

# **INDIA: DRAINAGE SYSTEM HIMALAYAN & PENINSULAR**



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# INTRODUCTION:

- **Drainage System** is an integrated system of a trunk stream and tributaries, which collect funnel surface water to sea, lake or some other body of water.
- **Drainage Basin:** The total area that contributes water to a single drainage system is known as a drainage basin and they are distinguished from a neighbouring basin by ridges and highlands that form divides.
- **Drainage Pattern:** A geometric arrangement of streams in a region; determined by slope, differing rock resistance to weathering erosion, climate, hydrological variability and structural controls of the landscape known as drainage pattern.
- **Factors controlling drainage pattern:** topography, slope, structural control, nature of rocks, tectonic activities, supply of water and above all geologic history of the region controls the drainage pattern. Every stream or river develops a unique pattern of drainage with their tributaries.



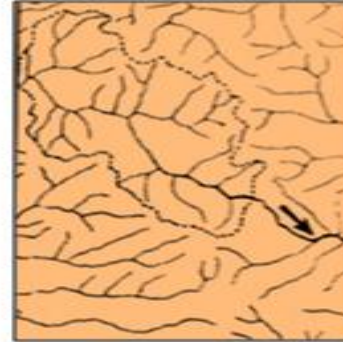
# Drainage Patterns in India



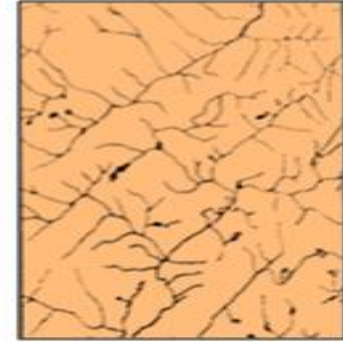
c. Dendritic Pattern



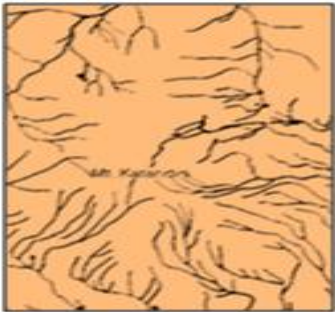
d. Trellis Pattern



e. Barbed Pattern



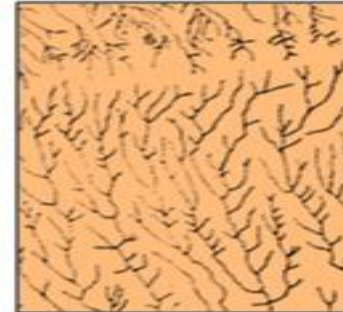
f. Rectangular Pattern



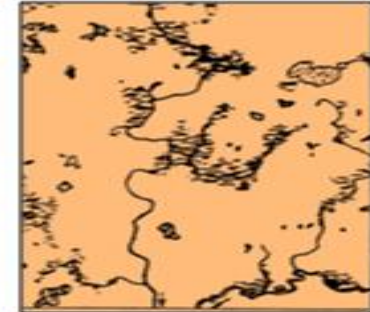
g. Radial Pattern



h. Annular Pattern



i. Parallel Pattern



j. Deranged Pattern

## Discordant Drainage Patterns:

- **Superimposed or Superinduced:** The Indus, Satluj, Ganga, Sarju/Kali, Arun, Tista, Brahmaputra
- **Antecedent / Inconsequent Drainage:** The Indus, Satluj, Ganga, Sarju/Kali, Arun, Tista, Brahmaputra

## Accordant/ Concordant Drainage Patterns

- **Consequent Rivers:** Streams of Peninsular India
- **Subsequent Rivers:** Chambal, Sind, Ken, Betwa, Tons and Son meet the Yamuna and the Ganga at right angles
- **Dendritic Pattern:** streams of Indo- Gangetic plains
- **Trellis Pattern:** s of the Chotanagpur plateau
- **Barbed Pattern:** Arun River
- **Rectangular Pattern:** Rivers of Vindhyan Mountains
- **Radial Pattern** The Amarkantak, Mikir hills & The Girinalr hills Rivers: The Narmada, The Son, The Mahanadi
- **Annual Pattern:** Streams of Pithorgarh , Nilgiri hills
- **Parallel Pattern:** western Coastal rivers
- **Deranged Pattern:** valley of Karakoram
- **Centripetal Pattern:** streams of Ladakh, Tibet, & Baghmata

# Classification of Drainage Systems of India

## 1. Drainage Systems Based on the Size of the Catchment Area:

- Major River- 20,000 Sq km
- Medium River- 2,000-20,000 Sq km
- Minor River - 2,000 and below Sq km

## 2. Drainage Systems Based on Origin:

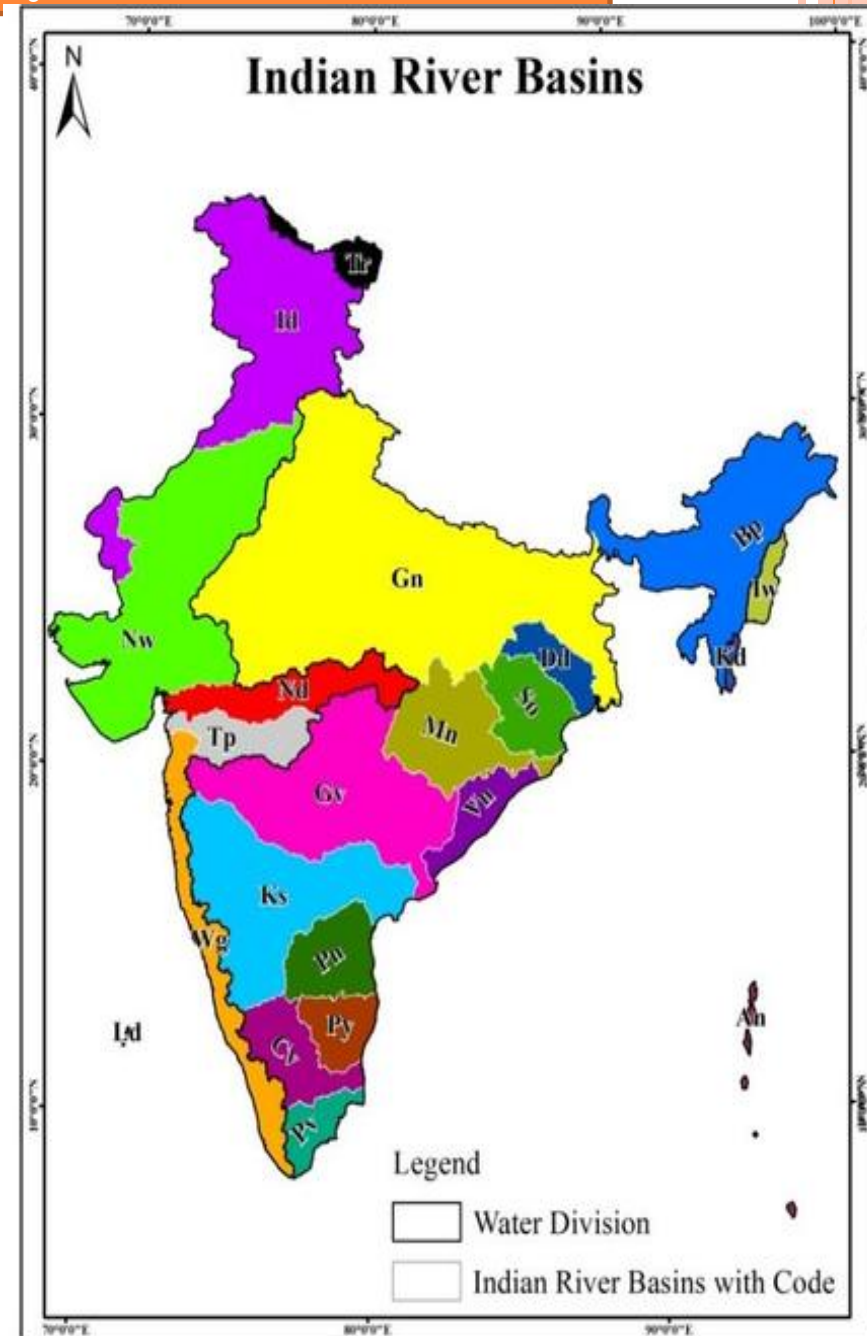
- **The Himalayan Rivers:** Perennial rivers: The Indus, The Ganga, The Brahmaputra and their tributaries.
- **The Peninsular Rivers:** Non-Perennial rivers: Mahanadi, the Godavari, the Krishna, the Cauvery, the Narmada and the Tapi and their tributaries.

## 3. Drainage Systems Based on the Type of Drainage

- **Oceanic Drainage Basins:** Rivers draining towards sea/ oceans. Himalayan rivers, Deccan Rivers and Coastal rivers drain into the sea.
- **Internal/Endorheic Drainage Basins:** Rivers draining into the inland basins or lakes; Stream like the Sambhar in western Rajasthan are mainly seasonal in character, draining into the inland basins and salt lakes. In the Rann of Kutch, the only river that flows through the salt desert is the Luni.

## 4. Drainage Systems Based on Orientation to the sea

- **The Bay of Bengal drainage:** Rivers (East flowing rivers) that drain into Bay of Bengal. The Ganga, the Brahmaputra, the Mahanadi, the Godavari, the Krishna, the Cauvery, the Pennaru, the Penneiyar, the Vaigai, etc. 77 per cent of the drainage area of the country is oriented towards the Bay of Bengal; the rest is drained into the Arabian Sea or forms inland drainage.
- **Arabian Sea drainage:** Rivers (West flowing rivers) that drain into Arabian Sea. 23 % of the drainage area of the country is oriented towards the Arabian Sea. The Indus, the Narmada, the Tapi, the Sabarmati, the Mahi and the large number of swift flowing western coast rivers descending from the Sahyadris.



**Table: 1.1 Major River Basins in India**

| Name of the River              | Origin/ Source              | Length (Km)  | Catchment Area (Sq Km) | % Area      | Annual Discharge (M <sup>3</sup> /Km <sup>2</sup> ) | % Discharge |
|--------------------------------|-----------------------------|--------------|------------------------|-------------|---|-------------|
| <b>I. Himalayan Rivers</b>     |                             |              |                        |             |   |             |
| 1. Ganga                       | Gangotri (Uttar Kashi)      | 2525         | 861452                 | 37.20       | 468700  | 25.2        |
| 1. Indus                       | Mansarovar (Tibet)          | 1114         | 321289                 | 9.80        | 79700   | 4.3         |
| 1. Brahmaputra                 | Kailash Range (Tibet)       | 916          | 194413                 | 7.90        | 627000  | 33.8        |
| <b>Himalayan Rivers Total</b>  |                             | <b>4555</b>  | <b>1377154</b>         | <b>54.9</b> | <b>1175400</b>                                      | <b>63.3</b> |
| <b>II. Peninsular Rivers</b>   |                             |              |                        |             |   |             |
| 1. Godavari                    | Nasik (Maharashtra)         | 1465         | 312812                 | 9.50        | 118000  | 6.4         |
| 1. Krishna                     | Mahabaleshwar (Maharashtra) | 1401         | 258948                 | 7.90        | 62800   | 3.4         |
| 1. Mahanadi                    | Nazri Town (Madhya Pradesh) | 851          | 141589                 | 4.30        | 66640   | 3.6         |
| 1. Narmada                     | Amarkantak (Madhya Pradesh) | 1312         | 98796                  | 3.00        | 54600   | 2.9         |
| 1. Cauvery                     | Coorg (Karnataka)           | 800          | 81155                  | 2.70        | 20950   | 1.1         |
| 1. Tapi                        | Betul (Madhya Pradesh)      | 724          | 65145                  | 2.00        | 17982   | 0.9         |
| 1. Pennar                      | Kolar (Karnataka)           | 597          | 55213                  | 1.70        | 32,38   | 0.2         |
| 1. Brahmani                    | Ranchi (Bihar)              | 799          | 39033                  | 1.20        | 18310   | 1           |
| 1. Mahi                        | Dhar (Madhya Pradesh)       | 583          | 34842                  | 1.00        | 11800   | 0.6         |
| 1. Sabarmati                   | Aravalli Hills (Rajasthan)  | 371          | 21674                  | 0.70        | 3800  | 0.2         |
| <b>Peninsular Rivers Total</b> |                             | <b>8903</b>  | <b>1109207</b>         | <b>34</b>   | <b>374882</b>                                       | <b>20.3</b> |
| <b>Country Total</b>           |                             | <b>13458</b> | <b>2486361</b>         | <b>88.9</b> | <b>1550282</b>                                      | <b>83.6</b> |

Source: India Water Portal & Department of Water Resource

## Himalayan River

- These rivers originate from the lofty Himalayan ranges and are named as the Himalayan rivers.
- These rivers have **large** basins and catchment areas. The total basin area of the Indus, the Ganga and the Brahmaputra is 11.78, 8.61 and 5.8 lakh square kilometers
- The Himalayan rivers flow through deep **V – shaped valleys** called gorges. These gorges have been carved out by down cutting carried on side by side with the uplift of the Himalayas.
- These are examples of **antecedent drainage**.
- Himalayan rivers are **perennial** in nature, i.e., water flows throughout the year in these rivers. These rivers receive water both from the monsoons and snow-melt. The perennial nature of these rivers makes them useful for irrigation.
- These rivers flow across the young fold mountains and are still in a **youthful** stage.
- The upper reaches of the Himalayan rivers are highly tortuous. When they enter the plains, there is a sudden reduction in the speed of flow of water. Under these circumstances these rivers **form meanders** and often shift their beds.
- The Himalayan rivers form **big deltas** at their mouths. The Ganga-Brahmaputra delta is the largest in the world.

## Peninsular River

- These rivers originate in the Peninsular Plateau and are named as Peninsular rivers.
- These rivers have **small** basins and catchment areas. The Godavari has the largest basin area of 3.12 lakh square kilometres only which is less than one-third the basin area of the Indus. **Valleys**.
- The Peninsular rivers flow in comparatively **shallow valleys**. These are more or less completely graded valleys. The rivers have little erosional activity to perform.
- These are examples of **consequent drainage**. **Water Flow**.
- The Peninsular rivers receive water only from rainfall and water flows in these rivers in rainy season only. Therefore, these rivers are seasonal or **non-perennial**. As such these rivers are much less useful for irrigation. Stage.
- These rivers have been flowing in one of the oldest plateaus of the world and have reached **maturity**.
- The hard rock surface and non-alluvial character of the plateau permits **little scope for the formation of meanders**. As such, the rivers of the Peninsular Plateau follow more or less **straight courses**.
- Some of the Peninsular rivers, such as the **Narmada** and the **Tapi** form **estuaries**.
- Other rivers such as the Mahanadi, the Godavari, the Krishna and the Cauvery form **deltas**.
- Several small streams originating from the Western Ghats and flowing towards the west enter the Arabian Sea without forming any delta.

# HIMALAYAN RIVER SYSTEMS

- The Indus, the Ganga and the Brahmaputra comprise the Himalayan river systems.
- The Himalayan Rivers existed even before the formation of Himalayas i.e. before the **collision of Indian Plate with the Eurasian plate**. {Antecedent Drainage}
- They were flowing into the **Tethys Sea**. These rivers had their source in the now **Tibetan region**.
- The **deep gorges** of the Indus, the Satluj, the Brahmaputra etc. clearly indicate that these rivers are **older than the Himalayas**.
- They continued to flow throughout the building phase of the Himalayas; their banks rising steeply while the beds went lower and lower due to vertical erosion (Vertical down cutting was significant and was occurring at a rate faster than the rising of Himalayas), thus cutting deep gorges.
- Thus, many of the Himalayan Rivers are typical examples of **antecedent drainage**.

## Evolution of Himalayan Drainage system:

- There was 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 discharged into the Gulf of Sind near lower Punjab during the Miocene period some 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.
- Himalayan rivers later got dismembered into three major systems.
- This dismembered was probably due to the Pleistocene upheaval in the western Himalayas, 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 (Garó- Rajmahal Gap) area between the Rajmahal hills and the Meghalaya plateau during the mid-Pleistocene period, diverted the Ganga and the Brahmaputra systems to flow towards the Bay of Bengal.



# The Indus River System

- India got her name from Indus.
- ‘The Indus Valley Civilization’ was born around this river.
- It flows in north-west direction from its source (**Glaciers of Kailas Range** – Kailash range in Tibet near Lake Manasarovar) till the **Nanga Parbhat Range**.
- It’s length is about 2,900 km. Its total drainage area is about 1,165,000 square km [more than half of it lies in semiarid plains of Pakistan]. It is joined by **Dhar River** near Indo-China border.
- After entering J&K it flows between the **Ladakh** and the **Zaskar Ranges**. It flows through the regions of Ladakh, Baltistan and Gilgit.
- The **gradient of the river in J&K is very gentle** (about 30 cm per km).
- Average elevation at which the Indus flows through JK is about **4000 m** above sea level.
- It is joined by the **Zaskar River at Leh** (these kind of points are important for prelims).
- Near **Skardu**, it is joined by the **Shyok** at an elevation of about 2,700 m.
- The **Gilgit, Gartang, Dras, Shiger, Hunza** are the other Himalayan tributaries of the Indus.
- It crosses the Himalayas (ends its mountainous journey) through a 5181 m deep gorge near **Attock**, lying north of the **Nanga Parbat**. It takes a sharp southerly bend here (**syntaxial bend**).

# The Indus River System

- **Kabul river** from Afghanistan joins Indus near **Attock**. Thereafter it flows through the **Potwar plateau** and crosses the **Salt Range** (South Eastern edge of Potwar Plateau).
- Some of the important tributaries below Attock include the **Kurram, Toch** and the **Zhob-Gomal**.
- Just above **Mithankot**, the Indus receives from **Panjnad (Panchnad)**, the accumulated waters of the five eastern tributaries—the Jhelum, the Chenab, the Ravi, the Beas and the Satluj.
- The river empties into the Arabian Sea south of **Karachi** after forming a huge delta

| Major Rivers of Indus River System                   | Source  | Length                            |
|--|---|-----------------------------------|
| Indus (Sindhu-Sanskrit; Sinthos-Greek; Sindus-Latin) | Glaciers of Kailas Range<br>(Close to Manasarovar Lake) | 2880 km total.<br>710 km in India |
| Jhelum   | Verinag   | 720 km                            |
| Chenab   | Bara Lacha Pass   | 1180 km                           |
| Ravi   | Near Rohtang Pass                                       | 725 km                            |
| Beas   | Near Rohtang Pass                                       | 460 km                            |
| Satluj   | Manasarovar-Rakas Lakes                                 | 1450 km total                     |

## Indus Water Treaty

The Waters Of The Indus River System Are Shared By India And Pakistan According To The Indus Water Treaty Signed Between The Two Countries On **19th September, 1960**.

According To This Treaty, India Can Utilize Only **20 Per Cent Of Its Total Discharge Of Water**.

# Major Tributaries of Indus River




## The Jhelum

- The Jhelum has its source in a **spring at Verinag** in the south-eastern part of the **Kashmir Valley**.
- It flows northwards into **Wular Lake** (north-western part of Kashmir Valley). From Wular Lake, it changes its course southwards. At **Baramulla** the river enters a gorge in the hills.
- The river forms steep-sided narrow gorge through **Pir Panjal Range** below **Baramulla**.
- At **Muzaffarabad**, the river takes a sharp hairpin bend southward.
- Thereafter, it forms the India-Pakistan boundary for 170 km and emerges at the Potwar Plateau near Mirpur.
- After flowing through the spurs of the Salt Range it **debouches (emerge from a confined space into a wide, open area)** on the plains near the city of Jhelum.
- It joins the Chenab at **Trimmu**.
- The river is **navigable for about 160 km** out of a total length of 724 km.

## Chenab River

- The Chenab originates from near the **Bara Lacha Pass** in the **Lahul-Spiti** part of the **Zaskar Range**.
- Two small streams on opposite sides of the pass, namely **Chandra** and **Bhaga**, form its headwaters at an altitude of 4,900 m.
- The united stream **Chandrabhaga** flows in the north-west direction through the **Pangi valley**, parallel to the **Pir Panjal** range.
- Near **Kistwar**, it cuts a deep gorge.
- It enters the plain area near **Akhnur** in Jammu and Kashmir.
- From here it flows through the plains of Pakistani Punjab to reach Panchnad where it joins the **Satluj** after receiving the waters of Jhelum and Ravi rivers.

## Ravi River

- The Ravi has its source in **Kullu hills** near the **Rohtang Pass** in Himachal Pradesh.
  - It drains the area between the **Pir Panjal** and the **Dhaola Dhar ranges**.
  - After crossing Chamba, it takes a south-westerly turn and cuts a deep gorge in the Dhaola Dhar range.
  - It enters Punjab Plains near **Madhopur** and later enters Pakistan below Amritsar.
  - It debouches into the Chenab a little above **Rangpur** in **Pakistani Punjab**.
- 

## Beas River

- The Beas originates near the **Rohtang Pass**, at a height of 4,062 m above sea level, on the **southern end of the Pir Panjal Range, close to the source of the Ravi.**
- It crosses the Dhaola Dhar range and it takes a south-westerly direction and meets the Satluj river at **Harike in Punjab.**
- It is a comparatively small river which is only 460 km long but **lies entirely within the Indian territory.**

## Satluj River

- The Satluj rises from the Manasarovar-Rakas Lakes in western Tibet at a height of 4,570 m within 80 km of the source of the Indus.
- Like the Indus, it takes a north-westerly course up to the Shipki La on the Tibet-Himachal Pradesh boundary.
- It cuts deep gorges where it pierces the Great Himalaya and the other Himalayan ranges.
- Before entering the Punjab plain, it cuts a gorge in Naina Devi Dhar, where the famous Bhakra dam has been constructed.
- After entering the plain at Rupnagar (Ropar), it turns westwards and is joined by the Beas at Harike.
- From near Ferozepur to Fazilka it forms the boundary between India and Pakistan for nearly 120 km.
- During its onward journey it receives the collective drainage of the Ravi, **Chenab** and Jhelum rivers. It joins the Indus a few kilometres above Mithankot.
- Out of its total length of 1,450 km, it flows for 1,050 km in Indian territory.

# THE GANGA RIVER SYSTEM

- The **Ganga** originates as **Bhagirathi** from the **Gangotri glacier** in Uttar Kashi District of Uttarakhand at an elevation of 7,010 m.
- **Alaknanda** River joins **Bhagirathi** at **Devprayag**.
- **From Devapryag the river is called as Ganga.**
- The Ganges was ranked as the fifth most polluted river of the world in 2007.
- Pollution threatens many fish species and amphibian species and the endangered **Ganges river dolphin (Blind Dolphin)**.
- The Ganga Action Plan, an environmental initiative to clean up the river, has been a major failure thus far, due to corruption, lack of technical expertise, poor environmental planning, and lack of support from religious authorities.
- Ganga **debouches** [emerge from a confined space into a wide, open area] from the hills into plain area at
- It is joined by the **Yamuna** at **Allahabad**.
- Near Rajmahal Hills it turns to the south-east.
- At Farraka, it bifurcates into **Bhagirathi-Hugli in West Bengal** and **Padma-Meghna in Bangladesh** (it ceases to be known as the Ganga after Farraka).
- Brahmaputra (or the Jamuna as it is known here) joins Padma-Meghna at
- The total length of the Ganga river from its source to its mouth (measured along the Hugli) is 2,525 km.
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## Major tributaries of Alaknanda

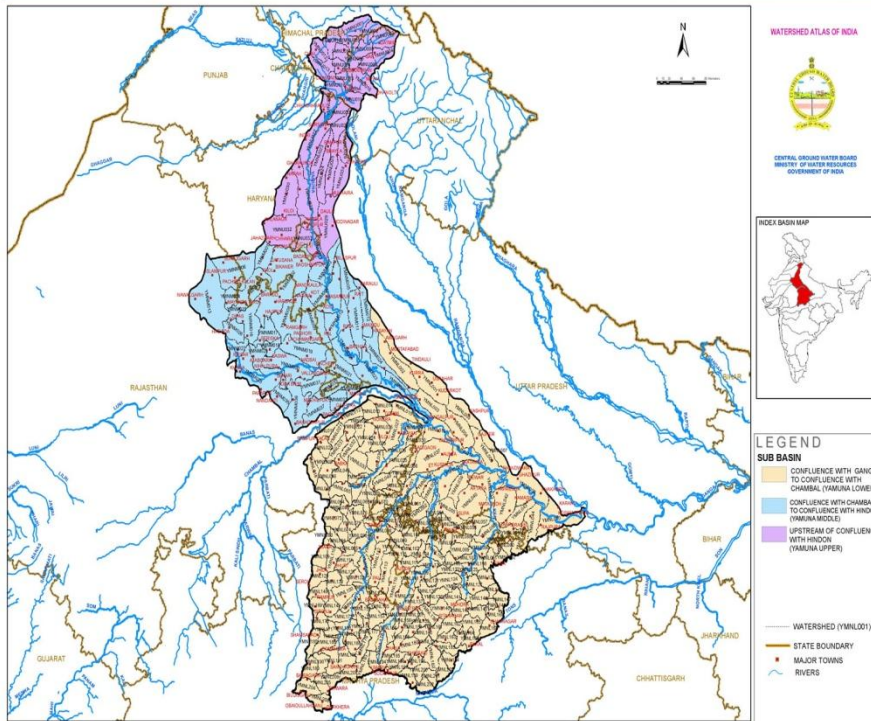
- **East Trisul** (joins Alaknanda at Karan Prayag)
- **Pindar** (rises from Nanda Devi)
- **Mandakini or Kali Ganga** (joins Alaknanda at Rudra Prayag)
- **Dhauliganga**
- **Bishenganga**.
- **Major tributaries of Bhagirathi: Bheling**

## Right Bank Tributaries of The Ganga

Most of them **except Yamuna** originate in the peninsular region

- **Yamuna River**
- **Largest and the most important tributary.**
- **It originates from the Yamnotri glacier on the Bandarpunch Peak in the Garhwal region in Uttarakhand at an elevation of about 6,000 meters.**
- **It cuts across the Nag Tibba, the Mussoorie and the Shiwalik ranges.**
- **It emerges out of the hilly area and enters plains near**
- **Its main affluent in the upper reaches is the Tons which also rises from the Bandarpunch glacier.**
- **It joins Yamuna below Kalsi before the latter leaves the hills.**
- **At this site, the water carried by the Tons is twice the water carried by the Yamuna.**

### YAMUNA BASIN



# Left Bank Tributaries of The Ganga River

- These rivers originate in the Himalayas.
- The major tributaries apart from the Yamuna, are **the Ramganga, the Gomati, the Ghaghra, the Gandak, the Burhi Gandak, the Bagmati, and the Kosi.**

## ○ Ramganga River

- The Ramganga river rises in the **Garhwal** district of Uttarakhand.
- It enters the Ganga Plain near Kalagarh.
- It joins the Ganga at
- The Khoh, the Gangan, the Aril, the Kosi, and the Deoha (Gorra) are important tributaries of Ramganga.

## ○ Ghaghra River

- Its source is near **Gurla Mandhata peak, south of Manasarovar in Tibet (river of the trans-Himalayan origin).**
- It is known as the **Karnaili** in Western Nepal.
- Its important tributaries are the **Sarda, the Sarju (Ayodhya is located on its bank) and the Rapti.**
- The Ghaghara joins the Ganga a few kilometres downstream of Chhapra in Bihar.
- After reaching the plain area, its stream gets divided into many branches of which, Koriyab and Garwa are important.
- The river bed is sandy and sudden bends start occurring in the stream.
- The river has a high flood frequency and has shifted its course several times.

## ○ Kali River

- Rises in the high glaciers of **trans-Himalaya.**
- It forms the boundary between **Nepal and Kumaon.**
- It is known as the **Sarda** after it reaches the plains near Tanakpur.

○ It joins the

## ○ Gandak River

- Originates near the Tibet-Nepal border at a height of 7,620 m
- It receives a large number of tributaries in Nepal Himalaya.
- Its important tributaries are the **Kali Gandak, the Mayangadi, the Bari and the Trishuli.**
- It debouches into the plains at
- It flows into Ganga at **Hajipur in Bihar.**

## ○ Burhi Gandak

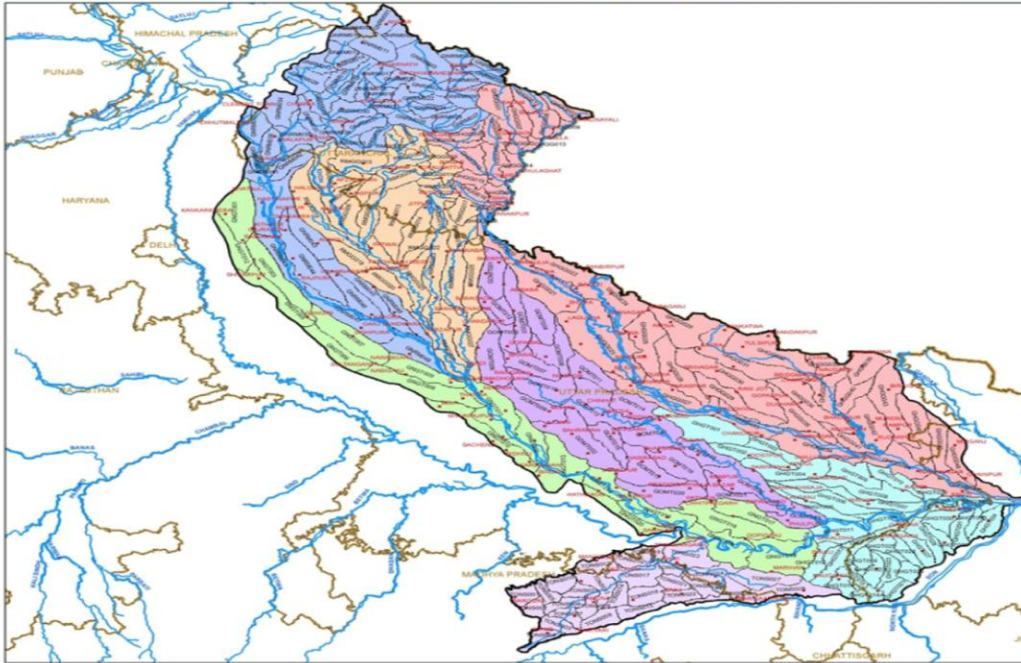
- Originates from the western slopes of **Sumesar hills near the India-Nepal border.**
- It joins the Ganga near Monghyr town.

## ○ Kosi River

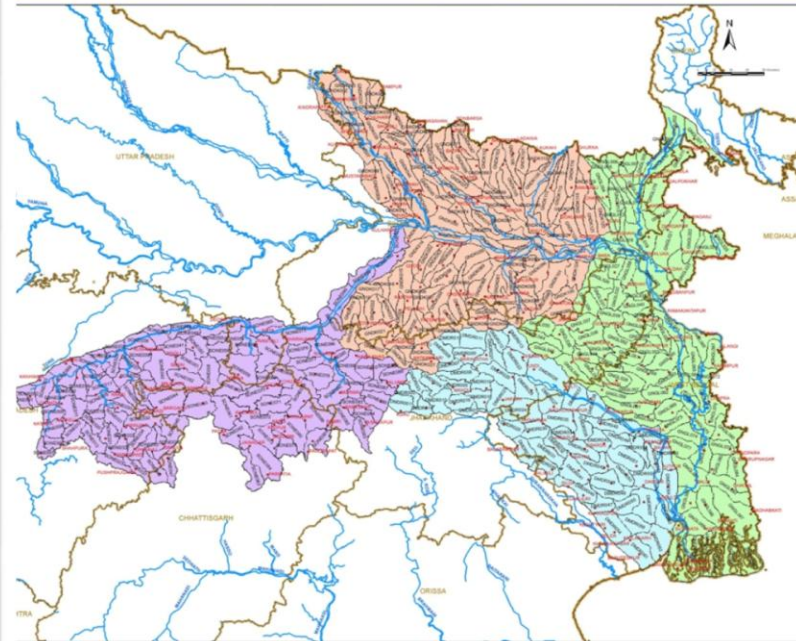
- The Kosi river consists of seven streams namely **Sut Kosi, Tamba Kosi, Talkha, Doodh Kosi, Botia Kosi, Arun and Tamber** and is popularly known as
- These streams flow through **eastern Nepal** which is known as the **Sapt Kaushik region.**
- The sources of seven streams of the Kosi are located in snow covered areas which also receive heavy rainfall.
- Consequently, huge volume of water flows with tremendous speed.
- Seven streams mingle with each other to form three streams named the Tumar, Arun and Sun Kosi.



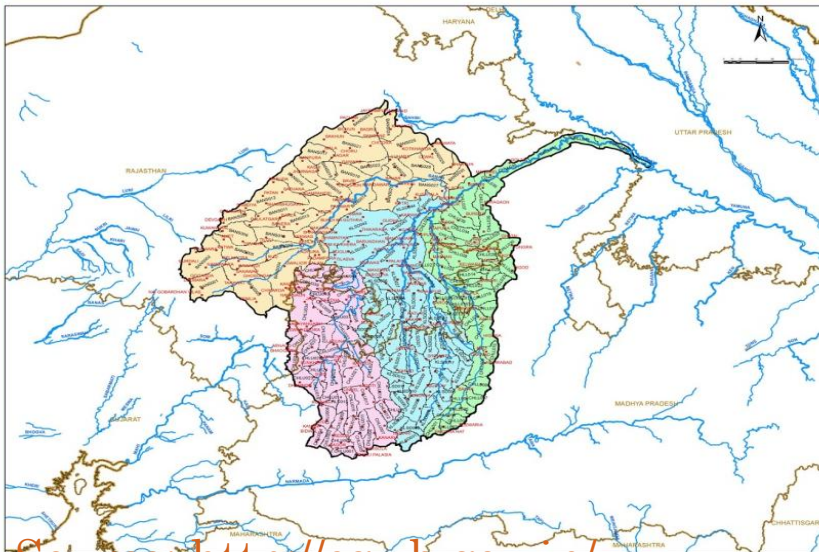
## UPPER GANGA BASIN



## LOWER GANGA BASIN



## CHAMBAL BASIN



They unite at **Triveni** north of the **Mahabharata Range** to form the Kosi.

The river enters the Tarai of Nepal after cutting a narrow gorge in the Mahabharata Range.

The joins the Ganga near

Soon after debouching onto the plain the river becomes sluggish. Large scale deposition of eroded material takes place in the plain region.

The river channel is braided and it shifts its course frequently.

This has resulted in frequent devastating floods and has converted large tracts of cultivable land into waste land in Bihar.

Thus the river is often termed as the '**Sorrow of Bihar**'.

In order to tame this river, a barrage was constructed in 1965 near Hanuman Nagar in Nepal.

Embankments for flood control have been constructed as a joint venture of India and Nepal.

# Peninsular Tributaries

## Chambal River

- The Chambal rises in the highlands of **Janapao Hills** (700 m) in the **Vindhyan Range**.
- It flows through the **Malwa Plateau**.
- It joins the Yamuna in **Etawah district** of Uttar Pradesh.
- The river flows much below its banks due to severe erosion because of poor rainfall and numerous deep ravines have been formed in the Chambal Valley, giving rise to **badland topography**. {Arid Landforms}
- The total length of the river is 1,050 km.

## Banas River

- The Banas is a tributary of the Chambal.
- It originates in the southern part of the **Aravali Range**.
- It join the Chambal on **Rajasthan – Madhya Pradesh border** near **Sawai Madhopur**.

## Sind River

- The Sind originates in **Vidisha Plateau** of Madhya Pradesh.
- It flows for a distance of 415 km before it joins the Yamuna.

## Betwa River

- The Betwa rises in **Bhopal district (Vindhyan Range)** and joins the Yamuna near
- It has a total length of 590 km.
- **The Dhasan** is its important tributary.

## Ken River

- The Ken river rising from the **Barner Range** of Madhya Pradesh joins the Yamuna near Chila.


## Son River

- The Son River rises in the **Amarkantak Plateau**.
- Its source is close to the origin of the Narmada.
- It passes along the **Kaimur Range**.
- It joins the Ganga near Danapur in Patna district of Bihar.
- It flows for a distance of 784 km from its source.
- The important tributaries of the Son are the Johilla, the Gopat, the Rihand, the Kanhar and the North Koel. Almost all the tributaries **join it on its right bank**.

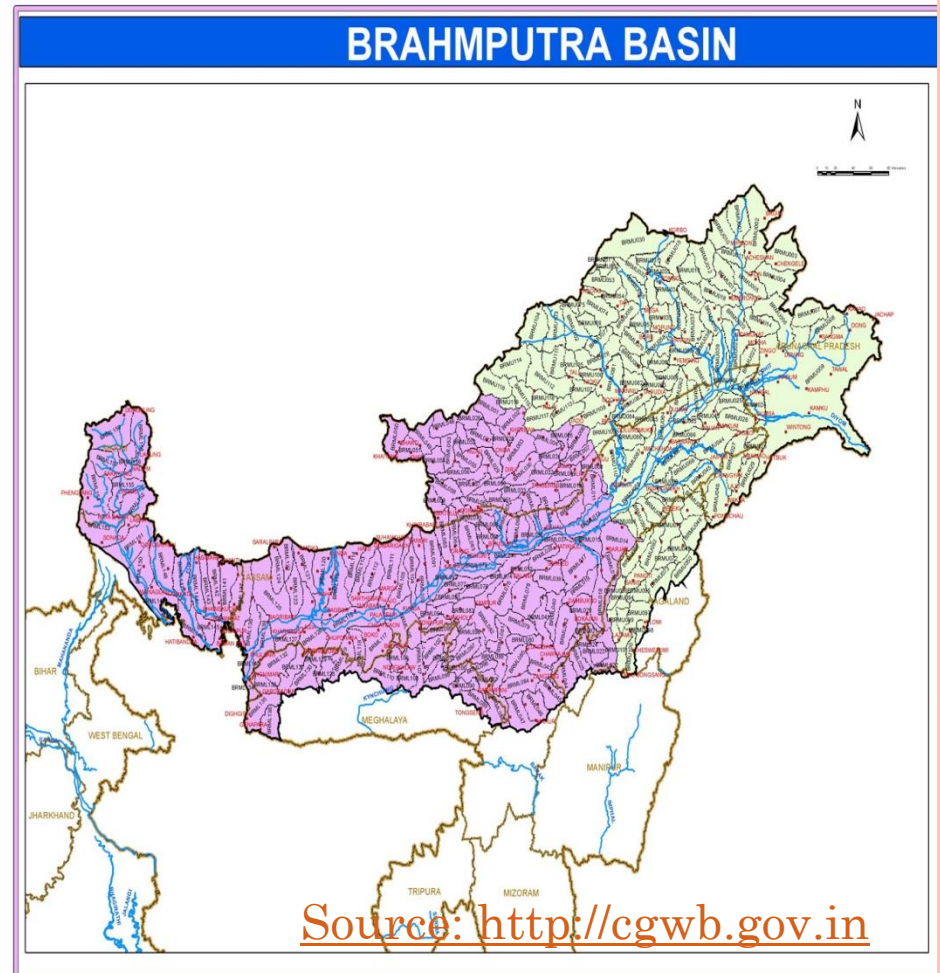
## Damodar river

- The Damodar river rises in the hills of the **Chotanagpur plateau** and **flows through a rift valley**.
- Rich in mineral resources, the valley is home to large-scale mining and industrial activity.
- It has a number of tributaries and subtributaries, such as **Barakar, Konar, Bokaro, Haharo, etc.**
- The **Barakar** is the most important tributary of the Damodar.
- Several dams have been constructed in the valley, for the generation of hydroelectric power. The valley is called **“the Ruhr of India”**.
- The first dam was built across the Barakar River, a tributary of the Damodar river.
- It used to cause devastating floods as a result of which it earned the name ‘Sorrow of Bengal’. Now the river is tamed by constructing numerous dams.
- It joins the **Hugli River** 48 km below Kolkata.
- The total length of the river is 541 km.

# THE BRAHMAPUTRA RIVER SYSTEM

- The Brahmaputra (meaning the son of Brahma).
  - It is 2,900 km in length.
  - Source: **Chemayungdung glacier (Kailas Range)** at an elevation of about 5,150 m. It's source is very close to the sources of Indus and Satluj.
  - **Mariam La** separates the source of the Brahmaputra from the Manasarovar Lake.
  - Brahmaputra flows eastwards in Southern Tibet for about 1,800 km.
  - In Tibet it passes through the **depression formed by the Indus-Tsangpo Structure Zone** between the Great Himalayas in the south and the Kailas Range in the north.
  - In spite of the exceptionally high altitude, the Tsangpo has a **gentle slope**. The river is sluggish and has a wide navigable channel for about 640 km.
  - It receives a large number of tributaries in Tibet. The first major tributary is the Raga Tsangpo meeting the Tsangpo near **Lhatse Dzong**.
  - The river Ngangchu flows through the trade centre of Gyantse in the south and joins the main river.
  - Towards the end of its journey in Tibet, its course abruptly takes a south ward turn around **Namcha Barwa (7,756 m)(Syntaxial Bend)**.
  - Here it cuts across the eastern Himalaya through the **Dihang or Siang Gorge** and emerges from the mountains near **Sadiya** in the Assam Valley.
  - Here it first flows under the name of Siong and then as the Dihang.
  - In the north-eastern parts of Assam Valley, it is joined by two important tributaries viz, the **Dibang (or Sikang)** from the north and **Lohit from the south**.
  - The main streams merging with the Brahmaputra from the north are, Subansiri, Kameng, Dhansiri (north), Raidak, Tista etc..
- 

- The Tista was a tributary of the Ganga prior to the floods of 1787 after which it diverted its course eastwards to join the Brahmaputra.
- The Brahmaputra has a **braided channel** (flow into shallow interconnected channels divided by deposited earth) for most of its passage through Assam where channels keep shifting. It carries a lot of silt and there is excessive meandering.
- The river is nearly 16 km wide at Dibrugarh and forms many islands, the most important of which is **MAJULI**. It is 90 km long and measures 20 km at its widest.
- With rainfall concentrated during the monsoon months only the river has to carry enormous quantities of water and silt which results in disastrous floods. The Brahmaputra is thus truly a **River of Sorrow**.
- The river is navigable for a distance of 1,384 km upto Dibrugarh from its mouth and serves as an excellent inland water transport route.
- Brahmaputra bends southwards and enters Bangladesh near Dhubri.
- It flows for a distance of 270 km in the name of **Jamuna river** and joins the Ganga at
- The united stream of the Jamuna and the Ganga flows further in the name of
- About 105 km further downstream, the Padma is joined on the left bank by the **Meghna**, originating in the mountainous region of Assam.
- From the confluence of Padma and Meghna, the combined river is known as the **Meghna** which makes a very broad estuary before pouring into the Bay of Bengal.



# PENINSULAR RIVER SYSTEM

- Peninsula rivers are much **older** than the Himalayan rivers {Discordant}.
- The peninsular drainage is mainly Concordant except for few rivers in the upper peninsular region. They are **non-perennial** rivers with a maximum discharge in the rainy season.
- The peninsular rivers have reached **mature stage** {Fluvial Landforms} and have almost reached their base level. [**Vertical down cutting is negligible**] which are characterized by **broad and shallow valleys**.
- The river banks have gentle slopes except for a limited tract where faulting forms steep sides.
- The main **water divide** in peninsular rivers is formed by the Western Ghats, which run from north to south close to the western coast.
- The velocity of water in the rivers and the **load carrying capacity of the streams is low** due to low gradient.
- Most of the major rivers of the peninsula such as the Mahanadi, the Godavari, the Krishna and the Cauvery flow eastwards and drain into the Bay of Bengal. These rivers make **deltas at their mouths**.
- But the west flowing rivers of Narmada and Tapi as well as those originating from the Western Ghats and falling in the Arabian Sea form **estuaries in place of deltas**.
- There are few places where rivers form superimposed and rejuvenated drainage which are represented by
- Examples: The **Jog on the Sharvati** (289 m), **Yenna of Mahabaleshwar** (183 m), **Sivasamundram on the Cauvery** (101 m), **Gokak on the Gokak** (55 m), **Kapildhara** (23 m) and **Dhuandar** (15 m) on the Narmada are the major waterfalls in the Peninsular India.
- **Rivers that drain into Bay of Bengal: The Mahanadi, the Godavari, the Krishna, the Cauvery** and several smaller rivers drains south-east into the Bay of Bengal.
- **Rivers that drain into Arabian Sea: The Narmada, the Tapi, the Mahi** flowing west as well as several small streams originating from the Western Ghats flow westwards into the Arabian Sea.
- **Rivers that drain into the Ganges:** Tributaries of the Ganga and the Yamuna such as the Chambal, the Betwa, the Ken, the Son and the Damodar flow in the north-easterly direction.

# MAJOR PENINSULAR RIVER SYSTEM

Rivers that drain into the Ganges

1. Chambal River

2. Banas River

3. Sind River

4. Betwa River

5. Ken River

6. Son River

7. Damodar River

\* It will be discussed as Tributaries of River Ganga (see slide no-18)

➤ East Flowing Peninsular Rivers

1. Mahanadi River

2. Godavari River

3. Krishna River

4. Kaveri (Cauvery) River

5. Pennar River

6. Subarnarekha River

7. Brahmani River

8. Sarada River

9. Ponnaiyar River

10. Vaigai River

➤ West Flowing Peninsular Rivers

1. Narmada River

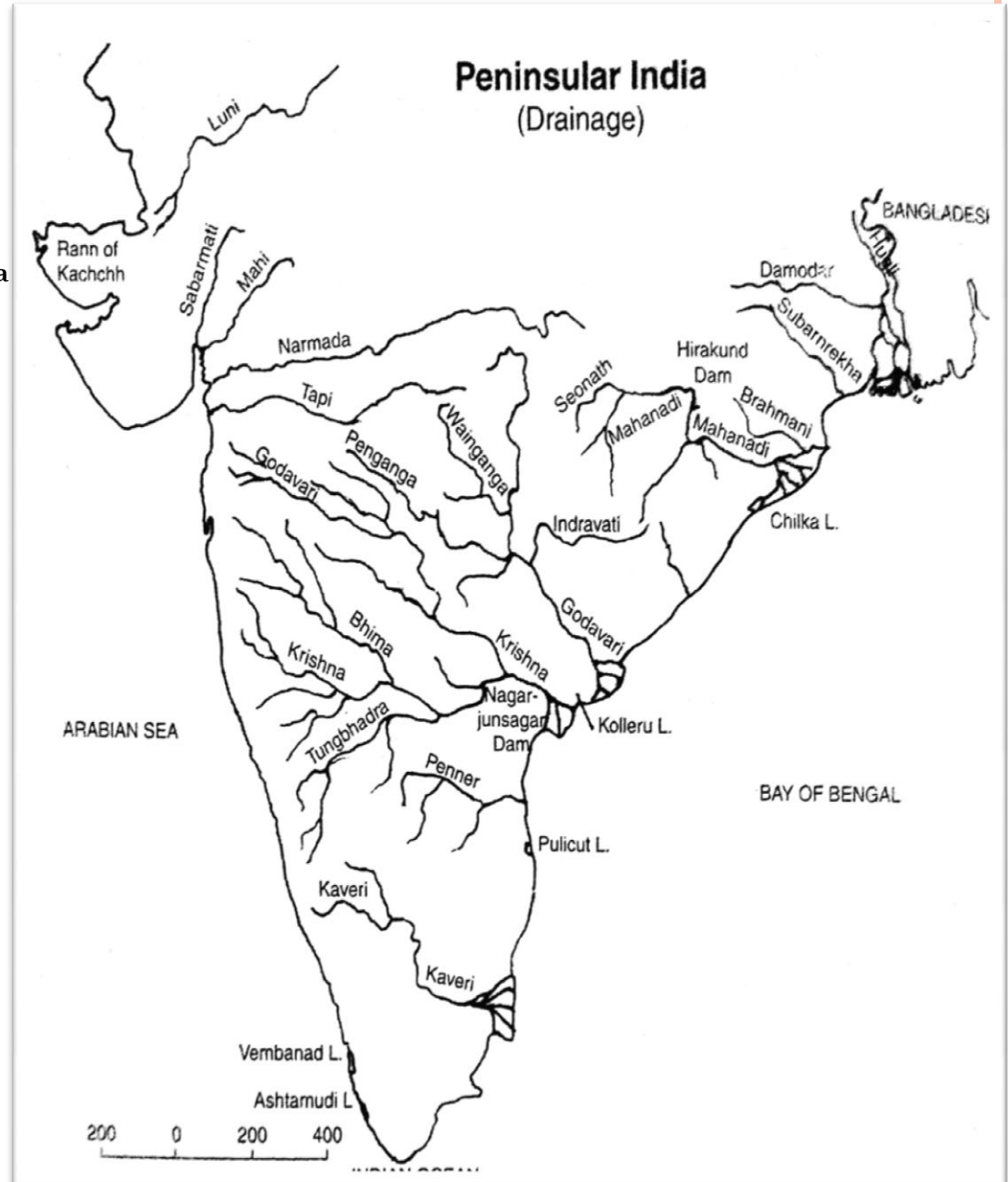
2. Tapi River

3. Sabarmati River

4. Mahi River

5. Luni River

6. Ghaggar River – Inland Drainage



# EVOLUTION OF THE PENINSULAR DRAINAGE

## Theory 1

- Geologists believe that the **Sahyadri-Aravali axis** was the main water divide in the past.
- According to one hypothesis, the existing peninsula is the remaining half of bigger landmass.
- The Western Ghats were located in the middle of this landmass.
- So one drainage was towards east flowing into Bay of Bengal and the other towards west draining into Arabian Sea.
- The western part of the Peninsula cracked and submerged in the Arabian Sea during the early **Tertiary period (coinciding with the formation of Himalayas)**.
- During the collision of the Indian plate, the Peninsular block was subjected to subsidence in few regions creating a series of **rifts (trough, faults)**.
- **The now west flowing rivers of the Peninsula, namely the Narmada and the Tapi flow through these rifts.**
- Straight coastline, steep western slope of the Western Ghats, and the **absence of delta formations on the western coast** makes this theory a possibility.

## Theory2

- It is believed that the west flowing peninsular rivers do not flow in the valleys formed by the rivers themselves.
- Rather they have occupied two fault rifts in rocks running parallel to the Vindhyas.
- These faults are supposed to be **caused by bend of the northern part of the Peninsula at the time of upheaval of the Himalayas.**
- Peninsular block, south of the cracks, tilted slightly eastwards during the event thus giving the orientation to the entire drainage towards the Bay of Bengal.
- Criticism: Tilting should have increased the gradient of the river valleys and caused some **rejuvenation** of the rivers. This type of phenomenon is absent in the Peninsula, barring a few exceptions such as waterfalls.



# Mahanadi River

- The Mahanadi basin extends over states of Chhattisgarh and Odisha and comparatively smaller portions of Jharkhand, Maharashtra and Madhya Pradesh, draining an area of 1.4 lakh Sq.km.

- It is bounded by the Central India hills on the north, by the Eastern Ghats on the south and east and by the Maikala range on the west.

- The Mahanadi (“Great River”) follows a total course of 560 miles (900 km).

- It has its source in the northern foothills of Dandakaranya in Raipur District of Chhattisgarh at an elevation of 442 m.

- The Mahanadi is one of the major rivers of the peninsular rivers, in water potential and flood producing capacity, it ranks second to the Godavari.

- Other small streams between the Mahanadi and the Rushikulya draining directly into the Chilka Lake also forms the part of the basin.

- The major part of basin is covered with agricultural land accounting to 54.27% of the total area.

- It is one of the most-active silt-depositing streams in the Indian subcontinent.

- After receiving the Seonath River, it turns east and enters Odisha state.

- At Sambalpur the Hirakud Dam (one of the largest dams in India) on the river has formed a man-made lake 35 miles (55 km) long.

- It enters the Odisha plains near Cuttack and enters the Bay of Bengal at False Point by several channels.

- Puri, at one of its mouths, is a famous pilgrimage site.

## Tributaries of Mahanadi River

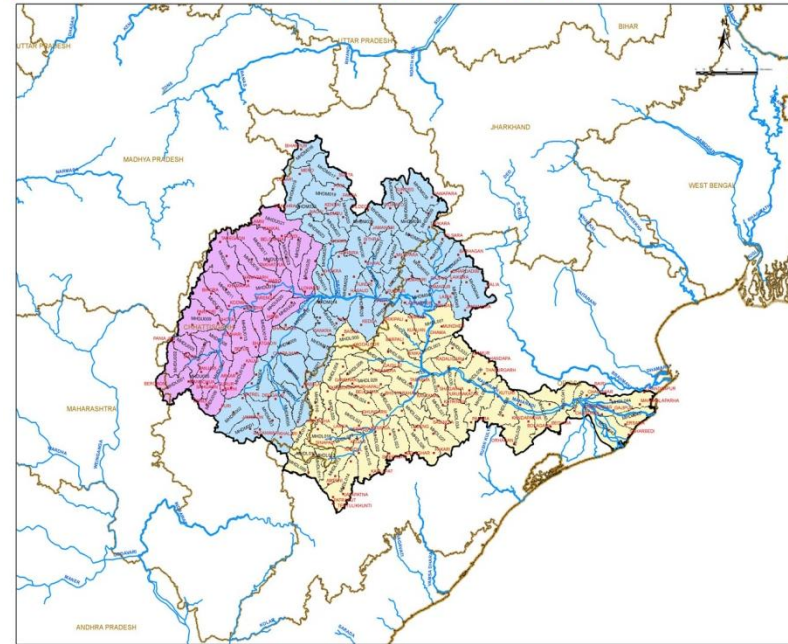
- Its upper course lies in the saucer-shaped basin called the ‘Chhattisgarh Plain’.

- This basin is surrounded by hills on the north, west and south as a result of which a large number of tributaries join the main river from these sides.

- Left bank Tributaries: The **Seonath**, the **Hasdeo**, the **Mand** and the **Ib**.

- Right bank Tributaries: The **Ong**, the **Tel** and the **Jonk**.

## MAHANADI BASIN



## Projects on Mahanadi River

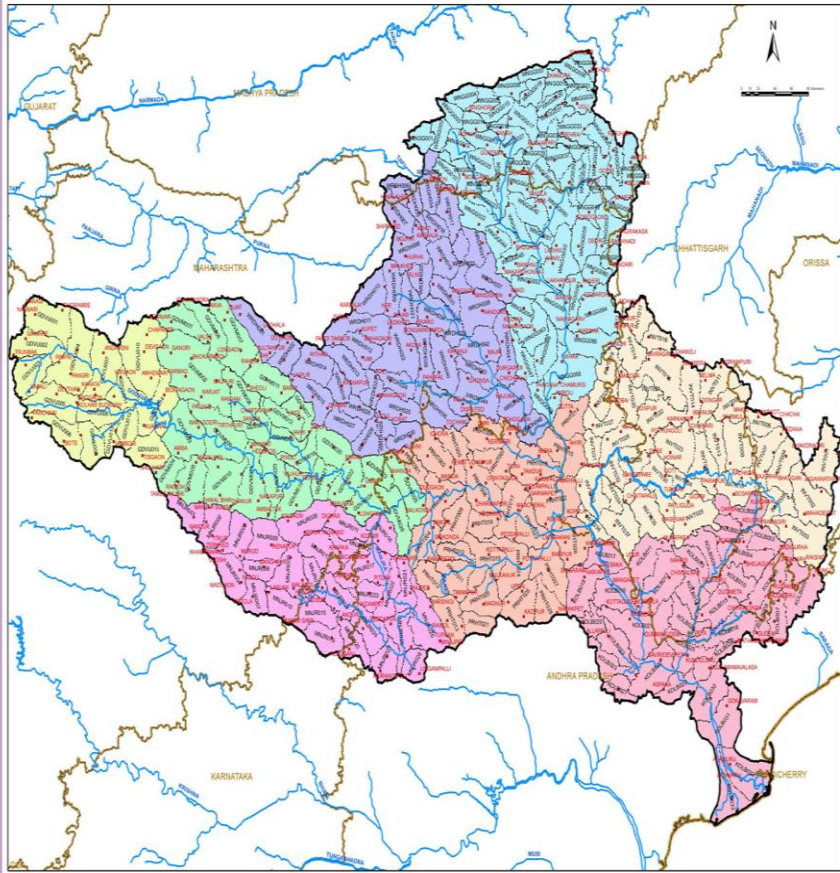
Two important projects completed during pre-plan period in the basin are the **Mahanadi main canal** and **Tandula reservoir in Chhattisgarh**.

During the plan period, the **Hirakud dam, Mahanadi delta project, Hasdeo Bango, Mahanadi Reservoir Project** were completed.





## GODAVARI BASIN



### ○ **Projects on Godavari River**

○ Important projects completed during the plan period are **Srirama Sagar, Godavari barrage, Upper Penganga, Jaikwadi, Upper Wainganga, Upper Indravati, Upper Wardha.**

○ Among the on-going projects, the prominent ones are **Prnahita-Chevala and Polavaram.**

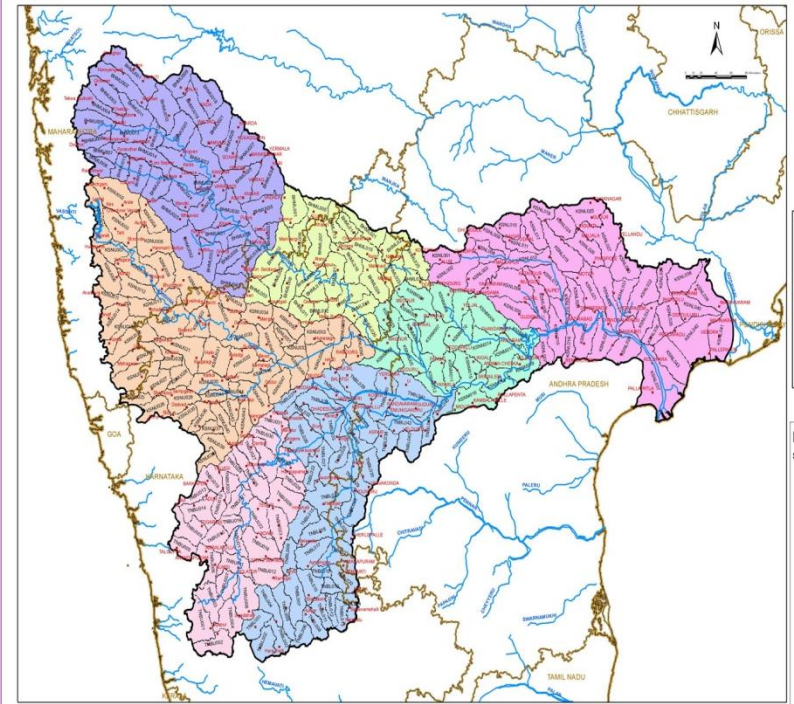
## Godavari River

- The Godavari is the **largest river system of the Peninsular India** and is revered as **Dakshina Ganga.**
- The Godavari basin extends over states of Maharashtra, Andhra Pradesh, Chhattisgarh and Odisha in addition to smaller parts in Madhya Pradesh, Karnataka and Union territory of Puducherry (Yanam) having a total area of ~ 3 lakh Sq.km.
- The basin is bounded by **Satmala hills, the Ajanta range** and the **Mahadeo hills** on the north, by the Eastern Ghats on the south and the east and by the Western Ghats on the west.
- The Godavari River rises from **Trimbakeshwar in the Nashik district** of Maharashtra about 80 km from the Arabian Sea at an elevation of 1,067 m.
- The total length of Godavari from its origin to outfall into the Bay of Bengal is 1,465 km.
- **Tributaries of Godavari River**
- The left bank tributaries are more in number and **larger** in size than the right bank tributaries.
- The **Manjra** (724 km) is the only important right bank tributary. It joins the Godavari after passing through the **Nizam Sagar.**
- *Left Bank Tributaries: Dharna, Penganga, Wainganga, Wardha, Pranahita [conveying the combined waters of Penganga, the Wardha and Wainganga], Pench, Kanhan, Sabari, Indravati etc.*
- *Right Bank Tributaries: Pravara, Mula, Manjra, Peddavagu, Maner etc.*
- Below Rajahmundry, the river divides itself into two main streams, the **Gautami Godavari** on the east and the **Vashishta Godavari** on the west and forms a large delta before it pours into the Bay of Bengal.
- The delta of the Godavari is of **lobate type** with a round bulge and many distributaries.

# Krishna River

- The Krishna is the second largest east flowing river of the Peninsula.
- The Krishna Basin extends over Andhra Pradesh, Maharashtra and Karnataka having a total area of ~2.6 lakh Sq.km.
- It is bounded by **Balaghat range** on the north, by the Eastern Ghats on the south and the east and by the Western Ghats on the west.
- The Krishna River rises from the **Western Ghats** near **Jor village of Satara district of Maharashtra** at an altitude of 1,337 m just north of **Mahabaleshwar**.
- The total length of river from origin to its outfall into the Bay of Bengal is 1,400 km.
- The major part of basin is covered with agricultural land accounting to 75.86% of the total area.
- The Krishna forms a large delta with a shoreline of about 120 km. The Krishna delta appears to merge with that formed by the Godavari and extends about 35 km into the sea.
- **Tributaries of Krishna River**
- Right bank: the **Ghatprabha, the Malprabha and the Tungabhadra**.
- Left Bank: the **Bhima, the Musi and the Munneru**.
- The **Koyna** is a small tributary but is known for **Koyna Dam**. This dam was perhaps the main cause of the devastating **earthquake** (6.4 on richter scale) in 1967 that killed 150 people.
- The Bhima originates from the **Matheron Hills** and joins the Krishna near Raichur after for a distance of 861 km.
- The Tungabhadra is formed by the unification of the **Tunga** and the **Bhadra** originating from **Gangamula** in the **Central Sahyadri**. Its total length is 531 km.
- At Wazirabad, it receives its last important tributary, the **Musi**, on whose banks the city of Hyderabad is located.

## KRISHNA BASIN



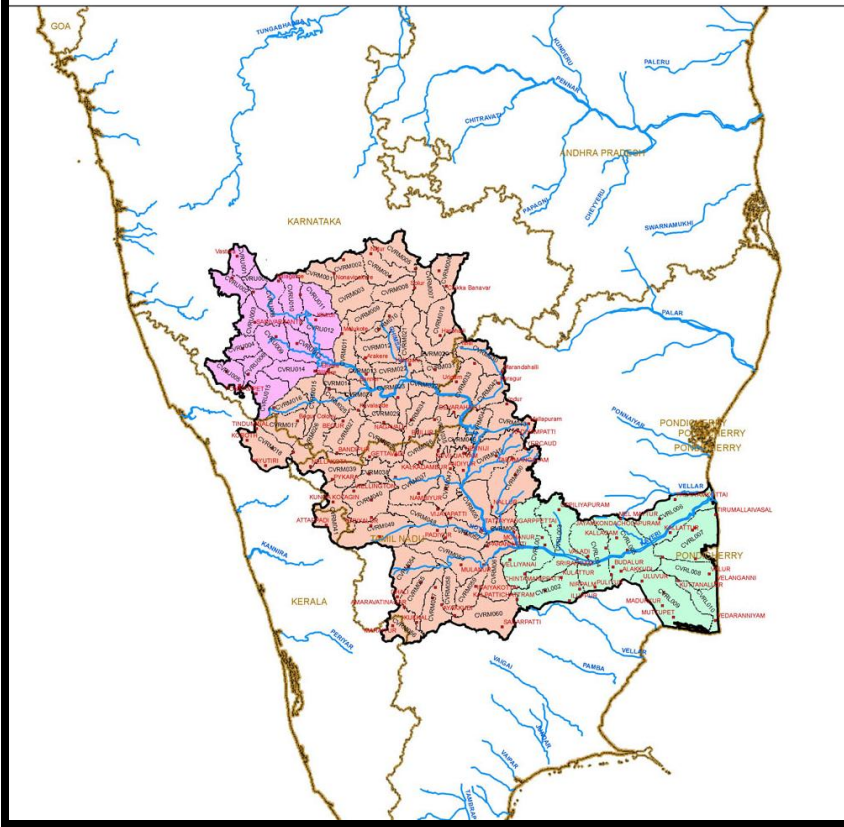
- **Projects on Krishna River**
- Important ones are the **Tungabhadra, Ghataprabha, Nagarjunasagar, Malaprabha, Bhima, Bhadra and Telugu Ganga**.
- The major Hydro Power stations in the basin are **Koyna, Tungabhadra, Sri Sailam, Nagarjuna Sagar, Almatti, Naryanpur, Bhadra**.
- Tunagabhadra is a major inter-States project in the basin. In order to operate the project and to regulate the flows among the beneficiary States of Karnataka and Andhara Pradesh.

# Cauvery River

- The Kaveri (Cauvery) is designated as the 'Dakshina Ganga' or 'the Ganga of the South'.
- The Cauvery River rises at an elevation of 1,341 m at Talakaveri on the Brahmagiri range near Cherangala village of Kodagu (Coorg) district of Karnataka.
- The total length of the river from origin to outfall is 800 km.
- The Cauvery basin extends over states of Tamil Nadu, Karnataka, Kerala and Union Territory of Puducherry draining an area of 81 thousand Sq.km.
- It is bounded by the Western Ghats on the west, by the Eastern Ghats on the east and the south and by the ridges separating it from Krishna basin and Pennar basin on the north.
- The Nilgiris, an offshore of Western ghats, extend Eastwards to the Eastern ghats and divide the basin into two natural and political regions i.e., Karnataka plateau in the North and the Tamil Nadu plateau in the South.
- Physiographically, the basin can be divided into three parts – the Western Ghats, the Plateau of Mysore and the Delta. The delta area is the most fertile tract in the basin. The principal soil types found in the basin are black soils, red soils, laterites, alluvial soils, forest soils and mixed soils. Red soils occupy large areas in the basin. Alluvial soils are found in the delta areas.
- The basin in Karnataka receives rainfall mainly from the S-W Monsoon and partially from N-E Monsoon. The basin in Tamil Nadu receives good flows from the North-East Monsoon.
- Its upper catchment area receives rainfall during summer by the south-west monsoon and the lower catchment area during winter season by the retreating north-east monsoon.
- It is, therefore almost a perennial river with comparatively less fluctuations in flow and is very useful for irrigation and hydroelectric power generation.
- Thus the Cauvery is one of the best regulated rivers and 90 to 95 per cent of its irrigation and power production potential already stands harnessed.
- The river drains into the Bay of Bengal. The major part of basin is covered with agricultural land accounting to 66.21% of the total area.
- **Tributaries of the Cauvery River:** Left Bank: the Harangi, the Hemavati, the Shimsha and the Arkavati.
- Right Bank: Lakshmantirtha, the Kabbani, the Suvarnavati, the Bhavani, the Noyil and the Amaravati joins from right.

- The river descends from the South Karnataka Plateau to the Tamil Nadu Plains through the *Sivasamudram waterfalls (101 m high)*.
- At Shivanasamudram, the river branches off into two parts and falls through a height of 91 m. in a series of falls and rapids.
- The falls at this point is utilized for power generation by the power station at Shivanasamudram.
- The two branches of the river join after the fall and flow through a wide gorge which is known as 'Mekedatu' (Goats leap) and continues its journey to form the boundary between Karnataka and Tamil Nadu States for a distance of 64 km.
- At Hogenekkal Falls, it takes Southerly direction and enters the Mettur Reservoir.
- A tributary called Bhavani joins Cauvery on the Right bank about 45 Kms below Mettur Reservoir. Thereafter it enters the plains of Tamil Nadu.
- Two more tributaries Noyil and Amaravathi join on the right bank and here the river widens with sandy bed and flows as 'Akhandu Cauvery'.
- Immediately after crossing Tiruchirapalli district, the river divides into two parts, the Northern branch being called 'The Coleroon' and Southern branch remains as Cauvery and from here the Cauvery Delta begins.
- After flowing for about 16 Kms, the two branches join again to form 'Srirangam Island'.
- On the Cauvery branch lies the "Grand Anicut" said to have been constructed by a Chola King in 1st Century A.D.
- Below the Grand Anicut, the Cauvery branch splits into two, Cauvery and Vennar.
- These branches divide and sub-divide into small branches and form a network all over the delta.

## CAUVERY BASIN



- **Projects on Cauvery River**
- During the pre-plan period many projects were completed in this basin which included **Krishnarajasagar** in Karnataka, **Mettur dam** and **Cauvery delta system** in Tamil Nadu.
- Lower **Bhavani, Hemavati, Harangi, Kabini** are important projects completed during the plan period.

## Pennar River

- The Pennar (also known as **Uttara Pinakini**) is one of the major rivers of the peninsula.
- The Pennar rises in the **Chenna Kasava hill** of the **Nandidurg range**, in **Chikkaballapura district** of **Karnataka** and flows towards east eventually draining into the Bay of Bengal.
- The total length of the river from origin to its outfall in the Bay of Bengal is 597 km.
- Located in peninsular India, the Pennar basin extends over states of Andhra Pradesh and Karnataka having an area of ~55 thousand Sq.km
- The fan shaped basin is bounded by the **Erramala range** on the north, by the **Nallamala** and **Velikonda** ranges of the Eastern Ghats on the east, by the **Nandidurg hills** on the south and by the narrow ridge separating it from the Vedavati valley of the Krishna Basin on the west.
- The other hill ranges in the basin to the south of the river are the **Seshachalam [famous for Red Sanders]** and **Paliconda** ranges.
- The major part of basin is covered with agriculture accounting to 58.64% of the total area.

### Tributaries of Pennar River

- Left Bank: the **Jayamangali**, the **Kunderu** and the
- Right bank: the **Chiravati**, the **Papagni** etc.

### Projects on Pennar River

- Tungabhadra high level canal in Krishna basin irrigated areas in Pennar basin also. The only major project in the basin is the **Somasila project**.

## Subarnarekha River

- The Subarnarekha originates from the **Ranchi Plateau** in Jharkhand forming the boundary between West Bengal and Odisha in its lower course.
- It joins Bay of Bengal forming an estuary between the Ganga and Mahanadi deltas. Its total length is 395 km.


## Brahamani River

- The Brahmani river comes into existence by the confluence of the Koel and the Sankh rivers near Rourkela. It has a total length of 800 km.
- The basin is bounded in the North by Chhotanagpur plateau, in the West and South by the Mahanadi basin and in the East by the Bay of Bengal.
- The basin flows through Jharkhand, Chhattisgarh and Orissa States and drains into Bay of Bengal.

## Ponnaiyar River

- The Ponnaiyar is a small stream which is confined to the coastal area only.
- It covers a small area in the state of Tamil Nadu, Karnataka and Andhra Pradesh.
- The Basin is bounded on the North -West and South by various ranges of the Eastern Ghats like the Velikonda Range, the Nagari hills, the Javadu hills, the Shevaroy hills, the Chitteri hills and the Kalrayan hills and in the East by the Bay of Bengal.

## Vaigai River

- South of the Cauvery delta, there are several streams, of which the Vaigai is the longest.
  - The Vaigai basin is an important basin among the 12 basins lying between the Cauvery and Kanyakumari.
  - This basin is bounded by the Varushanadu hills, the Andipatti hills, the Cardaman hills and the Palani hills on the West and by the Palk strait and Palk Bay on the East.
  - The Vaigai drains an area of 7,741 Sq.Km, which entirely lies in the state of Tamil Nadu.
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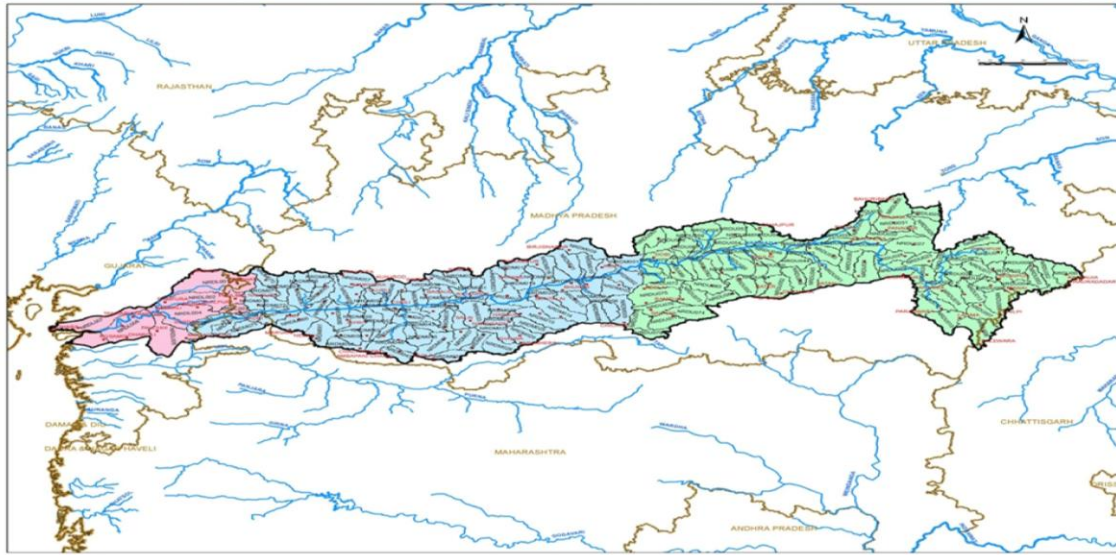
# Narmada River

- Narmada is the largest west flowing river of the peninsular India.
- Narmada flows westwards through a **rift valley** between the Vindhyan Range on the north and the Satpura Range on the south.
- It rises from **Maikala range near Amarkantak** in **Madhya Pradesh**, at an elevation of about 1057 m.
- Narmada basin extends over states of Madhya Pradesh, Gujarat, Maharashtra and Chhattisgarh having an area ~1 Lakh Sq.km.
- It is bounded by the Vindhyas on the north, Maikala range on the east, Satpuras on the south and by the Arabian Sea on the west.
- Its total length from its source in **Amarkantak** to its estuary in the **Gulf of Khambhat** is 1,310 km.
- The hilly regions are in the upper part of the basin, and lower middle reaches are broad and fertile areas well suited for cultivation.
- **Jabalpur** is the only important urban centre in the basin.
- The river slopes down near Jabalpur where it cascades (a small waterfall, especially one in a series) 15 m into a gorge to form the ***Dhuan Dhar (Cloud of Mist) Falls***.
- Since the gorge is composed of marble, it is popularly known as the Marble Rocks.
- It makes two waterfalls of 12 m each at Mandhar and Dardi. Near Maheshwar the river again descends from another small fall of 8 m, known as the **Sahasradhara Falls**.
- There are several islands in the estuary of the Narmada of which **Aliabet** is the largest.
- The Narmada is navigable upto 112 km from its mouth.

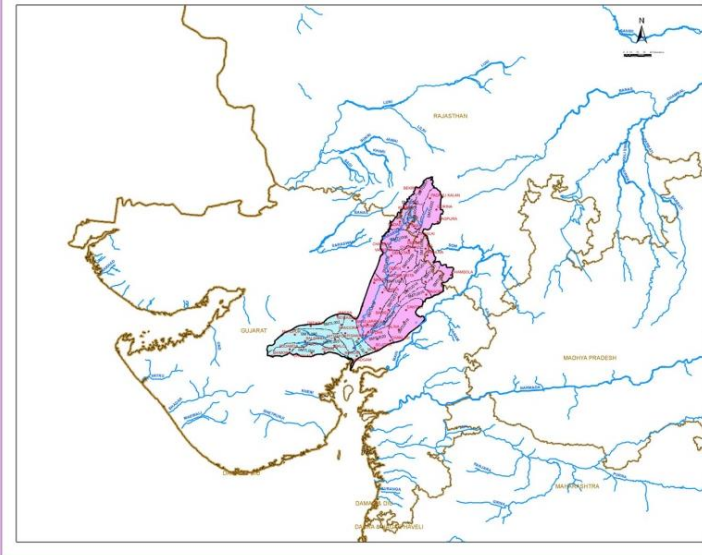
## Tributaries of Narmada River

- Since the river flows through a narrow valley confined by precipitous (dangerously high or steep) hills, it does not have many tributaries.
- The absence of tributaries is especially noted on the right bank of the river where the **Hiran** is the only exception.
- The other right bank tributaries are the **Orsang, the Barna and the Kolar**.
- A few left bank tributaries drain the northern slopes of the Satpura Range and join the Narmada at different places.
- The major Hydro Power Project in the basin are **Indira Sagar, Sardar Sarovar, Omkareshwar, Bargi & Maheshwar**.

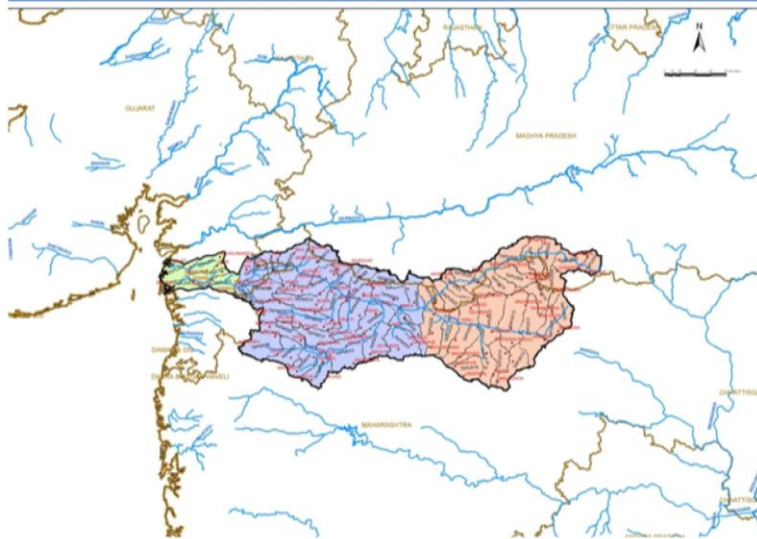
## NARMADA BASIN



## SABARMATI BASIN



## TAPI BASIN



## LUNI BASIN





# Tapti River

- The Tapti (also known as the Tapi) is the second largest west flowing river of the Peninsular India and is known as 'the twin' or 'the handmaid' of the Narmada.
- It originates near **Multai reserve forest in Madhya Pradesh** at an elevation of 752 m.
- Flows for about 724 km before outfalling into the Arabian Sea through the **Gulf of Cambay [Gulf of Khambhat]**.
- The Tapti River along with its tributaries flows over the plains of **Vidharbha, Khandesh** and Gujarat and over large areas in the state of Maharashtra and a small area in Madhya Pradesh and Gujarat.
- The basin extends over states of Madhya Pradesh, Maharashtra and Gujarat having an area of ~ 65,000 Sq.km
- Situated in the Deccan plateau, the basin is bounded by the **Satpura range** on the north, **Mahadev hills** on the east, **Ajanta Range** and the **Satmala hills** on the south and by the Arabian Sea on the west.
- The hilly region of the basin is well forested while the plains are broad and fertile areas suitable for cultivation.
- There are two well defined physical regions, in the basin, viz hilly region and plains; the hilly regions comprising **Satpura, Satmalas, Mahadeo, Ajanta and Gawilgarh hills** are well forested.
- The plain covers the **Khandesh areas** (Khandesh is a region of central India, which forms the northwestern portion of Maharashtra state) which are broad and fertile suitable for cultivation primarily.

## Tributaries of Tapti River

- **Right Bank:** the **Suki**, the **Gomai**, the **Arunavati** and the **Aner**.
- **Left Bank:** the **Vaghur**, the **Amravati**, the **Buray**, the **Panjhra**, the **Bori**, the **Girna**, the **Purna**, the **Mona** and the **Sipna**.

## Projects on Tapti River

- Hathnur Dam of Upper Tapi Project (Maharashtra)
- Kakrapar weir and Ukai Dam of Ukai Project (Gujarat)
- Girna Dam and Dahigam Weir of Girna Project (Maharashtra)

# Sabarmati River


- The Sabarmati is the name given to the combined streams the **Sabar** and **Hathmati**.
- The Sabarmati basin extends over states of Rajasthan and Gujarat having an area of 21,674 Sq km.
- The basin is bounded by **Aravalli hills** on the north and north-east, by Rann of Kutch on the west and by Gulf of Khambhat on the south.
- The basin is roughly triangular in shape with the Sabarmati River as the base and the source of the **Vatrak River** as the apex point.
- Sabarmati originates from **Aravalli hills** at an elevation of 762 m near village Tepur, in **Udaipur district of Rajasthan**.
- The total length of river from origin to outfall into the Arabian Sea is 371 km.
- The major part of basin is covered with agriculture accounting to 74.68% of the total area.
- Rainfall varies from a meager few mm in Saurashtra to over 1000 mm in southern part.
- Left bank tributaries: the Wakal, the Hathmati and the Vatrak.
- Right bank tributaries: the Sei.
- Projects: Sabarmati reservoir (Dharoi), Hathmati reservoir and Meshwo reservoir project are major projects completed during the plan period.



## Mahi River

- The Mahi basin extends over states of Madhya Pradesh, Rajasthan and Gujarat having total area of 34,842 Sq km.
- It is bounded by **Aravalli hills** on the north and the north-west, by **Malwa Plateau** on the east, by the **Vindhya**s on the south and by the Gulf of Khambhat on the west.
- Mahi is one of the major interstate west flowing rivers of India.
- It originates from the northern slopes of Vindhya at an altitude of 500 m in **Dhar district of Madhya Pradesh**.
- The total length of Mahi is 583 km.
- It drains into the Arabian Sea through the Gulf of Khambhat.
- The major part of basin is covered with agricultural land accounting to 63.63% of the total area
- Hydro Power stations are located in Mahi Bajaj Sagar dam and at Kadana Dam.
- **Vadodara** is the only important urban centre in the basin. There are not many industries in the basin.
- Some of the industries are cotton textile, paper, newsprint, drugs and pharmaceuticals. Most of these industries are located at **Tatlam**.

## Luni River

- The Luni or the **Salt River** (Lonari or Lavanavari in Sanskrit) is named so because its water is brackish below Balotra.
  - Luni is the only river basin of any significance in Western Rajasthan, which form the bulk of arid zone.
  - Luni originates from western slopes of the **Aravalli ranges** at an elevation of 772 m near **Ajmer** flowing in South West direction and traversing a course of 511 km in Rajasthan, it finally flow into the **Rann of Kachchh** (it gets lost in the marsh).
  - Most of its tributaries drain the steep north west of Aravalli hills and join it on left side. Its total catchment area falls in Rajasthan.
  - The peculiarity of this river is that it **tends to increase its width** rather than deepening the bed because the banks are of soils, which are easily erodible whereas beds are of sand. The floods develop and disappear so rapidly that they have no time to scour the bed.
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## The *Ghaggar*

- Some rivers of India are not able to reach the sea and constitute inland drainage.
- Large parts of the **Rajasthan desert** and parts of **Aksai Chin** in **Ladakh** have inland drainage.
- The ***Ghaggar*** is the most important river of inland drainage. It is a seasonal stream which rises on the lower slopes of the Himalayas and forms boundary between **Haryana and Punjab**.
- It gets lost in the dry sands of Rajasthan near Hanumangarh after traversing a distance of 465 km.
- Earlier, this river was an affluent of the Indus, the dry bed of the old channel is still traceable.
- Its main tributaries are the Tangri, the Markanda, the **Saraswati** and the Chaitanya.
- It contains a lot more water in rainy season when its bed becomes 10 km wide at places.
- Most of the streams draining western slopes of the Aravalli Range dry up immediately after they enter the sandy arid areas to the west of this range.



## West flowing Rivers of the Western Ghats

- About six hundred small streams originate from the Western Ghats and flow westwards to fall into the Arabian Sea.
- The western slopes of the Western Ghats receive heavy rainfall from the south-west monsoons and are able to feed such a large number of streams.
- Although only about 3% of the areal extent flow swiftly down the steep slope and some of them make waterfalls.
- The **Jog or Gersoppa Falls** (289 m) made by the **Sharavati river** is the most famous waterfall of India.

## Conclusion

- The large geographic span of India has a variety of rain-fed and mountain glacier fed rivers, that have sustained the ancient civilization of India, and still today continued to provide livelihood and sustenance for the large population of the nation.
- The rivers of India, apart from their utility, are a rich storehouse of natural beauty, and have a long and ancient history of mythological and historical treasures.
- The global environmental problems of the 21st century will also have their impact on the rivers of India.
- Some major problems are River Water Pollution, Shrinking of Glaciers, River erosion, Shrinking & Shifting of course or streams, Depletion in river ecology etc.
- By respecting these treasures of India, both for their history as well as for the precious natural resource of water, these rivers will sustain our country for many centuries to come.

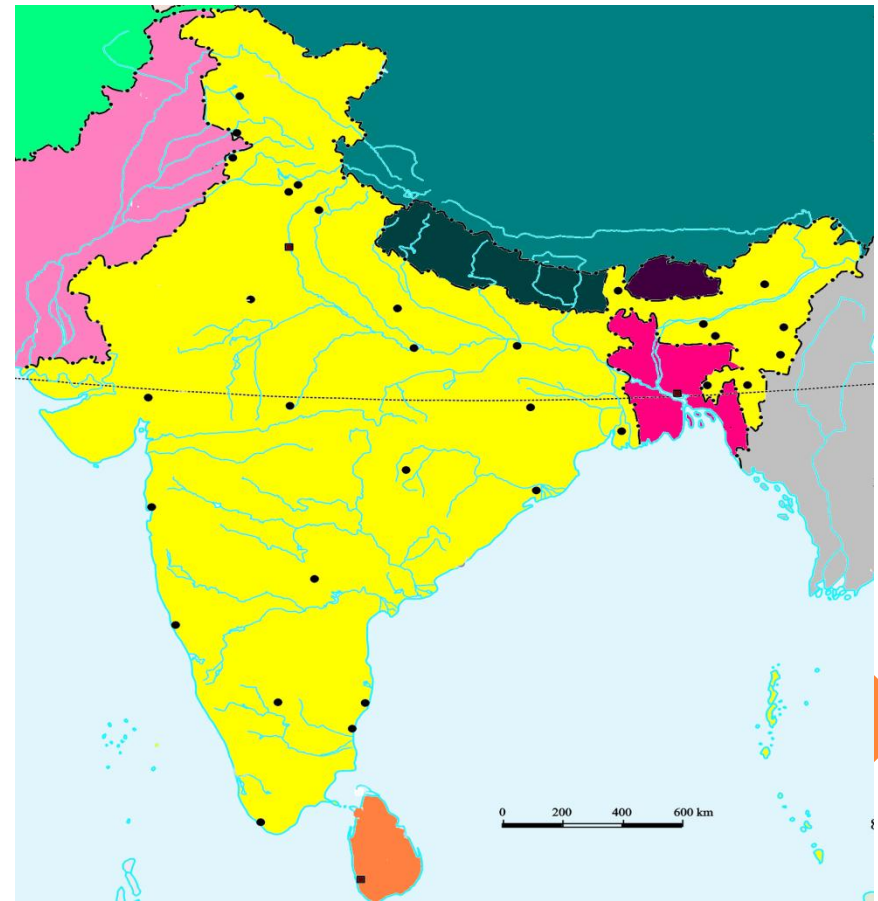
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# Question Questions for Exams & Assignments

1. What is Drainage System? Discuss briefly the major drainage systems of India.
2. How Peninsular Rivers are different from Himalayan Region?
3. Examine the Characteristics of Peninsular or Himalayan River system? Illustrate through Maps.
4. What is drainage pattern? Discuss the major drainage patterns found in India with illustrations.
5. Delimitate Major River Basins of the India in Given Maps?
6. Identify Major Rivers of the India in Given Maps?



Thank you

