Geography

Drainage System of India

1. Introduction

Drainage systems help prevent floods and without them flooding would have caused damage to property and we would have lost lives. The drainage system refers to the system of flow of surface water mainly through rivers. An area drained by a river and its tributaries is called a drainage basin. The drainage system is related to a number of factors like slope of land, geological structure, amount and velocity of water. A river is either perennial or ephemeral. It drains the water collected from a specific area, known as a 'catchment'. The river, through its drainage system, performs several tasks. These are excess water removal from a particular area, transportation of sediments from one place to another, providing a natural source for irrigation and maintaining the water table of a region. Traditionally, rivers were useful as a source of abundant fresh water and navigation. In today's world, rivers' importance has come to include hydro-power generation and setting up water-based industries. These are also important tourist attractions for activities such as boating, river rafting and cliff jumping.

This topic has been divided into 5 modules

- **The Drainage Patterns of Rivers and River Regimes**
- **The Indian Drainage Systems**
- **Evolution of the Indian River Systems**
- **Pollution of the Waters**
- **Rainwater Harvesting**

2. The Drainage Patterns of Rivers and River Regimes

The drainage pattern of an area is the outcome of the geological time period, nature and structure of rocks, topography, slope, amount of water flowing and the periodicity of the flow. The drainage pattern resembling the branches of a tree is known as "**dendritic**" the examples of which are the rivers of northern plains. When the rivers originate from a hill and flow in all directions, the drainage pattern is known as **'radial'**. The rivers originating from the Amarkantak range present a good example of it. When the primary tributaries of rivers flow parallel to each other and secondary tributaries join them at right angles, the pattern is known as '**trellis'**. When the rivers discharge their waters from all directions in a lake or depression, the pattern is known as 'centripetal'.

The pattern of flow of water in a river channel over a year is known as its regime. The north Indian rivers originating from the Himalayas are perennial as they are fed by glaciers through snow melt and also receive rainfall water during rainy season.

The rivers of South India do not originate from glaciers and their flow pattern witnesses fluctuations. The flow increases considerably during monsoon rains. Thus, the regime of the rivers of South India is controlled by rainfall which also varies from one part of the Peninsular plateau to the other. The discharge is the volume of water flowing in a river measured over time. It is measured either in cusecs or cumecs. The Ganga has its minimum flow during the **January-June** period. The maximum flow is attained either in **August** or in **September.**After September, there is a steady fall in the flow. The river, thus, has a monsoon regime during the rainy season.

There are striking differences in the river regimes in the eastern and the western parts of the Ganga Basin. The Ganga maintains a sizeable flow in the early part of summer due to snow melt before the monsoon rains begin.The mean maximum discharge of the Ganga at Farakka is about **55,000 cusecs** while the mean minimum is only **1,300** cusecs.The two Peninsular rivers display interesting differences in their regimes compared to the Himalayan rivers. The **Narmada** has a very **low** volume of discharge from **January to July** but it suddenly rises in **August** when the maximum flow is attained. The **fall in October** is as spectacular as the rise in August. The flow of water in the Narmada, as recorded at Garudeshwar, shows that the maximum flow is of the order of **2,300 cusecs**, while the minimum flow is only **15 cusecs**.

The Godavari has the **minimum** discharge in **May**, and the **maximum in July-August**. After August, there is a sharp fall in water flow although the volume of flow in **October and November** is higher than that in any of the months from January to May. The mean **maximum d**ischarge of the Godavari at Polavaram is **3,200 cusecs** while the mean minimum flow is only **50 cusecs.**

3. The Indian Drainage Systems

The Indian drainage system consists of a large number of small and large rivers. It is the outcome of the evolutionary process of the three major physiographical units and the nature and characteristics of precipitation. Of the drainage area of the Indian drainage systems, 77 per cent covering the drainage areas of the Ganges, Brahmaputra, Mahanadhi and Krishna is oriented towards the Bay of Bengal while the rest of the drainage area

(23 per cent) consisting of the Indus, Narmada, Tapti, Mahi and the Periyar rivers is oriented to the Arabian Sea.

On the basis of the size of the watersheds, the drainage basins of India can be classified as belonging to three categories, namely:

1. Major river basins with more than 20,000 km^2 of catchment area – 14 drainage basins;
2. Medium river basins with catchment area between 2,000 km^2 and 20,000 km^2 – 44 drainage basins.
3. Minor river basins with catchment area less than 2,000 km^2 – a fairly good number of small drainage basins.

Because of their utility, the rivers are important for life and hence regarded as lifeline. Many cities are located along the rivers and are densely populated. Delhi on the banks of Yamuna, Patna along Ganga, Guwahati along Brahmaputra, Nasik along Godavari and Cuttack along Mahanadi are some examples. On the basis of the origin the drainage can be divided in to two parts:

(a) The Himalayan drainage system; and
(b) The Peninsular drainage system.

On the basis of origin, the Indian rivers have been classified intotwo major drainage systems. Let us look at a comparison between the two drainage systems.

The Himalayan river systems have the following characteristics:

1. They are perennial rivers originating from glaciers.
2. Rivers form valleys by the process of erosion.
3. The rivers are ideal for irrigation purposes as they pass through the Indo-Gangetic plain and through the fertile tracts of lands.
4. These rivers have meandering courses which always shift over time.
5. They also receive water from the rainfall.

The main river systems in the Himalayan systems are:

1. The Indus river systems include the Jhelum, Ravi, Beas and Satluj.
2. The Gangesriver systems includethe Yamuna, Ramganga, Ghaghara, Gomti,Gandak and Kosi. The River Kosi is known as the ‘sorrow of Bihar’, because it causes severe damage to the life and property of the people due to flood.
3. The Brahmaputra river systems consist of the Dibang, Lohit, Tista and Meghna.

You have already studied about Peninsular Plateau. Most of the Peninsular rivers flow eastwards and enters into the Bay of Bengal. Only Narmada and Tapti rivers flow westwards of the Western Ghats. They are good for generating hydropower because these rivers form rapids and water falls. The major peninsular rivers are the Mahanadi, Godavari, Krishna and Kaveri. India has a large number of rivers that are the lifelines for millions of people living along their banks. These rivers can be broadly categorized into four groups:

1. Rivers that flow down from the Himalayas and are supplied by the melting snow and glaciers. This is why these are perennial, that is, they never dry up during the year.

2. The Deccan Plateau rivers, which depend on rainfall for their water.

3. The coastal rivers, especially those on the west coast, which are short and do not retain water throughout the year.

4. The rivers in the inland drainage basin of west Rajasthan, which depend on the rains. These rivers normally drain towards silt lakes or flow into the sand.

4. Evolution of the Indian River Systems

There are different viewpoints as to the evolution of the Indian river systems. The geologists believe that a mighty river called the Shiwalik or Indo-Brahma traversed and drained the entire stretch of the Himalayas and the Indo-Gangetic plains, from Assam to Punjab and onwards to Sindh. This system drained into the Gulf of Sindh during the Miocene period, some 5.24 million years ago. The remarkable continuity of the Shiwalik and its lacustrine origin and alluvial deposits of sand, silt, clay, boulders and conglomerates support this viewpoint.

In due course, however, the Indo-Brahma river system was dismembered into three main drainage systems: the Indus, the Ganges, and the Brahmaputra. The dismemberment was perhaps because of the Pleistocene upheaval in the Western Himalayas, including the uplift of the Potwar plateau (Delhi ridge).The down thrusting of the

Malda gap area between the Rajmahal hills and the Meghalaya plateau during the Mid-Pleistocene period, diverted the Ganges and the Brahmaputra systems to flow towards the Bay of Bengal.

The Peninsular drainage system is older than the Himalayan systems. This is evident from the broad, largely graded shallow valleys and the maturity of the rivers. The Western Ghats running close to the western coast is the water divide between the west and the east flowing rivers. Three major events in the geological past have shaped the present drainage systems of the Peninsular India: the subsidence of the western flank of the Peninsula leading to the submergence below the sea during the early tertiary period; Upheaval of the Himalayas when the northern flank of the Peninsula block was subjected to subsidence and the consequent trough faulting; and slight tilting of the Peninsular block from the northwest to southeast giving a orientation to the entire drainage system towards the Bay of Bengal during the same period.

Several cities as well as holy shrines are on the banks of rivers, and indeed, rivers such as the Ganges and the Yamuna are sacred to millions. Despite this, they are being polluted with unaccountable and environmentally threatening practices. Untreated raw sewage claims for about 70 percent of the pollution loads in the Indian rivers. Heavy loads of biological and chemical pollutants usually enter waterways to be consumed in some manner by the downstream users. This affects the aquatic life and causes various health hazards.

5. Pollution of the River

Along with the pollutants, the insensitivity of the people towards rivers is severely adding to the problem. Urban dwellers identify vaguely with rivers. An example can be the highly contaminated blackish water of the Yamuna river in New Delhi, which hardly draws attention from the capital's citizens. Youngsters are only beginning now to realize how the cities along the rivers drain their dirty waters into the rivers. They also realize that the industrial effluents and wastes also get disposed of into the rivers. Large scale bathing and washing of clothes using detergents are also polluting the rivers and lakes very much in the country.

Since, water issues are assigned to the State governments in India, each one of them treats a river as its own, with little or no regard to the downstream effects. Ecologist sand conservationists have long demanded that rivers need to be treated as one entity and work on a determined, time-specific combination of serious efforts. This could lead to an improvement in the water quality of the rivers. The government has come up with ambitious river cleaning initiatives such as the Ganga Action Plan (GAP) and the National River Conservation Plan (NRCP) in the hope of improving water quality.

6. Rainwater Harvesting

Water harvesting has been gaining popularity across the country, through which monsoon waters could be retained in the river basins. Several civic organizations and people's movements are also contributing towards raising awareness and sensitivity about the critical condition of polluted rivers as well as the scarce water resources requiring water harvesting. The city planning bodies have also begun to make water harvesting structures a compulsory feature of the residential areas of the city.

7. Conclusion

The drainage system of India includes like dendritic, radial, linier etc. to improve the efficiency of river system. The linking of river proposed where perennial northern river which are fad by glaciers are link to seasonal southern rivers. By doing this flooding of northern river can be avoided which will channelized the extra rivers that run die. By doing so is upheld task which includes lot of complexities like slop and mountains act as hurdles. If all the river system of India can be harvest to the optimum capacity effect of drought can be reduced in the rain shadow regions which in turn will increases the productivity of agriculture their by improving the standard of living of the people.