# 4

### The Rivers of India and their Drainage System

Look at the following picture. What does it show? Discuss in class.



Figure 4.1: The course of a river

Rivers originate in mountains, lakes, springs and glaciers. When it rains, some of the rainwater seeps into the earth, but most of it flows on the surface of the earth in small streams. You may have seen that rivers flow downhill along the slope. The flow is in a narrow channel in the beginning but the river widens as more and more tributaries (small streams) flow into it.

Water flows in streams on the earth's surface. The rainwater that seeps into the earth also flows below the surface. In some places, this subsurface water or aquifer emerges on the surface as springs. These springs feed the rivers and their tributaries. Rivers usually originate in the mountains. The point where the river originates is called the source and the point where the river ends is called the mouth. The flow of a river from its source to its mouth can be divided into three stages: 1) the upper course or youthful river, 2) the middle course or mature river, and 3) the lower course or old river.



Figure 4.2: A 'v' shaped river valley

1) The Upper Course or Youthful River: When the river emerges from its source in the mountains, it flows very swiftly. This fast-flowing stream cuts a narrow channel in the mountain. The erosion is

less along the river banks and more in the river bed. As a result, the river forms a 'v'-shaped valley. The valley is steep and narrow. The river carries along pebbles, stones and large pieces of rock in its swift current.

2) The Middle Course or Mature River: When the river reaches the plains, the gradient becomes gentle and its flow slows down. The current doesn't have enough force to carry



Figure 4.3: A river meandering through the plains

sand and pebbles along. In this stage, there is more erosion along the banks of the river and less erosion of the river bed. As a result, the river widens. Because of the slower current, the sand, gravel and soil are deposited to form an alluvial fan.

In the plains, the river can erode soft rocks but cannot erode hard rocks. So wherever it encounters hard rock, it changes its course.

The river meanders.

When there is heavy rain, the river overflows its banks and floods the plains. The floodwaters deposit the sediment (silt) they carry over a large area. This area is called the flood plain. The flood plain is very fertile because of the rich, silt deposit.

3) The Lower Course or Old River – By the time the river reaches this stage, its current is very slow. The river



Figure 4.4: A delta

carries large amounts of sediment (silt). It deposits this load before draining into the sea. The deposits obstruct the flow of the river, causing it to split into many distributory channels. The silt deposits and the distributaries form a triangular plain called the delta.

#### 4.1 Drainage System

Drainage is the flow of water into a river from the surrounding area. It depends on the gradient (slope) of the land and the surface features (topography) of that area.

#### Social Science Class-9th

The entire area from which the water drains into a river is called the river basin. The main river and its tributaries together form a system which is called the drainage system. Figure 4.5 shows the area from which the water drains into a river.

The small streams, tributaries and the main river form a pattern in the drainage basin. The pattern depends on the topography of the river basin so it is specific for each river. Some of these drainage patterns are described below:



Figure 4.6: A dendritic drainage pattern

**1. Dendritic drainage pattern:** This kind of drainage pattern is found in regions that have a uniform layer of sub-



Figure 4.5: The drainage pattern

surface rocks. In this pattern, the streams and tributaries resemble the branches of a tree and the main river resembles the trunk. The Ganga, Indus, Mahanadi and Godavari drainage systems are examples of the dendritric pattern.

**2. Trellised drainage pattern:** This drainage pattern develops in regions that have alternate bands of hard and soft rock. All the streams of water flow along the surface gradient. The streams form a trellis pattern, flowing in parallel valleys and turning at right angles. The tributaries also flow parallel and join the main river at right angles, creating the trellis-like pattern. This kind of river pattern is found in Saurastra and the



Figure 4.7: A trellised



Nilgiri and Amarkantak ranges.

Figure 4.8: A rectangular drainage

#### 3. Rectangular drainage pattern: This drainage

pattern forms in areas where the bedrock has tectonic faults and rectangular

joints. These cause the streams and tributaries to flow into the main river at right angles. This kind of drainage pattern is rare in India. But it is more commonly found along the sea coast of Norway.

**4.** The centripetal drainage pattern: In areas where the rivers from all four sides converge at a single point at a lower gradient,

we have a centripetal drainage pattern. The Sambhar Lake in Rajasthan is an example of this pattern.

# A A

Figure 4.9: A radial drainage pattern

## **4.2 India's Drainage System and the Main River Basins**

Rivers have played an important role in development of landforms in India. The country's civilizations, culture and economic development have been largely based around its rivers.

River basin: The entire area (watershed) drained by a river and its tributaries.

S.N.	Name of river	Origin	Length (km)	Drainage area (sq km)
1.	Narmada	Amarkantak (M.P.)	1313	98,796
2.	Tapti	Betul (Madhya Pradesh)	724	65,145
3.	Mahanadi	Sihawa (Chhattisgarh)	851	1,41,589
4.	Godavari	Nasik (Maharastra)	1465	3,12,813

Activity: Look at Map 4.1, which shows India's drainage system. Identify the drainage basin of the four rivers given in the table below.

Source: india-wris.nrsc.govt.in



Map 4.1: India's drainage system and river basins

#### **The Indus Basin**

The Indus basin includes the rivers Indus, Jhelum, Chenab, Ravi, Beas, Sutlej etc. These rivers originate in the Himalayas and flow in a south-westerly direction. The Indus is the main river. It originates from the southern part of the Mansarover Lake in the Kailash Mountains. It enters India in Ladakh where it is joined by smaller tributary rivers such as the Zanzskar, Shiyok, Gilgit etc. It flows through deep gorges in the Himalayan ranges. Most of the river basin falls in Pakistan. The Indus flows through Pakistan in a south-western direction and drains into the Arabian Sea. Intensive agriculture is practiced in this region. This highly fertile region, where commercial crops are grown, supports a very high density of population.

According to the 1960 Indus Water Agreement signed between India and Pakistan, India can use 20 percent of the Indus river water. The river water is used for irrigation and to generate electricity.

#### Ganga Basin

The Ganga and its tributaries form a vast plain in the northern part of India. This Gangetic plain is very fertile. The rivers in the basin flood every year and deposit a layer of alluvial soil that is rich in humus. The land is intensively cultivated. Several multi-purpose dams have been constructed on these rivers. They provide irrigation and electricity and support the development of industries like fishery, tourism etc.

The flat topography of the Gangetic plain facilitates the expansion of different modes of transport and the growth of industries. It is the most densely populated region of India.

Let us take a closer look at one part of this basin.

#### Life in the Sundarbans

Before draining into the Bay of Bengal, the Ganga splits into a number of smaller chanles (distributaries). The sediment it carries is deposited to form an extensive delta called the Sundarban Delta. This delta has aound 110 islands that are inhabited. Life for people living on these islands is very tough. Their main sources of livelihood are fishing, agriculture, hunting and collecting honey.

Every year, cyclones cause damage heavy in the Sundarbans. People obtain potable water with great difficulty. They fall prey to tigers when they venture out to catch fish and crabs. The brackish groundwater makes the land unsuitable for agriculture. The environment of this region is also changing. The growing population is encroaching into forests areas at an unprecedented rate. The delta is rapidly losing its green cover as its Sundari trees are felled.



Figure 4.10: The Sundarban mangroves

The Rivers of India and their Drainage System

The mowing of elephant grass, which camouflages the stripes of the tiger, is driving the predators to attack humans. When the delta floods, the tigers and their cubs are washed ashore and enter the villages. Excessive hunting by the local people has led to a sharp decline in the deer and wild boar population. Deprived of their prey, the tigers are increasingly preying on humans.

The Water Resources Department of the Government of West Bengal points out in its report that about 600,000 people



Figure 4.11: A tiger in the Sundarbans

migrated from the Sundarbans in 2004. There is no bamboo left in areas such as Pathar, Partima, Hengalganj, and Gosana. The embankments that had been constructed are collapsing, causing heavy damage to life and property.

#### The Brahmaputra Basin

This basin was formed by soil and gravel brought down by the mountain rivers. The Brahmaputra is the main river. It originates from a glacier near Mansarover Lake in Tibet. The river is called Tsangpo in Tibet and Dihang in Assam. Teesta, Subansiri, Bhareli, Manas and Lohit are its tributaries. The Brahmaputra is very wide in the lower reaches because of high rainfall upstream. Fertile soil is concentrated in the coastal areas. After its confluence with the Ganga in Bangladesh, the distributaries of the two rivers form the mighty Ganga delta. Jute, paddy etc, are grown on this extensive delta. Guwahati and Dibrugarh cities are located on the banks of the Brahmaputra.

#### The Narmada and Tapti Basin

This basin is a narrow strip of land created by the Narmada and Tapti rivers. There rivers flow parallel to each other in a western direction through a narrow rift valley. Both drain into Arabian Sea in the Gulf of Cambay. The Narmada flows through marble rocks at Bedhaghat near Jabalpur and plunges into a magnificent waterfall called Dhuandhar. Other waterfalls on the Narmada are Kapildhara and Dudh Dhara in Amarkantak.

#### The Godavari Basin

This basin is created by the Godavari and its tributaries Banganga, Manjira, Penganga etc. The basin is narrow is some parts and wide in others. The Godavari passes through Kandara near the Eastern Ghats at Pollavaram in Andhra Pradesh. After this, the river widens. It deposits the silt in the lower regions when it floods. Cotton and other commercial crops are grown extensively in the region's black cotton soil.

#### The Krishna Basin

This river originates near Mahabaleshwar in the Western Ghats and flows for 1,400km through Maharashtra, Karnataka and Andhra Pradesh before draining into the Bay of Bengal. Its main tributaries are the Tungabhadra, Koyna, Venna, Panchganga, Ghataprabha, Malaprabha and Bhima. The river water is used for irrigation and power generation. There is a dispute between Karnataka and Tamil Nadu on sharing the Krishna river water.

#### The Kaveri Basin

The river originates in a place called Coorg in Karnataka. Its main tributaries are the Amaravati, Bhavani, Hemawati, Shimsha, Noyyal, Kabini etc. Many multipurpose dams have been constructed on these rivers, which have stimulated agricultural and industrial development.

#### The Mahanadi Basin

Look at the physical map of Chhattisgarh and answer the following:

- 1. The place of origin of the Mahanadi
- 2. The northern and southern tributaries of the Mahanadi
- 3. Prominent places in Chhattisgarh located on the Mahanadi

The Mahanadi and its tributaries Sheonath, Hasdeo, Mand etc flow through this basin. In ancient times, the Mahanadi was called by different names such as Chitrotpala, Mahananda and Neelotpala. The river is the lifeline of Chhattisgarh. The fertile plains of the state were formed by the Mahanadi and its tributaries. Paddy is the dominant crop in these fertile plains, giving Chhattisgarh the name of 'rice bowl'.

The river flows across Chhattisgarh and crosses over to Orissa, where it forms a delta before draining into the Bay of Bengal. In Chhattisgarh, we have the Ravishankar Sagar Project (Gangrel Barrage), Mogra and Sikasar Multipurpose Projects on this river. India's longest dam, the Hirakud, is located on the river at the border of Chhattisgarh and Odisha. These projects have developed irrigation, power generation, fisheries etc. Most industries in Chhattisgarh are located on the banks of the Mahanadi, which traverses the entire state.

#### 4.3 Water: a Common Resource

There are many challenges in using water resources. The primary need is water for household use. Water is also needed for agriculture and industries. There are examples when the water needs of humans and cattle are ignored and priority is given to industries.

Many times, neighbouring states through which a river flows have disputes over sharing its water. The dispute is usually about which state has the right to the river's water and how much water each state is entitled to take. Such disputes become serious and complex problems.

Over the last few decades, groundwater has become the chief source for irrigation. It is difficult to curb excessive use of water, because people do not treat it as a common resource. Ground water is treated as private poperty and exploited ruthlessly. But the truth is that water doesn't collect under the surface of any individual's field. It flows below the surface. So if one person uses water excessively, other people are deprived and don't get enough water. This leads to a situation where people have to bore deeper and deeper to get water for irrigation. This over-exploitation of water is causing tubewells to dry up and is lowering the water table (level of ground water).

To control this situation, we need to consider water as a common or public resource. The state government is trying to formulate laws to regulate ground water utilization. We need to build an understanding that 'flowing gound water does not belong to the person under whose land it flows; it belongs to everybody'. Only such an understanding can help us resolve the problem.

#### An Example of Just Use of Water

Hivre Bazar is a village in the Ahmednagar district of Maharashtra. It is a drought-prone village. The average annual rainfall is 400mm. Soil and water conservation measures were undertaken in the village common lands and private pastures. Trenches were dug along the contours of the hills to

conserve rainwater and reduce soil erosion. These conservation activities led to more water becoming available for agriculture and grass in the pastures.

Check dams were built to store water for agriculture. Percolation tanks and loose boulder structures were also constructed. Trees were planted on both sides of the village roads and tree plantation was also done in the forests. A total ban on tree felling and open grazing was declared. Also banned was the use of bore wells and cultivation of banana and sugarcane. The bans were strictly enforced by common consent.

As a result of these efforts, the irrigated area in the village increased from 7 hectares to 72 hectares. The wells do not dry up for even a single day of the year. The fertility of the unirrigated land has improved. Small and marginal farmers have increased the productivity of their land. Compared to the past, more diverse crops are now cultivated. People grow potato, onion, pomegranate, flowers and wheat. The most important achievement was increasing the availability of water.

Increased production of fodder led to improvement of livestock and milch cattle. The dairy industry got a boost, with milk production increasing 20 times. The income of farmers in Hirve Bazar rose and the employment situation improved.

However, the villagers know that if the neighbouring villages continue to extract more groundwater with deep tubewells and do not enforce similar bans, they can do nothing to control their activities. They realise that the only solution is to declare water as a public resource and apply a uniform rule across the entire river basin. Only then will 'development for all' become possible.

b) 1 and 3 are correct

#### EXERCISE

- Which drainage pattern is depicted in the diagram alongside?
  a) dendritic
  b) rectangular
  c) trellis
  d) centripetal
- 2. The Brahmaputra basin spreads across 1) India and China, 2) India and Pakistan and 3) Bangladesh
  - a) Only 1 is correct
  - c) 1 and 2 are correct d) Only 2 is correct
- 3. Which river forms the Sundarban delta?
  - a) Godavari b) Ganga c) Kaveri d) Indus
- 4. Hirakund is India's longest dam. On which river is it located?

a) Ganga	b) Godavari
c) Narmada	d) Mahanadi

- 5. Explain what is meant by drainage and drainage system.
- 6. Describe the features of the upper course of a river.
- 7. What are the differences between the Ganga and the Godavari basins?
- 8. What problems would you face if you live in the Sundarbans? How would you resolve these problems?
- 9. Explain what is meant by groundwater: is the water table falling? If yes, then why?
- 10. How did the Hivre Bazar people resolve their water-scarcity problems?

