21/7/25
Monday

WATER RESOURCES

Page No.
Date

- 96.5% – oceans
  2.5% – freshwater
  - 70% – glaciers (Antarctica)
  - 30% – groundwater

- India – 4% of global precipitation
  - 133rd rank in water availability per person per annum
  - 1,897 sq. km: total water (renewable) resources present

- Water Scarcity – Shortage of water as compared to its demand

↓

- Reasons cities are facing water scarcity
  1. Growing population, increased demand
  2. Unequal access to water
  3. Large domestic usage
  4. Higher foodgrain production
  5. Expansion of irrigation for agriculture
  6. Low rainfall, seasonal variations

~~What's needed~~

  7. Urbanization and Industrialisation
  8. Lack of Planning
  9. Water pollution

What's needed?

- Conservation and management of water resources
- Safeguard measures (from health hazards)
- Food security
- Prevention of degradation
- Avoid over-exploitation and mismanagement

Date

Multi-Purpose River Projects and Integrated Water Resources Managements

»» Construction of hydraulic structures like dams (stone rubble), reservoirs, lakes, embankments and canals for irrigation is going since ancient times and continued even in modern India.

Hydraulic Structures in ancient India

1. 1st century BC – Sringaverapura near Allahbad had water harvesting system for river Ganga

2. Time of Chandragupta Maurya – dams, lakes and irrigation systems were built

3. Other evidences of sophisticated irrigation works
   - Kalinga (Odisha)
   - Nagarjunakonda (Andhra Pradesh)
   - Bennur (Karnataka)
   - Kohlapur (Maharashtra)

4. 11th century – One of the largest artificial lakes, Bhopal Lake, was built

5. 14th century – Tank in Hauz Khas, Delhi was constructed by Iltutmish for supplying water to Siri Fort area.

What are dams? → Reservoirs

»» A barrier across flowing water that obstructs, directs or retards the flow. There is a spillway or weir through which water flows.

Q How are dams used? / Role of multi-purpose projects

A vehicle that'd lead the nation to progress & development after Independence

1. Irrigation
2. Domestic and industrial uses
3. Hydro-electricity generation
4. Water conservation
5. Storage of water
6. Regulating flow of water
7. Flood control
8. Tourism and Recreation
9. Rural employment (construction)
10. Inland navigation
11. Fish breeding

Q Classification of DAMS

Structure & Material used	Height
↓	↓
Embankment dams	Low dams
Timber dams	Medium dams
Masonry dams	High dams

Example of Dams

1. Hirakud project - Mahanadi basin - water conservation, flood control

2. Bhakra-Nangal project - Sutluj-Beas basin - hydro-power generation, irrigation

Date

» Jawaharlal Nehru: Proclaimed dams as the 'temples of modern India'.
↓ Why?

» Dams would integrate development of agriculture and village economy
» Rapid industrialization and growth of urban economy.

↓

Irrigation
» changed cropping patterns
» farmers shifted to water-intensive and commercial crops
» Ecological consequences:
• e.g. - salinisation of soil
» Increased gap between rich and poor

~~Narmada- B~~

Disadvantages of dams
» Affect rivers' natural flow
» Causes poor sediment flow
» Excessive sedimentation at bottom of reservoir
» Poorer habitats for aquatic life
» Aquatic fauna cannot migrate (esp. for spawning)
» Submerge existing vegetation, leading to its decomposition
» Soil erosion

» Displacement of local communities
» Loss of land, livelihood, resources

Page No.
Date

Narmada Bachao Andolan / Save Narmada Movement

- NGO consisting tribal people, farmers, environmentalists and human rights activists
- Against the construction of Sardar Sarovar Dam across Narmada river (Gujarat).
- Initial focus - environmental issues
- Later - fighting for rights of displaced people and other people/things affected.

Sardar Sarovar Dam

- built over Narmada river in Gujarat
- Covers four states:
  - Maharashtra
  - Madhya Pradesh
  - Gujarat
  - Rajasthan
- Meet requirements of water in drought-prone, desert areas
- Provided irrigation facilities to 18.45 lakh hectare of land, covered:
  - 3112 villages } of Guj.
  - 15 districts }
- Irrigate 2,46,000 hectare of land in Barmer, Jalore (Rajasthan) and 37,500 hectare in tribal hilly tract of Maharashtra through lift
- 75% command area in Guj. and 100% command area in Rajasthan is drought-prone. ↓

  Water supply will make it drought proof

Page No.
Date

Sabarmati dispute

- Sabarmati basin farmers' riot : ↓ against
  - priority of water supply in urban areas
- Inter-state water disputes about :
  - Sharing costs and benefits of the project.

Krishna-Godavari dispute

- Objections raised by Karnataka & Andhra P. govt.
- Regarding diversion of more water at Koyna by Maharashtra govt.

↓

- Would reduce downstream flow in their states

↓

consequences to agriculture

Most objections' Reasons (common reasons why dams are objected) [can also be taken as disadvantages]

1. Failure to achieve purposes
2. Dams, made to control floods, actually triggered floods due to sedimentation in reservoirs
3. Big dams unsuccessful in controlling flood during heavy rain - Maharashtra & Gujarat 2006 loss of life, soil erosion
4. Due to sedimentation, floodplains deprived of silt → land degradation
5. Result in earthquakes, floods, etc.
6. Water-borne diseases and pests
7. Pollution with excessive water use

Pradhan Mantri Krishi Sinchaee Yojana

objectives

- access to protective irrigation (access to water).
- expand cultivable area under irrigation
- increase water use efficiency to avoid wastage
- Sustainable water conservation
- water saving irrigation technologies & • Rural prosperity

RAIN WATER HARVESTING

» Disadvantages and rising resistance against the multi-purpose projects.

» Water Harvesting System is a good alternative both socio-economically and environmentally.

» In ancient India, along with hydraulic structures, System of water harvesting also existed.

⇓

» People had in-depth Knowledge — rainfall regimes and soil types

⇓

» Developed various techniques to harvest rain-water, groundwater, river water, flood water while keeping with:
- local ecological conditions
- water needs

⇓

◉ Hilly regions
» Diversion channels like 'guls' or 'Kuls' of the Western Himalayas were built for agriculture.

◉ Rooftop Rainwater Harvesting
» Practiced in Rajasthan (particularly)
- store drinking water

◉ Bengal - Inundation channels for irrigation

◉ Arid, semi-arid regions — Agricultural fields were converted into rainfed storage structures that

allowed water to stand and moisten the soil.
- 'Khadins' – Jaisalmer
- 'Johads' – other parts of Rajasthan

- Bikaner, Phalodi, Barmer – houses had underground tanks or tankas to store drinking water.
  - as large as a big room
  - Phalodi (one household tank) example
    - 6.1 m deep
    - 4.27 m long
    - 2.44 m wide
  - Tankas-built inside houses or in courtyards.
  - Connected to sloping roofs through pipe

Rain → Rooftop → Pipe → Tankas

- First rain not collected – as it cleans roof, pipe
- Water from subsequent showers collected
- Highly reliable: water stored till next rainfall
- "Palar pani" (rainwater) considered purest water.
- Underground rooms adjoining 'tankas' were made to beat summer heat as it keeps room cool.

Q Mention all methods of Rain water Harvesting.
1. Rooftop Rainwater Harvesting – Rajasthan
2. 'Guls' and 'Kuls' – Western Himalayas
3. 'Johads' and 'Khadins' – arid, semiarid regions
4. Inundation channels – Bengal
5. 'Tankas'

Declining Rooftop Rainwater Harvesting in Western Rajasthan

- Reason: Availability of plenty of water due to perennial Indira Gandhi Canal.

- Some houses still maintain tankas
  - ↳ do not like taste of tap water

- Luckily, many parts of India still use Rooftop Rainwater Harvesting to store and conserve water

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Example

- Gendathur (village in Mysuru, Karnataka)
  - Households installed rainwater harvesting system on their rooftops.
  - 200 households have installed this system
  - Village became rich in rainwater

- Other Features about Gendathur
  - receives 1000 m of annual precipitation
  - 80% of collection efficiency
  - 10% fillings

↓

  - Each household collects 50,000 litres of water annually
  - From 200 houses, net amount of rainwater harvested is 1,00,000 litres.

Tamil Nadu

- First State in India which has made rooftop rainwater harvesting compulsory for all houses.
- Legal provisions to punish the defaulters.