

CHAPTER 3: DRAINAGE

PREMIUM EXAM-ORIENTED STUDY NOTES • CLASS 9 GEOGRAPHY

SECTION 1: Chapter Introduction

The term **drainage** describes the river system of an area. India's physical features have naturally shaped a vast web of large and small river channels across the subcontinent. Rivers have been the lifelines of human settlements since ancient times; they provide water essential for life, sustain agricultural lands, act as natural transportation channels, and drive industrial and socio-economic growth. This chapter covers the classification of Indian river systems into Himalayan and Peninsular networks, details their evolutionary patterns, examines the role of lakes, and addresses the critical challenges of river pollution and resource conservation.

SECTION 2: Detailed Explanation of Concepts

- **Drainage Basin:** The total geographic area drained by a single, integrated river system is called its drainage basin. For example, the Amazon Basin is the largest globally, while the Ganga Basin is the largest in India.
- **Water Divide:** Any elevated landform, such as an upland, mountain range, or plateau, that separates two adjacent drainage basins is known as a water divide. A prominent example is the elevated terrain between the Indus and Ganga river systems near Ambala.
- **River System:** A primary river along with all its active tributaries and network extensions forms a complete river system.
- **Tributary:** A smaller stream or river that flows into and joins a larger primary river, increasing its total volume (e.g., Yamuna is a tributary of Ganga).
- **Distributary:** A channel that branches off from the main river near its mouth and flows away, typically occurring in deltas due to heavy silt deposition blocking the primary channel (e.g., Bhagirathi-Hooghly is a distributary of Ganga).
- **Catchment Area:** The specific area from which rainfall and surface runoff collection feeds into a river or its tributaries.
- **Drainage Patterns:** The distinct geometric arrangements formed by streams within a basin, heavily controlled by slope, rock structures, and climate:
 - **Dendritic Pattern:** Resembles the branches of a tree; develops where the river channel follows the slope of the terrain (e.g., Ganga plains).
 - **Trellis Pattern:** Formed when primary tributaries flow parallel to each other and secondary streams join them at right angles; common where hard and soft rocks lie parallel (e.g., Himalayan foothills).

- **Rectangular Pattern:** Characterized by sharp, right-angled bends; develops on strongly jointed rocky terrains.
- **Radial Pattern:** Develops when streams flow outward in different directions from a central peak or dome-like structure (e.g., rivers originating from Amarkantak Hills).

SECTION 3: Drainage Systems of India

Indian rivers are divided into two primary groups based on their physiological point of origin:

A. Himalayan River System

These rivers are **perennial** because they receive water from rainfall as well as from melting glaciers located on high mountain peaks. They have long courses and perform intensive erosional activity in their upper courses, carrying massive loads of silt and sand.

• 1. Indus River System:

- *Origin:* Rises in Tibet, near Lake Mansarowar. It flows west and enters India in the Ladakh district.
- *Major Tributaries:* Zaskar, Nubra, Shyok, and Hunza in Kashmir. In Punjab, the five main rivers—Satluj, Beas, Ravi, Chenab, and Jhelum—merge together to join the Indus near Mithankot in Pakistan.
- *Coverage:* Ladakh (India), Jammu & Kashmir, Punjab, Himachal Pradesh, and Pakistan.
- *Important Features:* Total length is **2900 km**. It has a very gentle slope. Under the **Indus Water Treaty (1960)**, India can use only 20% of the total water carried by this river system.

• 2. Ganga River System:

- *Origin:* The headwaters, called the **Bhagirathi**, are fed by the Gangotri Glacier and join the **Alaknanda** at Devprayag in Uttarakhand to form the Ganga. It emerges from the mountains onto the plains at Haridwar.
- *Major Tributaries:* Right-bank: Yamuna (joins at Prayagraj), Son. Left-bank: Ghaghara, Gandak, Kosi.
- *Coverage:* Uttarakhand, Uttar Pradesh, Bihar, West Bengal, and Bangladesh.
- *Important Features:* Total length is over **2500 km**. At Farakka in West Bengal, it splits into its distributary, the Bhagirathi-Hooghly, and the main branch which enters Bangladesh as the Padma. Joined by the Brahmaputra, it forms the **Sundarbans Delta**, the largest and fastest-growing delta in the world.

• 3. Brahmaputra River System:

- *Origin:* Rises in Tibet, east of Lake Mansarowar, very close to the sources of the Indus and Satluj.
- *Major Tributaries:* Dibang, Lohit, Kenula.
- *Coverage:* Tibet (China), Arunachal Pradesh, Assam, and Bangladesh.
- *Important Features:* Known as **Tsangpo** in Tibet, where it carries a smaller volume of water and less silt due to a cold and dry climate. It takes a sharp 'U-turn' at Namcha Barwa (**7757 m**) to enter India via Arunachal Pradesh as the Dihang. In Assam, it experiences high rainfall, carrying massive volumes of water and silt, leading to frequent floods and forming the world's largest riverine island, **Majuli**.

B. Peninsular River System

These rivers are predominantly **seasonal** as their flow is entirely dependent on rainfall. They have shorter and shallower courses compared to Himalayan rivers.

- **1. Narmada Basin:** Originates in the Amarkantak hills in Madhya Pradesh. Flows westwards in a rift valley formed by faulting. Notable features include the 'Marble Rocks' near Jabalpur and the 'Dhuadhar Falls'. Length is approx. **1312 ext{ km}** . Covers MP and Gujarat.
- **2. Tapi Basin:** Originates in the Satpura ranges, in the Betul district of Madhya Pradesh. It flows parallel to the Narmada in a rift valley but is much shorter. Covers MP, Maharashtra, and Gujarat.
- **3. Godavari Basin:** The largest Peninsular river, also known as the **Dakshin Ganga**. Originates from the slopes of the Western Ghats in the Nashik district of Maharashtra. Length is **1500 ext{ km}** . Tributaries include Purna, Wardha, Pranhita, Manjra, Wainganga, and Penganga. Covers Maharashtra, MP, Odisha, and Andhra Pradesh.
- **4. Mahanadi Basin:** Rises in the highlands of Chhattisgarh and flows through Odisha to reach the Bay of Bengal. Length is **860 ext{ km}** . Covers Chhattisgarh, Jharkhand, Maharashtra, and Odisha.
- **5. Krishna Basin:** Rising from a spring near Mahabaleshwar, it flows eastwards to the Bay of Bengal. Length is **1400 ext{ km}** . Tributaries include Tungabhadra, Koyana, Ghatprabha, Musi, and Bhima. Covers Maharashtra, Karnataka, and Andhra Pradesh.
- **6. Kaveri Basin:** Rises in the Brahmagiri range of the Western Ghats and reaches the Bay of Bengal south of Cuddalore in Tamil Nadu. Length is **760 ext{ km}** . Tributaries are Amravati, Bhavani, Hemavati, and Kabini. Covers Karnataka, Kerala, and Tamil Nadu.

SECTION 4: Lakes of India

Lakes vary greatly in size and characteristics. They help regulate river water flow, prevent flooding during heavy rains, maintain water supply during dry periods, generate hydel power, and promote eco-tourism.

- **Freshwater Lakes:** Mostly located in the Himalayan region; formed by glacial action. The **Wular Lake** in Jammu & Kashmir is the largest freshwater lake in India, formed by tectonic activity. Other examples include Dal Lake, Bhimtal, Nainital, Loktak, and Barapani.
- **Saltwater Lakes:** Mostly found in arid regions or coastal areas. The **Sambhar Lake** in Rajasthan is an inland saltwater lake used for manufacturing salt. Coastal saltwater bodies formed by spits and bars are called lagoons, such as **Chilika Lake** (largest saltwater lake in India, Odisha), Pulicat Lake, and Kolleru Lake.
- **Artificial/Man-made Lakes:** Created by damming rivers for hydel power generation. Examples include **Guru Gobind Sagar** (Bhakra Nangal Project), Rana Pratap Sagar, and Nagarjuna Sagar.

SECTION 5: Role of Rivers in the Economy

- **Agriculture:** River water is a primary source of canal and lift irrigation, turning arid lands into fertile food bowls.

- **Hydroelectric Power:** Fast-flowing rivers are dammed to generate clean energy (e.g., Bhakra-Nangal and Hirakud dams).
- **Transportation & Inland Navigation:** Rivers act as commercial highways for carrying heavy goods inland.
- **Socio-Economic Development:** Rivers sustain domestic tourism, support massive commercial fisheries, and fulfill daily industrial and drinking water needs.

SECTION 6: River Pollution

- **Causes:** Heavy dumping of untreated domestic sewage, toxic industrial effluents, and agricultural runoff containing chemical fertilizers and pesticides.
- **Consequences:** Severe depletion of dissolved oxygen, destruction of aquatic ecosystems, and loss of the river's natural self-purification capacity.
- **Conservation Efforts:** Action plans like the **National River Conservation Plan (NRCP)** and Ganga Action Plan (GAP) focus on setting up sewage treatment plants and monitoring water quality closely.

SECTION 7: Important Terms & Definitions

- **Meander:** A sharp, loop-like bend or curve formed by a river in its middle or lower course due to continuous lateral erosion and deposition.
- **Oxbow Lake:** A crescent-shaped lake formed when a cutting meander loop gets completely cut off from the main river channel over time.
- **Delta:** A triangular feature formed at the mouth of a river where it enters a sea or ocean, composed of heavily deposited fine sediment splits.
- **Estuary:** A semi-enclosed coastal body of water where fresh water from rivers meets and mixes directly with open saltwater from the sea without forming a delta (e.g., formed by Narmada and Tapi).

SECTION 8: NCERT Key Points

NCERT HIGH-YIELD DATA

- The world's largest drainage basin belongs to the **Amazon River**.
- The **Sundarbans Delta** derives its unique name from the 'Sundari' tree, which grows abundantly in its marshy mangrove waters. It is also the home of the Royal Bengal Tiger.
- Westward-flowing peninsular rivers like Narmada and Tapi do not form deltas; instead, they flow through steep channels to form clear **estuaries**.
- The main water divide in Peninsular India is formed by the continuous line of the **Western Ghats** from north to south.

SECTION 9: Tables & Flowcharts

Table 9.1: Comparison Between Himalayan and Peninsular Rivers

FEATURE	HIMALAYAN RIVERS	PENINSULAR RIVERS
Nature of Flow	Perennial (Fed by glaciers and rain)	Seasonal (Dependent purely on monsoon rain)
Origin	Lofty Himalayan Mountains	Peninsular Plateaus and Western Ghats
Course Length	Long courses; perform intensive deep valley erosion	Shorter, shallower, and relatively stable courses
Landforms Formed	Gorges, Meanders, Oxbow lakes, large Deltas	Estuaries or relatively smaller Deltas

Table 9.2: Summary of Major Indian Rivers

RIVER	ORIGIN LOCATION	LENGTH	KEY DRAINAGE STATES
Indus	Near Mansarowar Lake (Tibet)	2900 km	Ladakh, J&K, Punjab (India/Pak)
Ganga	Gangotri Glacier (Uttarakhand)	2500+ km	Uttarakhand, UP, Bihar, West Bengal
Brahmaputra	East of Mansarowar Lake	2900 km	Arunachal Pradesh, Assam
Godavari	Nashik District (Maharashtra)	1500 km	Maharashtra, AP, Telangana, Odisha
Krishna	Near Mahabaleshwar (Western Ghats)	1400 km	Maharashtra, Karnataka, AP
Narmada	Amarkantak Hills (MP)	1312 km	Madhya Pradesh, Gujarat

SECTION 10: Maps & Diagram Notes

Focus heavily on locating these precise items on the outline map of India for examination:

- **River Courses:** Track Indus entering Ladakh, Ganga flowing through the plains to Farakka, and Brahmaputra's loop at Namcha Barwa.

- **Peninsular Layouts:** Draw Narmada and Tapi flowing left into the Arabian Sea; Godavari, Mahanadi, Krishna, and Kaveri flowing right into the Bay of Bengal.
- **Lakes Location:**
 - *Wular Lake:* Northernmost J&K tip.
 - *Sambhar Lake:* Central Rajasthan pocket.
 - *Chilika Lake:* Distinct bird-beak shaped lagoon indentation on the Odisha coast.
 - *Pulicat Lake:* Border boundary point of Andhra Pradesh and Tamil Nadu.

SECTION 11: How to Remember This Chapter Quickly (Memory Tricks)

A. MNEMONIC FOR LEFT-BANK TRIBUTARIES OF GANGA

Use the acronym: "**3G-K-M**"

Ghaghara, Gandak, Gomti, Kosi, Mahananda.

B. MNEMONIC FOR EAST-FLOWING PENINSULAR RIVERS (NORTH TO SOUTH)

Use the sentence phrase: "**Mahanadi God Krishna Kaa hai**"

Mahanadi → Godavari → Krishna → Kaveri.

SECTION 12: Common Mistakes Students Make

1. Confusing Tributaries with Distributaries

Mistake Listing the Hooghly River as a tributary of the Ganga.

Correction Hooghly does not bring water to the Ganga; it branches out from the main river near Farakka to drain independently into the sea, making it a **distributary**.

2. Swapping the Flow Directions of Narmada/Tapi and Godavari/Krishna

Mistake Showing Narmada draining into the Bay of Bengal on a map.

Correction Narmada and Tapi are west-flowing rivers that drain into the **Arabian Sea** via rift valleys. Godavari, Mahanadi, Krishna, and Kaveri flow east into the **Bay of Bengal**.

SECTION 13: Quick Revision Notes

- **Water Divide:** Elevational upland separating two basins (e.g., Ambala plain).
- **Sundarbans:** Largest growing delta formed by Ganga-Brahmaputra confluence.
- **Dakshin Ganga:** Epithet given to Godavari due to its vast size and basin extent.
- **Tectonic Origin Lake:** Wular Lake in J&K; largest freshwater body in India.

SECTION 14: One-Page Summary

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|                CHAPTER 3: DRAINAGE |
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| BASIN DEFINITIONS:                |
|   - Drainage Basin: Area drained by a single river system. |
|   - Water Divide: Mountain or upland separating two adjacent drainage areas. |
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| RIVER COMPARISON:                |
|   - Himalayan: Perennial, high erosion, make gorges, deltas (Indus, Ganga, Brah) |
|   - Peninsular: Seasonal, rain-fed, stable courses (Narmada, Tapi, Godavari) |
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| WEST VS EAST FLOW:                |
|   - West Flowing: Narmada, Tapi -> Form Estuaries into Arabian Sea. |
|   - East Flowing: Godavari, Krishna, Mahanadi, Kaveri -> Form Deltas in BoB. |
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| IMPORTANT LAKES TO MEMORIZE:      |
|   - Freshwater: Wular (Tectonic), Dal, Nainital, Bhimtal. |
|   - Saltwater / Lagoon: Sambhar (Salt-source), Chilika, Pulicat. |
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SECTION 15: Mind Map

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          |                                     |
[HIMALAYAN RIVERS]                                [PENINSULAR RIVERS]
          |                                     |
          |-- Indus (Mansarowar -> Arabian Sea) | |-- West-Flowing
(Estuaries)                                     |
          |-- Ganga (Gangotri -> Sundarbans Delta) | |-- Narmada & Tapi
          |-- Brahmaputra (Tsangpo -> Majuli Island) | |-- East-Flowing
(Deltas)                                         |
                                                |-- Godavari
(Dakshin Ganga)
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SECTION 16: Exam Tips

- **Map Precision:** Always plot Chilika lake with a clean dot right above the coastal curve of Odisha to gain full marks.
- **Length Metrics:** Remember that Indus (2900 km) and Brahmaputra (2900 km) are longer than Ganga (2500 km), but Ganga forms the longest run course *within* political Indian borders.