

- Water Scarcity and Water Conservation
- Ancient Hydraulic Structures
- Multipurpose River Projects
- Rainwater Harvesting
- Solved Examples
- Practice Set
- Answer Key
- Quick Reference
- Glossary

## Water Scarcity and Water Conservation

---

Water is an essential resource for human survival, ecosystems, agriculture, industry, and domestic use. Although three-fourths of the Earth's surface is covered with water, only a small fraction is freshwater available for use. Freshwater is mainly obtained from surface runoff and groundwater, which are replenished through the hydrological cycle.

**Water Scarcity** occurs when the demand for water exceeds its availability. Causes include over-exploitation, unequal access among social groups, population growth, industrialization, and urbanization. Even regions with ample water resources can face scarcity due to these factors.

Water scarcity impacts agriculture, lowers groundwater levels, and can lead to conflicts over water sharing. In urban areas, excessive groundwater pumping by housing societies further depletes water resources.

### Exam Questions

**Q1:** What are the main causes of water scarcity in India?

**A1:** The main causes include over-exploitation of water resources, unequal access among social groups, increasing population, industrialization, urbanization, and excessive groundwater pumping.

**Q2:** Why is water conservation important?

**A2:** Water conservation is important to manage limited freshwater resources sustainably, ensure availability for future generations, support agriculture and industry, and prevent conflicts over water.

## Ancient Hydraulic Structures

---

India has a rich history of sophisticated water management systems dating back centuries. Examples include:

- Sringeri near Allahabad had a water harvesting system channeling floodwaters of the Ganga River (1st century B.C.).
- Sudarshan Lake at Junagarh in Gujarat, an important ancient lake.
- Bhopal Lake, one of the largest artificial lakes built in the 11th century A.D.
- The tank in Hauz Khas, Delhi, constructed in the 14th century by Iltutmish to supply water to the Siri Fort area.

## Exam Questions

**Q1:** Name two ancient hydraulic structures in India and their significance.

**A1:** Sringeri's water harvesting system managed floodwaters of the Ganga River, and Bhopal Lake is a large artificial lake built for water storage and supply.

# Multipurpose River Projects

---

**Dams** are barriers built across rivers to control water flow, creating reservoirs used for irrigation, electricity generation, water supply, flood control, and navigation. They are often called multipurpose projects due to their multiple uses.

Famous multipurpose projects in India include:

- Damodar Valley Corporation on the Damodar River (Jharkhand and West Bengal)
- Bhakra Nangal on the Sutlej River (Punjab, Haryana, Rajasthan, Himachal Pradesh)
- Hirakud on the Mahanadi River (Odisha)
- Kosi on the Kosi River (Bihar and Nepal)
- Chambal Valley on the Chambal River (Madhya Pradesh and Rajasthan)

**Advantages:** Support agriculture, generate electricity, control floods, and provide water for domestic and industrial use.

**Disadvantages:** Sedimentation, disruption of aquatic habitats, difficulty for aquatic fauna migration, submergence of vegetation and soil, displacement of local people, and social conflicts.

## Exam Questions

**Q1:** What are the benefits of multipurpose river projects?

**A1:** They provide irrigation water, generate electricity, control floods, supply water for domestic and industrial use, and support navigation and recreation.

**Q2:** Mention some environmental and social problems caused by multipurpose river projects.

**A2:** Problems include sedimentation, loss of aquatic habitats, difficulty for aquatic fauna migration, submergence of land and vegetation, displacement of people, and social disputes.

## Rainwater Harvesting

---

Rainwater harvesting is the collection and storage of rainwater for various uses. It is an environmentally friendly and socio-economically viable alternative to large multipurpose projects.

Traditional methods include diversion channels like 'guls' or 'kuls' in the Western Himalayas and underground tanks in arid regions like Rajasthan. Modern methods include rooftop rainwater harvesting systems that collect rainwater from roofs, filter it, and store it for use or groundwater recharge.

States like Tamil Nadu have made rooftop rainwater harvesting compulsory with legal provisions for enforcement. It is commonly practiced in regions like Rajasthan, Meghalaya, and Karnataka.

### Exam Questions

**Q1:** What is rainwater harvesting and why is it important?

**A1:** Rainwater harvesting is the process of collecting and storing rainwater for use. It helps conserve water, reduces dependence on groundwater, and supports sustainable water management.

**Q2:** Describe the rooftop rainwater harvesting process.

**A2:** Rainwater is collected from roofs using pipes, filtered through sand and bricks, stored in sumps, and excess water is directed to wells to recharge underground tanks.

## Solved Examples

---

**Example 1:** Explain the causes of water scarcity in urban areas.

**Solution:** Urban areas face water scarcity due to high population density, over-extraction of groundwater, industrial and domestic water demand, and inadequate water management.

**Example 2:** List two advantages and two disadvantages of multipurpose river projects.

**Solution:** Advantages: irrigation and electricity generation; Disadvantages: displacement of people and environmental degradation.

## Practice Set

---

### Easy

- What is the hydrological cycle?
- Name two ancient water harvesting structures in India.

### Moderate

- Explain the importance of dams in water resource management.
- Describe the process of rooftop rainwater harvesting.

### Challenging

- Discuss the environmental and social impacts of multipurpose river projects.
- Analyze the reasons for water scarcity despite abundant water resources in some regions.

## Answer Key

---

- **Hydrological cycle:** The continuous circulation of water in the Earth–Atmosphere system.
- **Ancient structures:** Sringaverapura water harvesting system, Bhopal Lake.
- **Dams:** Used for irrigation, electricity, flood control, water supply.
- **Rooftop rainwater harvesting:** Collecting rainwater from roofs, filtering, storing, and recharging groundwater.
- **Impacts of multipurpose projects:** Environmental degradation, displacement, sedimentation.
- **Water scarcity reasons:** Overuse, unequal access, population growth, urbanization.

## Quick Reference

---

- **Water Scarcity:** Insufficient water to meet demand due to overuse and unequal access.
- **Dams:** Barriers that create reservoirs for multiple uses.
- **Multipurpose Projects:** Large dams serving irrigation, power, flood control.
- **Rainwater Harvesting:** Collecting and storing rainwater for use.
- **Hydrological Cycle:** Continuous movement of water on Earth.

## Glossary

---

- **Hydrological Cycle:** The natural process of water circulation through evaporation, condensation, precipitation, and runoff.
- **Dam:** A structure built to block or control river flow, creating a reservoir.
- **Aquatic Fauna:** Animals living in water environments.
- **Multipurpose Project:** A dam or water project serving multiple functions like irrigation and power generation.

- **Rainwater Harvesting:** The collection and storage of rainwater for future use.
- **Surface Runoff:** Water flow over land into rivers and lakes.

Year	Event	Significance
1st century B.C.	Sringaverapura water harvesting system	Early example of floodwater management in India
11th century A.D.	Construction of Bhopal Lake	One of the largest artificial lakes for water storage
14th century	Tank in Hauz Khas, Delhi	Water supply system for Siri Fort area
Post-Independence	Development of multipurpose river projects	Boosted irrigation, power generation, and flood control
Modern Era	Implementation of rainwater harvesting	Alternative water conservation method