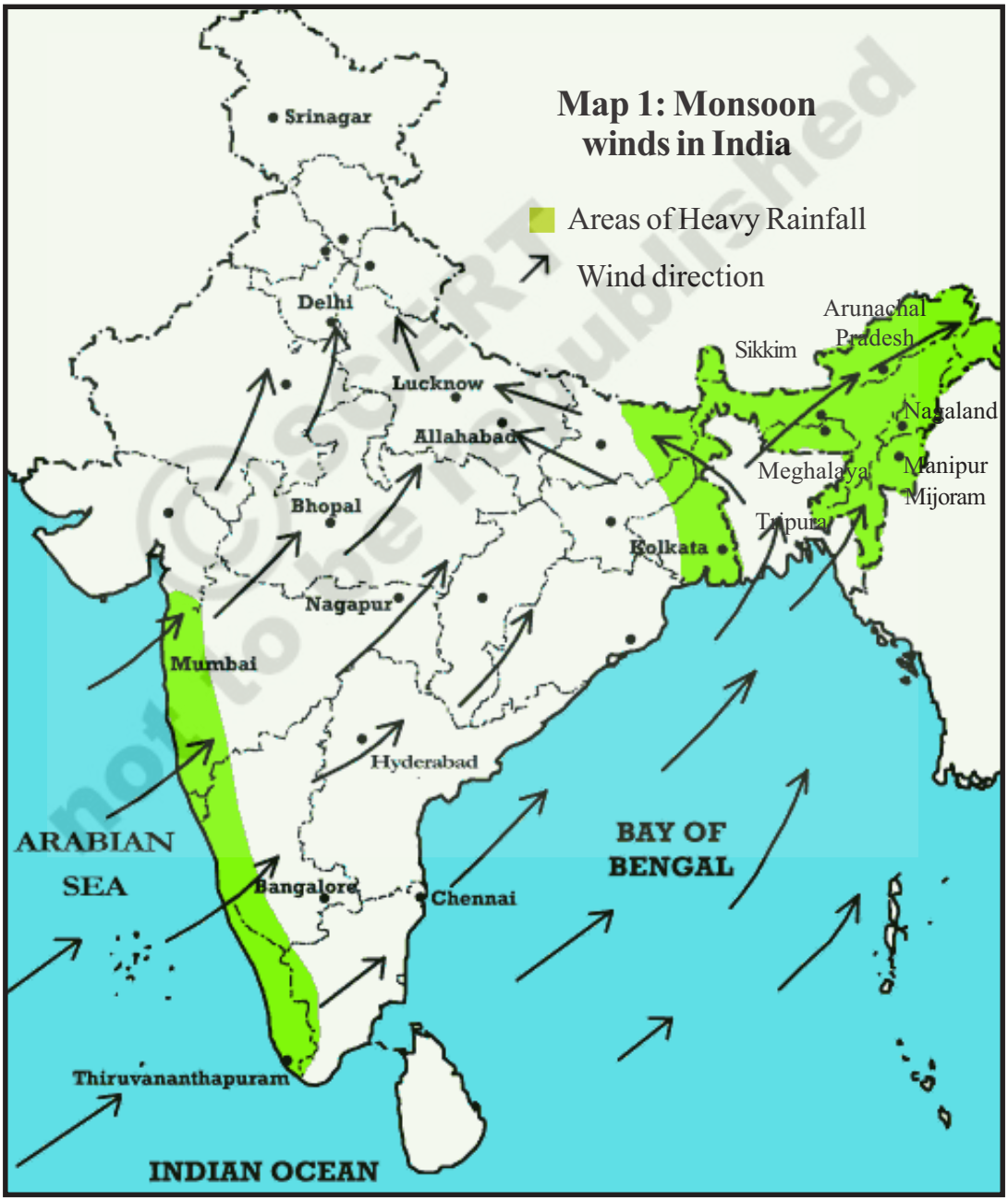
Winds and Clouds

Since evaporation takes place all over the earth's surface, clouds are also being formed all over. However, it is on the surface of the oceans that maximum evaporation and cloud formation takes place. After all, oceans are vast water

bodies extending upto thousands of kilometres. As a result it also rains very heavily on the oceans. Clouds also travel inland for thousands of kilometres to bring rain to us. Do you know what brings them deep inland?

From which direction does the wind blow during the rainy season?

These winds come all the way from the Arabian Sea and the Bay of Bengal and they transport the rain clouds. They are called '*Monsoon winds'*. They are also called '*South-West Monsoon* winds' as they blow from that direction. These winds blow only in the summer.



There are two arms of the monsoon winds: one blows from the Arabian Sea and the other from the Bay of Bengal. The arrows in Map 1 show us the direction of winds.

- Towards which parts of the country will the winds take the clouds being formed in the Bay of Bengal?
- Towards which parts of the country will the winds take the clouds being formed in the Arabian Sea?
- From which direction will the winds blow to bring monsoon rains to West Bengal, Lucknow and Delhi?
- From which direction will the winds blow to bring monsoon rains to Mumbai, Hyderabad, Bangalore?

Rainfall in Andhra Pradesh

- In which months of the year does it rain the most in your place? List three rainiest months.
- In which months of the year does it rain the least in your place? Name the three driest months.
- Do you have 'normal' rainfall every year in your place or does it vary every year?
- Have you experienced drought years in which it rained very little?
- Have you experienced flood years in which it rained too much?

When the South West Monsoon sets around the beginning of June the winds carrying the clouds also reach Andhra Pradesh. As you can see from Map 1, these winds reach Rayalaseema districts of Chittoor and Kurnool first. However they bring very little rain as most of the moisture in the clouds falls down in rain in the Western Ghats and only dry clouds and winds reach Rayalaseema.

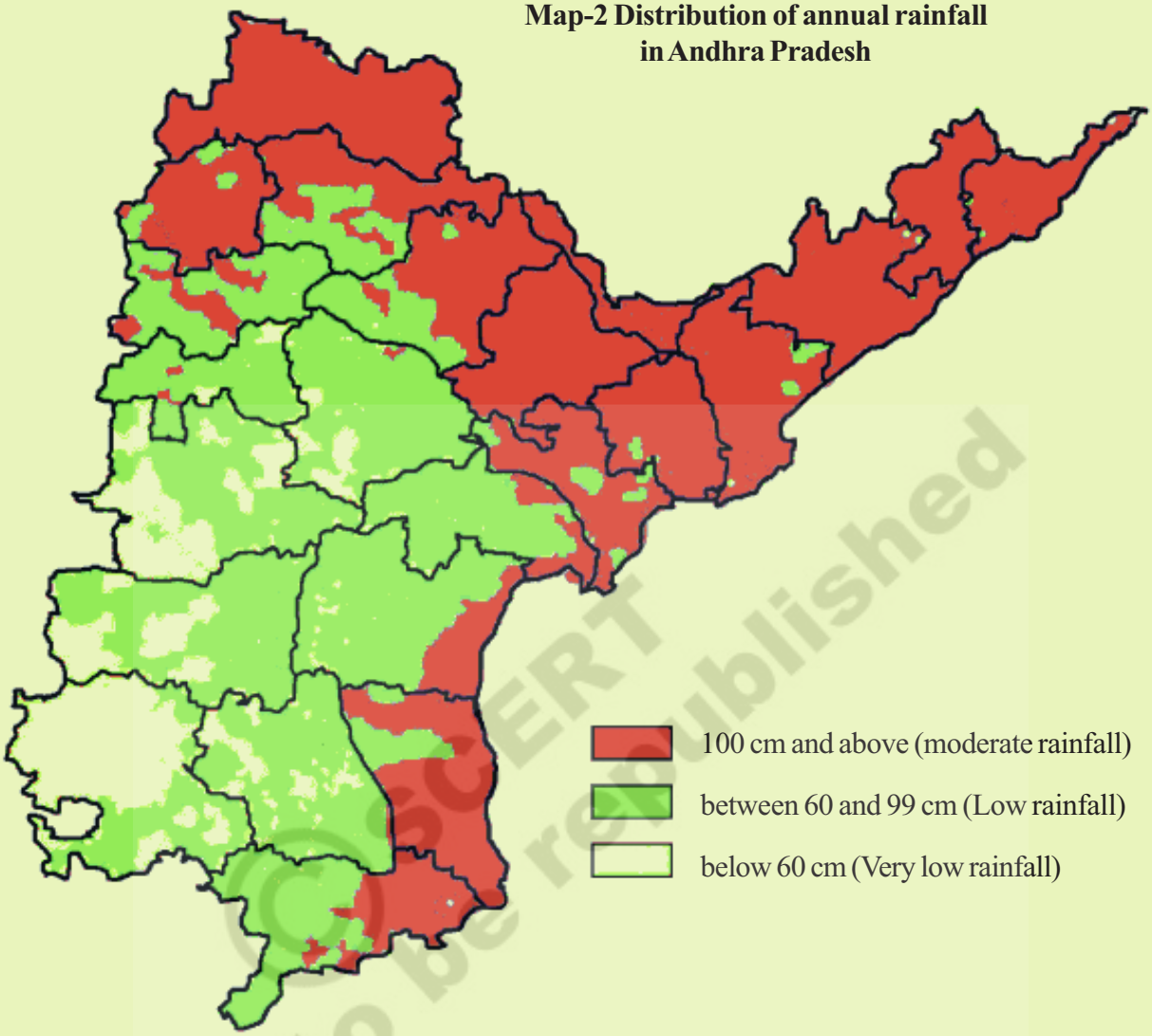
The mountain ranges like the Western Ghats in the path of rain-bearing wind cause them to rise. Rising air cools down and water vapour condenses faster. Further ascent leads to rainfall. This type of rainfall is common in the mountainous regions. However, when the clouds descend on the other side of the mountain range (as it happens when they reach Rayalaseema) they become dry and give very little rain.

The South West Monsoon however, brings much rain to the Telangana districts as the winds again rise over the Eastern Ghats.

In the months from May to October cyclones form in the Bay of Bengal causing widespread rains in coastal and inland Andhra Pradesh. Rain caused by whirling storms is called cyclonic rain. These cyclones are formed in the sea due to intense heating up in summer. In a cyclone, winds blow in from every side towards the centre of it. The whirling air rises up and causes rain. The centre of the cyclonic storm moves fast with the wind and hits the coastal areas causing heavy rains and winds. While these bring rains to the coastal regions they also cause much destruction.

The direction of the winds reverse in the months after October as the winds begin to blow from the Bay of Bengal South Westwards. This causes heavy rains in October-December months in coastal Andhra Pradesh and moderate rains in Rayalaseema and Telangana districts. This is called North East Monsoon or the Return Monsoon.

Map-2 Distribution of annual rainfall in Andhra Pradesh



- Look at the map given above of rainfall received in different parts of Andhra Pradesh:

i. Does your district receive moderate or low rainfall?

ii. Which town has the least rainfall and which has the highest – Ongole, Anantapur, Adilabad, Machilipatnam, Hyderabad?

iii. Make more such questions and ask each other.

- Look at physical map of India in your Atlas and identify Western Ghats, Eastern Ghats.
- Western Ghats are spread across the following states _____
- Eastern Ghats are spread across the following states _____
- In which direction of Andhra Pradesh are Western Ghats?
- Now create rough outlines of India in a note book – then draw imaginary hills, along 'Western Ghats', Eastern Ghats. Roughly mark the areas that are in Rayalaseema and Telangana. And label them with months in which it rains.

Raingauge

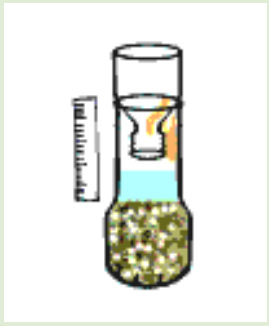
An instrument by which the rainfall is measured is known as 'raingauge'. The amount of rainfall for a unit area is measured in centimeters. How do we measure the amount of rainfall? How do we find out if Anantapur has more rain or Guntur?

Make your own Raingauge

Collect the above items to make a rain (pic 1).

Cut the top of the bottle like this. This ensures the top of the bottle and bottom of the rain has the same circumference (pic 2).

Turn top of the bottle upside down like this, and fix it to the bottle. (pic 3).



Fill the bottle with sand and water till the spot where you can mark zero. If the bottom of your bottle is flat you need not fill too much water (pic 4).

Now ensure that you keep this bottle in an open place. Make sure that there are no walls or trees that can block the rain water from falling into the bottle. You can use a scale to measure the water. If you leave the bottle in the open for a few days you can know how much it rained in a week, a month.

When it rains the water level in the rises. Measure the height of water with the help of a scale and you will get the rainfall in Centimetres for your area during the period you had kept the in the open.

PART -II

Flow of Rivers

What happens to the water that falls on the earth? Some of it percolates into the soil, some flows on the surface of the land and the rest becomes water vapour and mixes with air. You will read about the water that percolates down into the soil in the next chapter. In this part we will discuss the water which flows on the surface of the land.

Rivers

Have you seen rain water flow in small streamlets on sloping land? Water flows in small streams from the mountain slopes during the rainy season. However, these streams dry up after some time. Neverthless, water cuts channels on the mountains.

When it rains again, water flows down the same channels. In this way river courses and river valleys are formed. This process is shown in figure 2.3.

Study the figure below and answer these questions:

- Mark the direction of the flow of the river with arrows.
- Mark the direction of the slope of the land with arrows.
- Does the river flow in the same direction as that of the slope of the land?

Transformation of a Stream into a Broad River

At its source, a river usually is in the form of a thin stream. As it flows further it gets bigger and broader. This happens because many small streams join it as the stream flows. Rivers or streams which join a larger river, are called '*tributaries*'.

As the river becomes bigger and broader, its flow gets slower. It starts depositing the silt and sand it has carried, on its bed and banks. This causes the formation of plains. Do you remember the village on plains you read about last year?

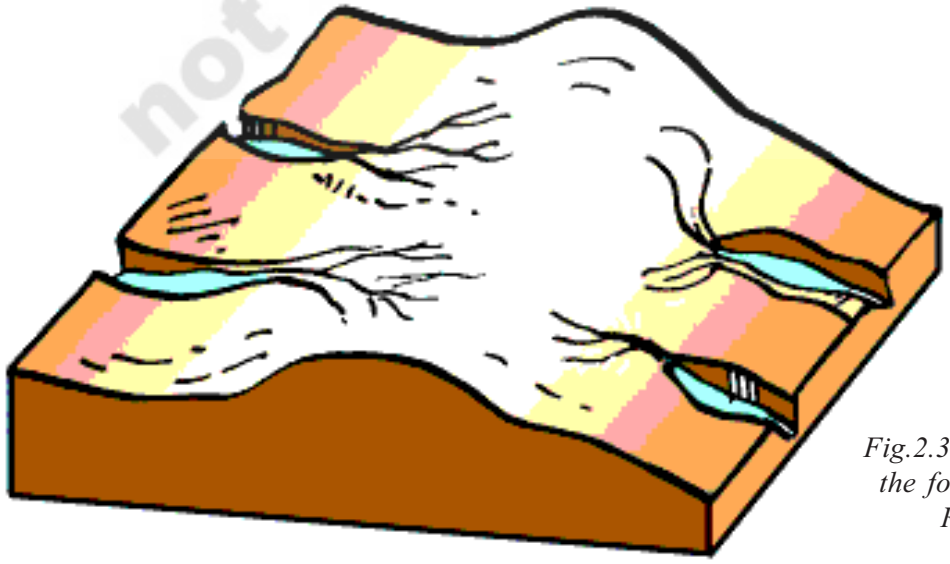


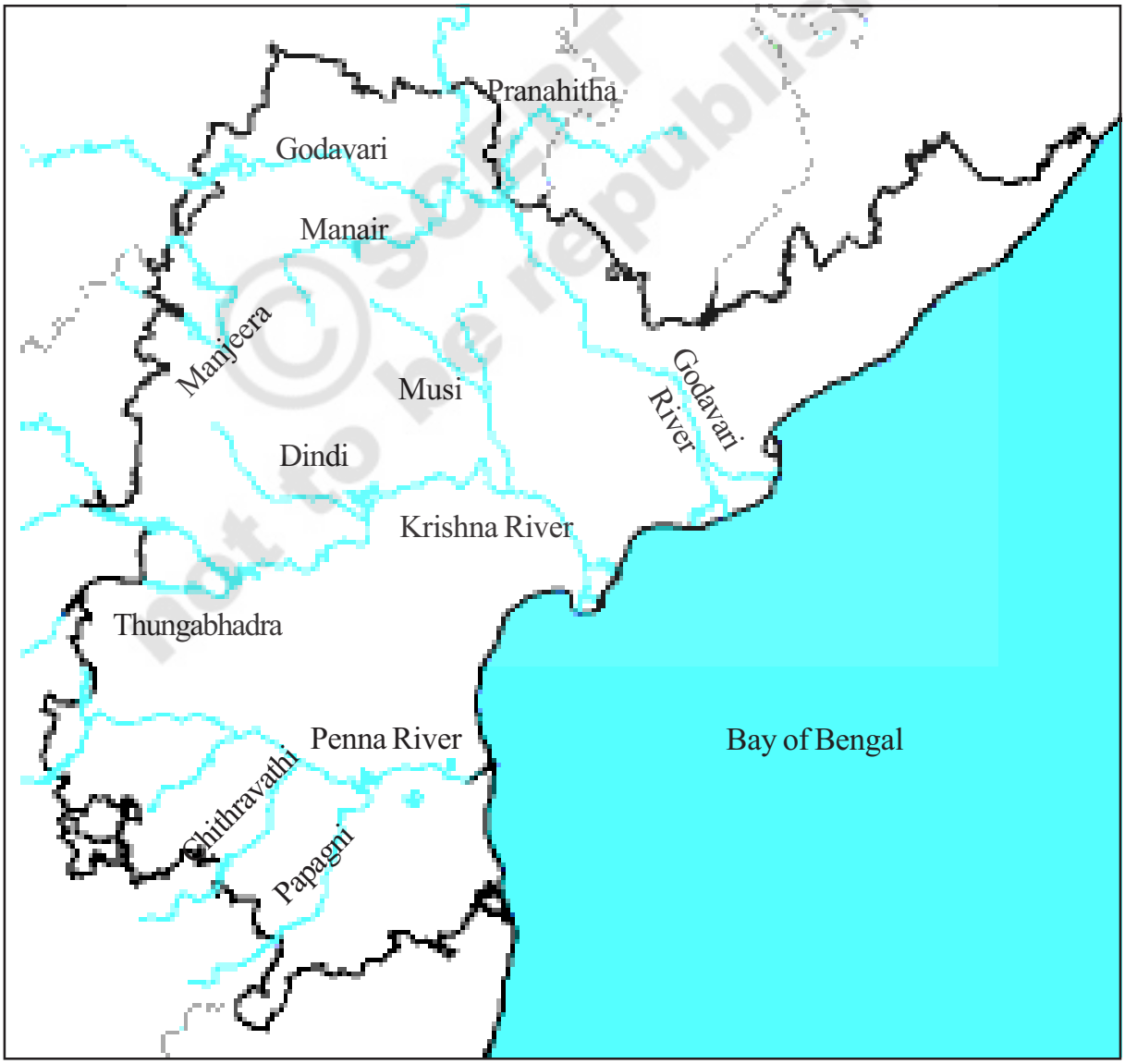
Fig.2.3 Slope and the formation of Rivers

As it nears the sea, the river gets even more slower and is no longer able to carry the silt and sand. It deposits them on its own course which then gets filled up. When flood waters come again they have to cut through new channels to reach the sea. Thus towards the end of its journey to the sea a river forms a delta. In our state we have two main deltas of the Godavari and the Krishna rivers. Look for them in the map.

We have two large rivers flowing through our state - the Krishna and the Godavari. However, we also have a large number of rivers that have water only during the rainy season. Why is this so?

Rivers like the Krishna and the Godavari start from the Western Ghats which receive heavy rains. The rain water slowly percolates into the ground and flows into the river all through the year. On the other hand, many of the rivers which start from the dry regions of Rayalaseema like the Penna are fed by scanty rains. Others which start in the Eastern Ghats too receive only

Map -3 Rivers of Andhra Pradesh



moderate rains and the water flows rapidly into the sea. That is why they go dry during the non-rainy season.

- Look at a map 3 and prepare a list of rivers that rise from:

Western Ghats	Rayalaseema	Eastern Ghats

- What do you think is the direction of slope in Andhra Pradesh – from North to South or East to West or West to East?

Flood-Plains and Floods

A river does not contain the same amount of water all the year around. While the river is full during the rainy season, it usually shrinks during the dry season. Look at figures 2.4 & 2.5 You can see that the river trough is very wide and it has high banks. This valley is filled with sand and gravel. The river flows as a small stream amidst them. You will notice that there are no trees here. This is because every year when it rains heavily, this valley is filled with water allowing no permanent trees or plants to grow here. This treeless bed is called the *flood-plain* of the river. All major rivers have their flood plains.

You must have heard that during the rainy seasons some parts of the country get flooded due to excess rainfall. You may have read about floods occurring in rivers like Krishna, Godavari, Brahmaputra or the Ganga.

Figure 2.5 depicts a flood situation. Look at it carefully and answer the following questions:

- Has the river water covered the entire flood-plain or is it confined to the tiny stream that was flowing in the dry season?
- Is the water confined to the flood-plain or has it overflown the banks of the river?
- In what way have the floods affected the villages, agricultural fields and trees?
- Floods are also beneficial to agricultural fields. Can you find out how floods help?

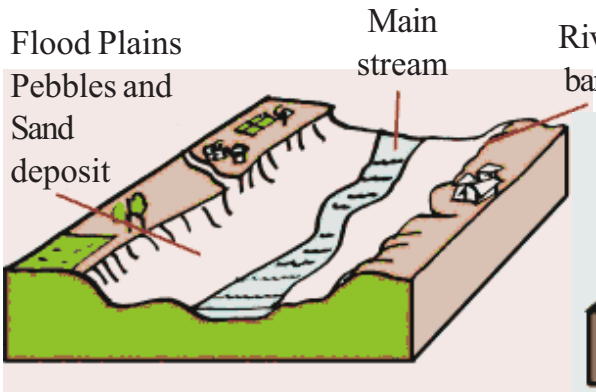


Fig - 2.4 Flood Plains

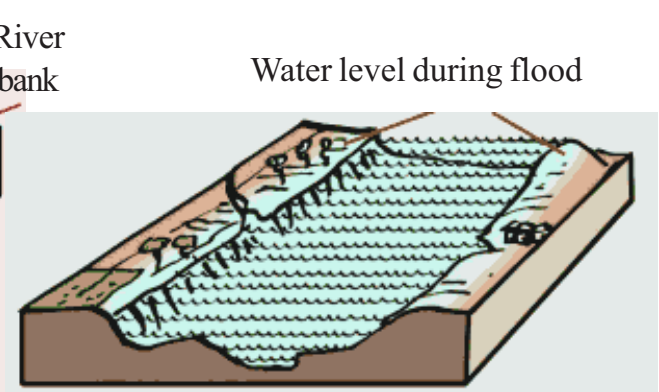


Fig - 2.5 Flood

Floods have become a major problem in our country in recent years. Some part of the country or the other is flooded every year during the rainy season. This causes severe damage to people, crops and livestock. Let us find out if we have contributed to this in any way.

Vegetation cover on the land (trees, plants, grass, etc.) obstructs the run off of rainwater and slows down the speed of its flow. This slowing down helps the rainwater to percolate into the soil. Floods are often caused by sudden increase in the volume of water reaching a river. Vegetation allows the water to flow slowly into the river, thus preventing sudden flooding. It also helps to increase the amount of water which goes into the soil.

Vegetation also helps to prevent floods in another way. It reduces the erosion of soil by rainwater. If there is little or no vegetation, rainwater cuts and carries with it a lot of topsoil. This soil is deposited on the riverbed, which reduces the depth of the river. This results in the reduction of capacity of the river to carry water. Thus, with even a little rain, the rivers are flooded and they overflow their banks, causing damage. If the surface of the land is covered with vegetation, then soil erosion is greatly reduced.

Let us take the case of Ganga. Earlier there were dense forests on the Himalayas from where the Ganga and its tributaries originate. In the recent years there has been a large scale felling of trees and hence the forest cover in the Himalayas has been reduced considerably. As a result, every time there is heavy rainfall, the rainwater rapidly flows down the slopes of the mountains and fills up the floodplain of the river. The waters also bring a very large quantity of silt and deposit it on the riverbed. This results in frequent floods, which cause heavy damage to life and property along the river.

All this tells us the importance of protecting our forests and increasing the vegetative cover over other lands.

- Can you explain how forests and vegetation can help in preventing floods?
- Can forest and vegetation help in lessening the effects of droughts (less rainfall)?

Facing the challenge in Cyclones and Floods

Fig 2.6 Cyclone cloud in Bay of Bengal

Our state has a long coast line and is frequently faced with very destructive cyclones. When heavy winds blow from the sea, heavy rains lash the lands, and high waves make the sea very unsafe. These usually occur between June and December. The worst cyclone hit the state in November 1977, perhaps, the worst cyclonic storm to hit the Indian shores. Six - metre high tidal waves swept across villages in coastal Andhra Pradesh, killing 9941 people. At least 100 villages were washed away by the cyclonic storms and the ensuing floods. Seen from air, it seemed like a sheet of water drawn over the affected areas floating in the swirling waters. About 100 people who left their homes to seek shelter in a building in Bapatla town died when the building collapsed. Most lives were lost in Diviseema, Krishna District.

Formation of cyclones may seem natural over which human beings have no control. However, the impact of these disasters are hightened or lessened due to how our society is organised and prepared. For example, if you see who lives in the most vulnerable part of the land which is most affected by cyclones, you will find that it is the poorest people who live there with least resources to defend themselves. The sea coasts are lined with the huts of poor fisherfolk and the low lands of the towns and villages which get flooded are usually inhabited by the slums of the poor. The people who live in high cement concrete buildings are able to store food, water etc. for many days. Thus we can see that disasters affect the poorest most.

Usually immediately after the flood waters recede, all sources of water are polluted and become unsafe for drinking. But people especially the poor are forced to use the polluted water and face the risk of several diseases like cholera, dysentery, jaundice etc. Only those with resources are able to arrange for safe bottled water to drink. Since roads are damaged and it rains heavily, bringing in relief to worst affected areas is not easy. Here people are forced to rely on their own resources to save themselves.

While the immediate damage of the cyclones is also heavy – like loss of lives, crops, houses etc., more importantly they also cause long term damages.

For example, the life savings of most of the poor stored in the houses in the form of food, tools, cattle, small shops, vehicles, boats, nets, etc are destroyed. To go back to their work they need to buy all these again. Many families may loose their working members. Daily wage workers face loss of work for several weeks till normalcy returns and therefore loss of livelihood. Farmers too not only face loss of crops but also permanent damage to their lands.

How can people meet the challenge of disasters like cyclones and floods?

This can be done through long term planning by governments and close cooperation between the people and government agencies. With the installation of early warning systems by the government, today it is possible to predict considerably in advance the possibilities of natural disasters like cyclone and flood perticularly regions that are most vulnerable. Governments thus put in place these systems and inform people about possibility of disasters.

Governments are also responsible for providing for long term security of all people by building strong roads which are not easily destroyed, safe pucca houses for those living in vulnerable areas like sea coast or along the rivers or in low lands. Food, water and medical emergency teams should be kept ready whenever there is a forecast of cyclone.

How can the people prepare for disasters?

1. Cyclones and floods are a seasonal phenomenon. During the cyclone listen to radio or TV weather reports and in case of a cyclone/flood warning, ensure that everyone is alerted. This is usually done through loudspeakers or by going from door to door.
2. Keep an emergency kit ready at home. These kits should contain important papers, and some food materials, currency. Information about important telephone numbers that may have to be contacted during emergency should also be stored in the kit.
3. The nearest available place where refuge could be sought in case of a cyclone should be identified in advance.
4. Where necessary the walls of the house, roofing, doors and windows should be strengthened.
5. When you get a cyclone warning, store adequate drinking water and food grains in waterproof bags.
6. Do not venture outside, specially into the sea during and after the warning has been sounded.
7. Close doors and windows and stay indoors.
8. Move to a pucca building if you feel your house is too weak to withstand even an ordinary upsurge.
9. If the cyclone strikes while you are in a vehicle, stop but keep away from the sea shore, trees, electric poles, and other objects that may be uprooted during the gale.

10. If the cyclone wind suddenly drops, do not venture out, as this could be the eye of the cyclone. Wait till the all clear declaration is made officially.
11. Heed to such advice as may be coming through Radio broadcasts.
12. Even after 'all clear' has been sounded take necessary precautions while moving to or out of your house. There may be partially uprooted trees or poles.
13. Look out for snakes that may have come out of their holes.
14. Do not enter flood waters. They may be too deep.
15. As a student group you can play a very significant role in spreading awareness about the above precautions.

If you need to Evacuate:

1. Pack clothing, essential medication, valuables, personal papers, etc. in water-proof bags, to be taken to the safe shelter.
2. Raise furniture, clothing, appliances on to beds or tables (electrical items highest).
3. Turn off power.
4. Whether you leave or stay, put sandbags in the toilet bowl and cover all drain holes to prevent sewage back-flow.
5. Lock your house and take the recommended or known evacuation routes from your area to the safe-shelter.
6. Do not get into water of unknown depth and current.

During Floods:

1. Drink boiled water.
2. Keep your food covered, don't eat heavy meals.
3. Use raw tea, rice water, tender coconut water etc. during diarrhoea.
4. Do not let children remain on empty stomach.
5. Use bleaching powder and lime to disinfect the surroundings.
6. Avoid entering floodwaters. If you have to enter, wear proper protection for your feet and check depth and current with a stick. Stay away from water over knee-deep depth.
7. Do not eat food that has got wet in the flood waters.
8. Boil tap water before drinking in rural areas. Use halogen tablets to purify water before drinking (askVillage Health Worker for details).
9. Be careful of snakes. Snakebites are common during floods.

Key words :

1. Rivers and Tributaries 2. Condensation 3. Annual rainfall 4. Flood plain

Improve your learning

1. Explain how water changes into water vapour and also how clouds are formed from water vapour.
2. Where does evaporation and cloud formation take place on a large scale?
3. How do the clouds reach deep inland?
4. Where does it rain maximum? Choose the right option :
   a) sea coasts that are in the direction of the winds
   b) mountains that are in the direction of the winds
   c) lands far away from the seas.
5. Fill in the blanks choosing the correct options (bank, tributaries, flood-plain, river valley):
   a) A river flows through the ……..
   b) Streams or rivers joining a larger river are called the …….. of the main river.
   c) The entire valley of a river which is filled with water during the floods is called the …….. of the river.
6. The Godavari flows from the west to the east. Why?
7. Describe the main stages of the water cycle.
8. Can you explain the causes of devastating floods? In what way is it natural occurrence and in what way is it man-made?
9. There may be streams and rivers flowing near your village or town. Find out about them and fill in the table below:

No.	Name	Source	Which river does it join?	Which sea does it meet?

10. Do the rivers in your area contain water throughout the year? Find out from your elders if they had more water in earlier times.