

**UPSC**  
**NCERT Summary**  
**Drainage System – 1**

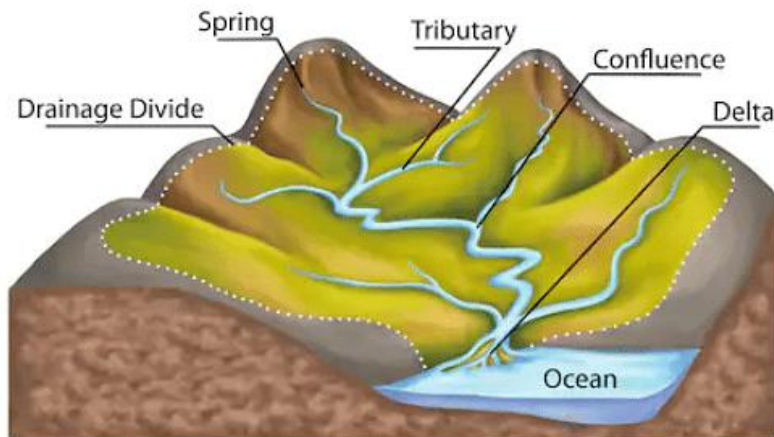
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### **What is Drainage System?**

The flow of water through well-defined channels is known as 'drainage' and the network of such channels is called a 'drainage system'.

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 period of the flow.

A river drains the water collected from a specific area, which is called its 'catchment area'.



### **Drainage Basin**

An area drained by a river and its tributaries is called a drainage basin. The boundary line separating one drainage basin from the other is known as the watershed. The catchments of large rivers are called river basins while those of small rivulets and rills are often referred to as watersheds. There is, however, a slight difference between a river basin and a watershed. Watersheds are small in the area while the basins cover larger areas.

Indian drainage systems may be divided on various bases. On the basis of discharge of water (orientations to the sea), it may be grouped into:

- The Arabian Sea drainage

- The Bay of Bengal drainage

They are separated from each other through the Delhi ridge, the Aravalis and the Sahyadris (water divide is shown by a line in Figure. Nearly 77 percent of the drainage area consisting of the Ganga, the Brahmaputra, the Mahanadi, the Krishna, etc. is oriented towards the Bay of Bengal while 23 percent comprising the Indus, the Narmada, the Tapi, the Mahi and the Periyar systems discharge their waters in the Arabian Sea.

On the basis of the size of the watershed, the drainage basins of India are grouped into three categories:

- Major river basins with more than 20,000 sq. km. of catchment area. It includes 14 drainage basins such as the Ganga, the Brahmaputra, the Krishna, the Tapi, the Narmada, the Mahi, the Pennar, the Sabarmati, the Barak, etc.
- Medium river basins with catchment area between 2,000- 20,000 sq. km. incorporating 44 river basins such as the Kalindi, the Periyar, the Meghna, etc.
- Minor river basins with catchment area of less than 2,000 sq. km. include fairly good number of rivers flowing in the area of low rainfall.

The Narmada and Tapi are two large rivers which are exceptions. They along with many small rivers discharge their waters in the Arabian Sea.

On the basis of the mode of origin, nature and characteristics, the Indian drainage may also be classified into the Himalayan drainage and the peninsular drainage. Although it has the problem of including the Chambal, the Betwa, the Son, etc. which are much older in age and origin than other rivers that have their origin in the Himalayas, it is the most accepted basis of classification.

## **Drainage Systems of India**

Indian drainage system consists of a large number of small and big rivers. It is the outcome of the evolutionary process of the three major physiographic units and the nature and characteristics of precipitation.

## **Important Drainage Patterns**

- The drainage pattern resembling the branches of a tree is known as “**Dendritic**” the examples of which are the rivers of northern plain.
- 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 Himalayan Drainage



- The Himalayan drainage system has evolved through a long geological history. It mainly includes the Ganga, the Indus and the Brahmaputra rivers basins. Since these are fed both by melting of snow and precipitation, rivers of this system are perennial. These rivers pass through the giant gorges carved out by the erosional activity carried on simultaneously with the uplift of the Himalayas.
- Besides deep gorges, these rivers also form V-shaped valleys, rapids and waterfalls in their mountainous course. While entering the plains, they form depositional features like flat valleys, ox-bow, lakes, flood plains, braided channels, and deltas near the river mouth. In the Himalayan reaches, the course of these rivers is highly tortuous, but over the plains, they display a strong meandering tendency and shift their courses frequently.
- River Kosi, also known as the 'sorrow of Bihar', has been notorious for frequently changing its course. The Kosi brings huge quantity of sediments from its upper reaches and deposits in the plains. The course gets blocked, and consequently, the river changes its course.

## **Evolution of the Himalayan Drainage**

- There are difference of opinion about the evolution of the Himalayan rivers. However, geologists believe that a mighty river called Shiwalik or Indo-Brahma traversed the entire longitudinal extent of the Himalaya from Assam to Punjab and onwards to Sind, and finally discharge into the Gulf of Sind near lower Punjab during the Miocene period some 5-24 million years ago. The remarkable continuity of the Shiwalik and its lacustrine origin and alluvial deposits consisting of sands, silt, clay, boulders and conglomerates support this viewpoint.
- It is opined that in due course of time Indo-Brahma river was dismembered into three main drainage systems:
  - i) the Indus and its five tributaries in the western part.
  - ii) the Ganga and its Himalayan tributaries in the central part.
  - iii) the stretch of the Brahmaputra in Assam and its Himalayan tributaries in the eastern part.
- The dismemberment was probably due to the Pleistocene upheaval in the western Himalayan, including the uplift of the Potwar Plateau (Delhi Ridge), which acted as the water divide between the Indus and Ganga drainage systems. Likewise, the down thrusting of the Malda gap area between the Rajmahal hills and the Meghalaya plateau during the mid-Pleistocene period, period, diverted the Ganga and the Brahmaputra systems to flow towards the Bay of Bengal.

## **The River System of The Himalayan Drainage**

The Himalayan drainage consists of several river systems but the following are the major river systems:

### **1. The Indus System**





- It is one of the **largest river basins of the world**, covering an area of 11,65,000 sq. km (in India it is 321,289 sq. km and a total length of 2,880 km (in India 1,114 km). The Indus **also known as the Sindhu**, is the **westernmost** of the Himalayan rivers in India. It **originates from a glacier** near Bokhar Chu ( $31^{\circ} 15' N$  latitude and  $81^{\circ} 40' E$  longitude) in the Tibetan region at an altitude of 4,164 m in the Kailash Mountain range.
- In Tibet, it is known as '**Singi Khamban; or Lion's mouth**. After flowing in the northwest direction between the Ladakh and Zaskar ranges, it passes through Ladakh and Baltistan. It cuts across the Ladakh range, forming a spectacular gorge near Gilgit in Jammu and Kashmir. It enters into Pakistan near Chillar in the Dardistan region.
- The Indus receives a number of Himalayan tributaries such as the Shyok, the Gilgit, the Zaskar, the Hunza, the Nubra, the Shigar, the Gasting and

the Dras. It finally emerges out of the hills near Attock where it receives the Kabul river on its right bank. The other important tributaries joining the right bank of the Indus are the Khurram, the Tochi, the Gomal. The Viboa and the Sangar. They all originate in the Sulaiman ranges. The river flows southward and receives Panjnad' a little above Mithankot. The Panjnad is the name given to the five rivers of Punjab, namely the Satluj, the Beas, the Ravi, the Chenab and the Jhelum. It **finally discharges into the Arabian Sea**, east of Karachi. The Indus flows in India only through the Leh district in Jammu and Kashmir.

- The **Jhelum an important tributary** of the Indus, rises from a spring at Verinag situated at the foot of the Pir Panjal in the southeastern part of the valley of Kashmir. It flows through Srinagar and the Wular lake before entering Pakistan through a deep narrow gorge. It joins the Chenab near Jhang in Pakistan. The Chenab is the largest tributary of the Indus. It is formed by two streams, the Chandra and the Bhaga, which join at Tandi near Keylong in Himachal Pradesh. Hence, it is also known as **Chandrabhaga**. The river flows for 1,180 km before entering into Pakistan.
- The **Ravi** is another important tributary of the Indus it rises west of the Rohtang pass in the Kullu hills of Himachal Pradesh and flows through the Chamba valley of the state. Before entering Pakistan and joining the Chenab near Sarai Sidhu, it drains the area lying between the southeastern part of the Pir Panjal and the Dhauladhar ranges.
- The **Beas** is another important tributary of the Indus, originating from the Beas Kund near the Rohtang Pass at an elevation of 4,000m above the mean sea level. The river flows through the Kullu valley and forms gorges at Kati and Large in the Dhauladhar range. It enters the Punjab plains where it meets the Satluj near Harike.
- The **Satluj** originates in the Rakas lake near Mansarovar at an altitude of 4,555 m in Tibet where it is known as Langchen Khambab. It flows almost parallel to the Indus for about 400 km before entering India, and comes out of a gorge at Rupar. It passes through the Shipki La on the Himalayan ranges and enters the Punjab plains. It is an antecedent river. It is a very important tributary as it feeds the canal system of the Bhakra Nangal project.

## 2. The Ganga System



- The Ganga is the most important river of India both from the point of view of its basin and cultural significance. It rises in the Gangotri glacier near Gaumukh (3,900 m) in the Uttarkashi district of Uttarakhand. Where, it is known as the **Bhagirathi**. It cuts through the Central and the Lesser Himalayas in narrow gorges.
- At Devprayag, the Bhagirathi meets the Alaknanda; hereafter, it is known as the Ganga. The Alaknanda has its source in the Satopanth glacier above Badrinath. The Alaknanda consists of the Dhauti and the Vishnu Ganga which meet at Joshimath or Vishnu Prayag. The other tributaries of Alaknanda such as the Pindar join it at Karna Prayag while Mandakini or Kali Ganga meets it at Rudra Prayag.
- The Ganga enters the plains at Haridwar. From here, it flows first to the south, then to the south-east and east before splitting into two distributaries, namely the Bhagirathi and the Hugli. The river has a length of 2,525 km. It is shared by Uttarakhand (110 km) and Uttar Pradesh (1,450 km), Bihar (445 km) and West Bengal (520 km). The Ganga basin covers about 8.6 lakh sq. km area in India alone. The Ganga river system is the largest in India has a number of perennial and non-perennial rivers originating in the Himalayas in the north and the Peninsula in the south, respectively. The **Son is its major right-bank tributary**. The important left bank tributaries are the Ramganga, the Gomati, the Ghaghara, the Gandak, the Kosi and the Mahananda. The river finally discharges itself into the Bay of Bengal near the Sagar Island.

- The **Yamuna, the westernmost and the longest tributary of the Ganga**, has its source in the Yamunotri glacier on the western slopes of Bandarpunch range (6,316 km). It joins the Ganga at Prayag (Allahabad). It is joined by the Chambal, the Sind, the Betwa and the Ken on its right bank which originates from the Peninsular plateau while the Hindan, the Rind, the Sengar, the Varuna, etc. join it on its left water feeds the western and eastern Yamuna and the Agra canals for irrigation purposes.
- The **Chambal** rises near Mhow in the Malwa plateau of Madhya Pradesh northwards through a gorge upwards of Kota in Rajasthan, where the Gandhisagar dam has been constructed. From Kota, it traverses down to Bundi, Sawai Madhopur and Dholpur, and finally joins the Yamuna. The Chambal is **famous for its badland topography** called the **Chambal ravines**.
- The **Gandak** comprises two streams, namely Kali Gandaki and Trishulganga. It rises in the Nepal Himalayas between the Dhaulagiri and Mount Everest and drains the central part of Nepal. It enters the Ganga plain in Champaran district of Bihar and joins the Ganga at Sonpur near Patna.
- The **Ghaghara** originates in the glaciers of Mapchachungo. After collecting the waters of its tributaries- Tila, Seti and Beri, it comes out of the mountain, cutting a deep gorge at Shishapani. The river Sarda (Kali or Kali Ganga) joins it in the plain before it finally meets the Ganga at Chhapra.
- The Kosi is an antecedent river with its source to the north of Mount Everest in Tibet, where its mainstream Arun rises. After crossing the Central Himalayas in Nepal, it is joined by the Sun Kosi from the West and the Tamur Kosi from the east. It forms Sapt Kosi after uniting with the River Arun.
- The Ramganga is comparatively a small river rising in the Garhwal hills near Gairsain. It changes its course to the southwest direction after crossing the Shiwalik and enters into the plains of Uttar Pradesh near Najibabad. Finally, it joins the Ganga near Kannauj. The Damodar occupies the eastern margins of the Chotanagpur Plateau where it flows through a rift valley and finally joins the Hugli. The Barakar is its main tributary. Once known as the 'sorrow of Bengal', the Damodar has been now tamed by the Damodar Valley corporation, multipurpose project.
- The Sarda or Saryu river rises in the Milan glacier in the Nepal Himalayas where it is known as the Goriganga. Along the Indo- Nepal border, it is called Kali or Chauk, where it joins the Ghaghara.



- The Mahananda is another important tributary of the Ganga rising in the Darjeeling hills. It joins the Ganga as its last left bank tributary in West Bengal.
- The Son is a large south bank tributary of the Ganga, originating in the Amarkantak plateau. After forming a series of waterfalls at the edge of the plateau, it reaches Arrah, west of Patna, to join the Ganga.