

## 1. Water Resources of India: Availability and Distribution

India receives nearly **4,000 cubic km of precipitation** annually from various sources . However, the total available surface water and replenishable groundwater is estimated at only **1,869 cubic km** .

Due to topographical, hydrological, and other constraints, only about **60 per cent (1,122 cubic km)** of this available water can actually be put to beneficial use .

### I. Surface Water Resources

Surface water exists in four primary sources: **rivers, lakes, ponds, and tanks** .

- **River Systems:** There are approximately 10,360 rivers and their tributaries in India, each longer than 1.6 km .
- **Catchment Potential:** The mean annual flow in all the river basins in India is estimated to be 1,869 cubic km . However, the distribution is highly uneven.
- **Regional Variation:** The **Ganga, Brahmaputra, and Indus** basins, which account for about one-third of the total catchment area, contain **60 per cent** of India's total surface water resources .
- **Utilization Constraints:** In many Peninsular rivers like the Godavari, Krishna, and Kaveri, a much larger proportion of the water potential has been utilized compared to the Himalayan rivers, which still have vast untapped potential .

### II. Groundwater Resources

The total replenishable groundwater resource in the country is about **432 cubic km** .

- **Distribution:** The **Ganga and Brahmaputra basins** have about 46 per cent of the total replenishable groundwater resources .
- **Utilization Levels:** The level of groundwater utilization is relatively high in the river basins of north-western India (Punjab, Haryana, Rajasthan) and parts of South India (Tamil Nadu) .
- **State-wise Trends:** States like **Punjab, Haryana, and Rajasthan** utilize a very high proportion of their groundwater, primarily for agriculture . Conversely, states like Chhattisgarh, Odisha, and Kerala utilize only a small fraction of their potential . If the current trend of high withdrawal continues, it will lead to severe water scarcity and environmental issues in high-utilization states .

### III. Lagoons and Backwaters

India has a long coastline and a very indented coast in some states, leading to the formation of many lagoons and lakes .

- **States:** These are most prominent in **Kerala, Odisha, and West Bengal** .
- **Usage:** While these water bodies are generally brackish (salty), they are vital for fishing and irrigating certain varieties of paddy crops and coconut trees .

## 2. Water Demand and Utilization

India has traditionally been an agrarian economy, and about two-thirds of its population has been dependent on agriculture . Consequently, development goals post-Independence focused on expanding irrigation to ensure food security .

### I. Sectoral Consumption

- **Agriculture:** This is the dominant user of water in India. It accounts for **89 per cent** of

surface water and 92 per cent of groundwater utilization .

- **Industrial and Domestic:** Currently, these sectors account for a small share (9% surface/5% ground for domestic; 2% surface/3% ground for industries) . However, as the country industrializes and urbanizes, their share of water demand is projected to rise significantly .



## II. Demand for Irrigation

Irrigation is essential in India due to the **spatio-temporal variability of rainfall** .

- **Need:** Large parts of the country are deficient in rainfall and drought-prone (e.g., North-western India and the Deccan Plateau) . Even in high-rainfall areas like West Bengal and Bihar, breaks in the monsoon or its early retreat can be detrimental to crops .
- **Green Revolution Support:** The success of the Green Revolution in Punjab, Haryana, and Western Uttar Pradesh was entirely dependent on the expansion of irrigation .

- **Multi-cropping:** Irrigation has made it possible to grow multiple crops in a year. In West Bengal and Bihar, farmers grow three crops of rice—**aus, aman, and boro**—in a single year provided irrigation is available .

## 3. Emerging Water Problems

The increasing demand for water, coupled with a growing population and deteriorating quality, has created a multifaceted crisis .

### I. Deterioration of Water Quality

Water quality refers to the purity of water or water without unwanted foreign substances . Water becomes "polluted" when its concentration of suspended particles and organic/inorganic substances increases to the point where its self-purifying capacity is exceeded .

#### • Sources of Pollution:

- **Industrial Effluents:** Discharge of toxic chemical residuals, heavy metals, and dust from industries like leather, pulp, and chemicals .
- **Agricultural Runoff:** Modern agriculture uses vast amounts of inorganic fertilizers, pesticides, and herbicides, which wash into rivers and lakes .
- **Domestic Sewage:** Untreated waste from urban centers is often dumped directly into water bodies .

- **Highly Polluted Rivers:** The **Yamuna** is the most polluted river in India between Delhi and Etawah . The **Ganga** faces severe pollution at Kanpur and Varanasi .

### II. Scarcity and Depletion

Over-extraction of groundwater has led to a falling water table in many states .

- **Chemical Contamination:** Depletion has increased the concentration of toxic substances. For example, over-withdrawal

has led to high **fluoride** levels in parts of Rajasthan and Maharashtra, and **arsenic** contamination in West Bengal and Bihar .

- **Per Capita Availability:** Due to population growth, the per capita availability of water is declining steadily .

- **Neeru-Meeru:** (Water and You) program in Andhra Pradesh .
- **Arvary Pani Sansad:** (Alwar, Rajasthan) involved the construction of various water-harvesting structures like *johads* and check dams .

## 4. Water Conservation and Management

Given that the supply of fresh water is limited and the demand is increasing, there is an urgent need for conservation .

### I. Prevention of Pollution

Strict enforcement of environmental laws like the **Water (Prevention and Control of Pollution) Act 1974** is necessary . However, effective implementation remains a challenge. Public awareness and community participation are critical for reducing ritualistic and domestic pollution in rivers .

### II. Recycle and Reuse

Encouraging the use of low-quality water for purposes other than drinking can save vast amounts of fresh water .

- **Examples:** Using reclaimed wastewater for cooling in thermal power plants, fire-fighting, or gardening .

### III. Watershed Management

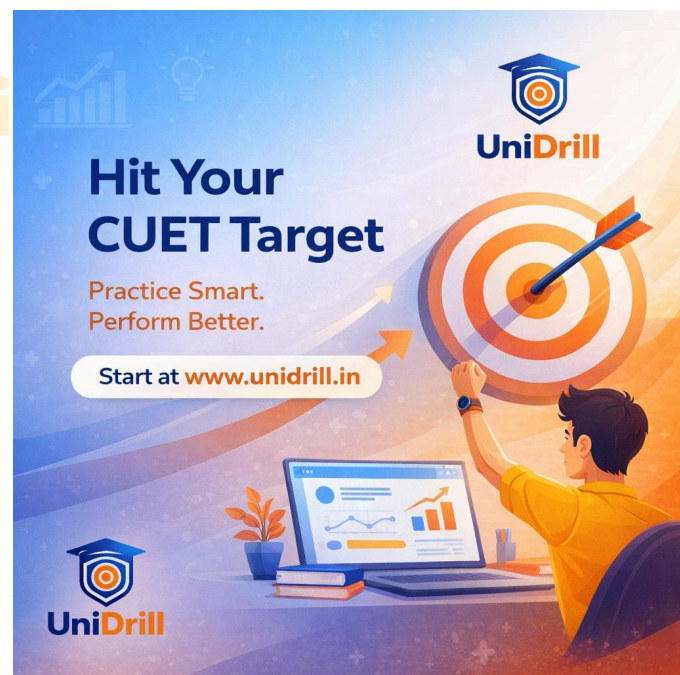
Watershed management involves the efficient management and conservation of all natural resources—land, water, plants, and animals—within a single hydrological unit (watershed) .

- **Objective:** To bring about a balance between natural resources on one hand and society on the other .
- **Key Programs:**
  - **Haryali:** A central government-sponsored project executed by Gram Panchayats with people's participation .

### IV. Rainwater Harvesting

Rainwater harvesting is a method to capture and store rainwater for various uses and to recharge groundwater aquifers .

- **Benefits:** It is low-cost and eco-friendly; it stops soil erosion, improves water quality (by diluting pollutants like fluoride), and provides water security during dry seasons .
- **Traditional Methods:** Include storage in tanks (*tanka* or *kund*) in Rajasthan .
- **Modern Compulsion:** **Tamil Nadu** is the first state in India to make rooftop rainwater harvesting structures compulsory for all buildings .



### V. National Water Policy 2012

The policy emphasizes the following priorities:

- Treating water as an **economic good** to promote conservation .
- Providing potable water to all human beings and livestock .

- Promoting community-based management of water resources .
- Prioritizing **social equity** and integrated water resource management .

## 5. Case Study: Success in Water Management

### Ralegan Siddhi (Ahmadnagar, Maharashtra):

This village provides a classic example of transformation through watershed development .

- **The Problem:** The village suffered from extreme poverty, illegal liquor trade, and severe water scarcity .
- **The Solution:** Led by Anna Hazare, the community built **percolation tanks** and check dams to trap every drop of rain .
- **Outcome:** The groundwater level rose significantly, allowing for multiple crops and the cultivation of diverse vegetables . The village became self-sufficient, and social evils like untouchability and alcoholism were eradicated through collective community action .

<b>Largest Water Consumer</b>	Agriculture (89% of surface water)
<b>Most Polluted River</b>	Yamuna (Delhi to Etawah stretch)
<b>Tamil Nadu Rule</b>	Compulsory rooftop rainwater harvesting
<b>Watershed Successes</b>	Neeru-Meeru (AP) and Arvary Pani Sansad (Rajasthan)
<b>Main Groundwater Use</b>	Irrigation for HYV crops (Green Revolution)

### Summary Table for CUET Aspirants

Concept	Key Fact
<b>Total Utilisable Water</b>	1,122 cubic km
<b>Groundwater Potential</b>	432 cubic km