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**SAIRAM**  
DIGITAL RESOURCES

YEAR  
**II**

SEM  
**IV**

**GE8291**

**ENVIRONMENTAL SCIENCE AND ENGINEERING**

## UNIT No. 3 NATURAL RESOURCES

### 3.2 Water resources:

- Use and over-utilization of surface and ground water
- Floods, drought, conflicts over water
- Big dams - benefits and problems

**SCIENCE & HUMANITIES**



## WATER RESOURCES

- It is an important component of all living beings. Almost 80% of our earth is covered with water.
- Nearly 97% by volume of water is found in oceans (too salty in nature) and 2% by volume is present as icecaps and glaciers. Remaining 1% of fresh water includes both surface and ground water resources. Therefore only less than 1% of water is available for drinking purposes.

### IMPORTANCE OF WATER:

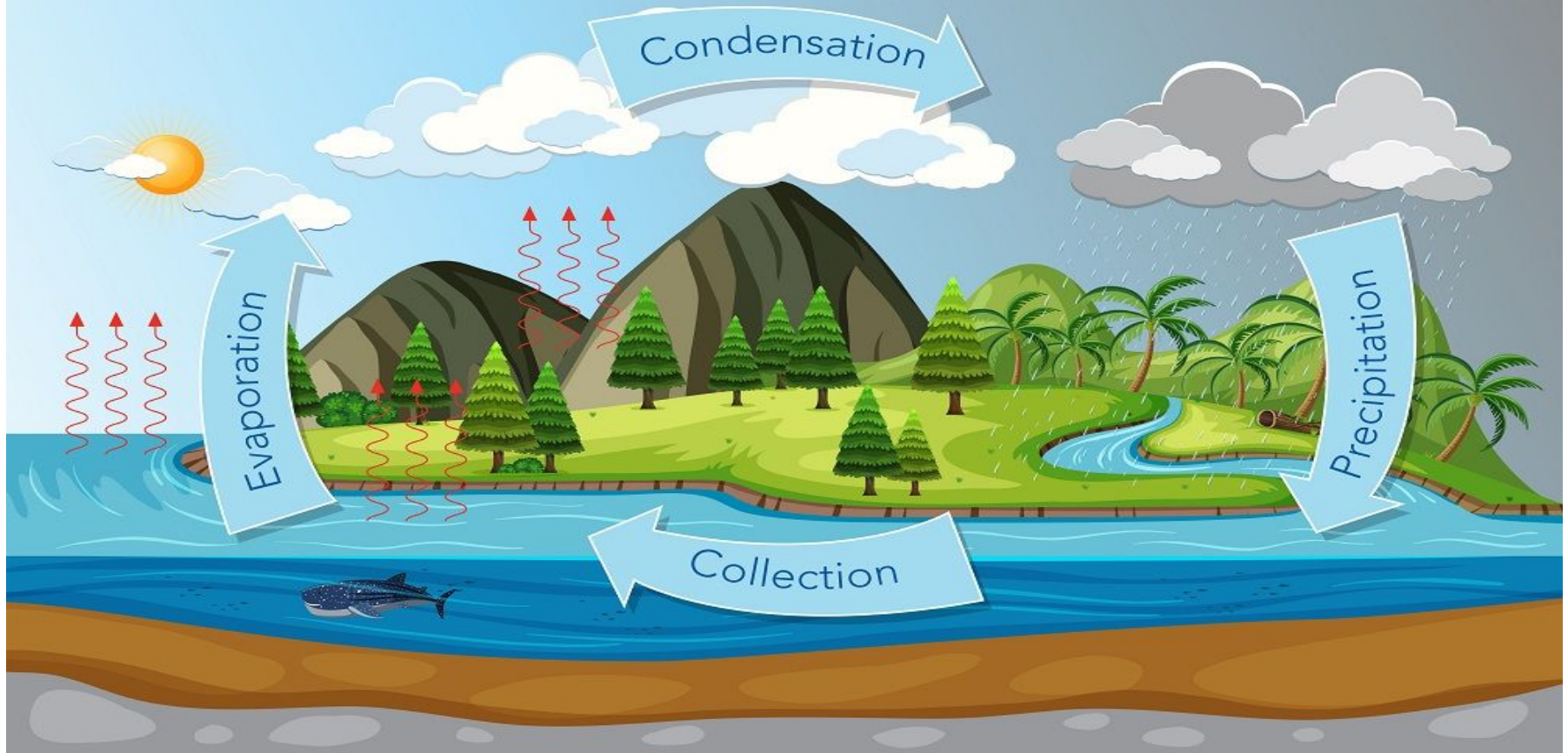
- **Domestic use:** Drinking, Cooking, Bathing, Washing etc.
- **Commercial use:** Offices, hotels, theaters, institutions etc.
- **Industrial use:** Water is used in the industries like iron, paper, refineries, tanneries etc.,
- **Hydroelectric power:** Water is used to generate electricity.
- **Agriculture:** Water is used for irrigation.
- Water is essential for living organisms

## Hydrological Cycle:

It is the cyclic process of evaporation, condensation and transpiration.

1. **Evaporation:** It is a type of vaporization that occurs on the surface of a liquid (Ocean, rivers, streams, lakes and ponds) into the gas phase.
2. **Condensation:** This is when water vapour in the air cools down and turns back into liquid water.
3. **Precipitation:** This is when water (in the form of rain, snow, hail or sleet) falls from clouds in the sky.
4. **Transpiration:** This is the loss of water from a **plant** in the form of water vapor. Water is absorbed by roots from the soil and transported as a liquid to the leaves via xylem. In the leaves, small pores allow water to escape as a vapor.

# The Water Cycle





## OVER UTILIZATION OF WATER

The rapid increase in population and industrial growth have increased the demand for water resources. Due to increase in groundwater usage, the annual extraction of groundwater is far excess than the natural recharge.

### (i) Causes:

- The rapid increases in population and industry, there is a great demand for water resources.
- Due to an increase of water usage, the annual extraction of groundwater is in far excess than the natural recharge.

## OVER UTILIZATION OF WATER

### (ii) Effects:

- **Decrease of groundwater:** Due to increased usage of water the groundwater level decreases.
- **Ground subsidence:** When the ground water withdrawal is more than its recharge rate, the sediments in the aquifer get compacted, which results in shrinking of overlaying land surface. This process is known as ground subsidence. It results in structural damage in buildings.

### Problems:

- ❖ Structural damage in buildings.
- ❖ Fracture in pipes.
- ❖ Reversing the flow of canals and tidal flooding.

- **Lowering of water table:** Excess utilization of water in arid and semi-arid regions for agriculture disturbs the state of equilibrium of the reservoirs leads to lowering of water table.
  - **Problems:**
  - Lowering of the water table.
  - Decreased pressure in the aquifers and changes in the speed and direction of waterflow.
- **Intrusion of Saltwater:** On coastal areas, over exploitation of ground water would lead to rapid intrusion of salt water from the sea. This may cause the water not suitable for drinking and agriculture.

**Problems:** Water cannot be used for drinking and agriculture.

- **Earthquake, Landslides:** The decrease in water level may lead to earthquakes, landslides and famine.
- **Drying of wells:** Over utilization of water decreases the ground water at a faster rate than the recharge rate. So, the dug wells as well as borewells get dried.
- **Pollution of water:** When the ground water near the agricultural land decreases the water containing nitrogen as fertilizer, percolates rapidly into the ground and pollutes the groundwater.
  - **Problems:** Water becomes unsuitable for potable use by infants, when nitrate concentration exceeds 25 ppm.



**Remedial measure:**

- Use less water for luxury purposes.
- We should reduce or use chemicals and dispose of them properly.
- More comprehensive research and additional funding can help with groundwater depletion.
- Find alternative sources of water.
- The pumping of groundwater should be regulated.

## FLOODS

A flood is an overflow of water, whenever the magnitude of flow of water exceeds the carrying capacity of the channel with its banks.

### (i) Causes of Floods

- Heavy rainfall, melting of icecaps, sudden release of water from dams.
- Reduction of carrying capacity of the channel, due to accumulation of sediments or obstructions built on the floodways.
- Deforestation, overgrazing, mining increases the runoff from rains and hence the level of flood raises.
- The removal of forest cover over the hilly region leads to occurrence of floods.
- Prolonged downpour can also cause the overflowing of lakes and rivers resulting in floods.

## FLOODS

### (ii) Effect of floods

- Due to floods, water spreads in the surrounding areas and submerges them.
- Due to floods the plain surface has become eroded and silted with mud and sand, thus the cultivable land areas get affected.
- Extinction of civilization in some coastal areas also occurs.

### (iii) Flood management

- Flood can be controlled by constructing dams or reservoirs.
- Channel management and embankments also control the floods.
- Encroachment of flood ways should be banned.
- Flood hazard may also be reduced by forecasting or flood warning.
- Flood may also be reduced by reduction of runoff by increasing infiltration through appropriate deforestation in the catchment area.

## DROUGHT

Drought is nothing but scarcity of water, which occurs due to inadequate rainfall, late arrival of rains and excessive withdrawal of groundwater.

### (i) Types of drought:

- i) **Meteorological drought:** It occurs when the total amount of water of rainfall is less than 75% of the normal rainfall. This drought will be severe if the rainfall is less than 50% of the normal rainfall.
- ii) **Hydrological drought:** It occurs when the total amount of rainfall is less than the average rainfall. It is generally associated with reduction of statistical average of water reserves available in the source such as aquifers, lakes and reservoirs.
- iii) **Agricultural drought:** This occurs due to the shortage as well as the timing of overall rainfall, which in turn reduces the groundwater and reservoir levels, soil moisture. Agricultural drought affects cropped plants.
- iv) **Socio-economic drought:** It occurs due to reduction in the availability of food and social security of the people in the affected areas. Socio-economic drought leads to famine.

## DROUGHT

### (ii) Causes of drought

- When annual rainfall is below normal and less than evaporation, drought is created.
- High population is also another cause for drought. Population growth leads to poor land use and makes the situation worse.
- Intensive cropping pattern and over exploitation of scarce water resources through dug well or bore well to get high productivity has converted drought-prone areas into desert.

### (iii) Effects of drought

- Drought causes hunger, malnutrition and scarcity of drinking water and also changes the quality of water.
- The drought causes widespread crop failures leading to acute shortage of food and adversely affects human and livestock populations.
- The drought indicates the worst situation and initiation of desertification.
- Raw materials for agro-based industries are critically affected during drought time, hence retarding the industrial and commercial growth.
- Drought also accelerates degradation of natural resources.
- Drought leads to large migration of people and urbanization.



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## DROUGHT

### (iv) Drought management

- Indigenous knowledge in control of drought and desertification is very useful for dealing with the problems.
- Rain water harvesting programme is another fruitful method to conserve more water and to control drought.
- To improve ground water level construction of reservoirs are essential in drought area.
- Modern irrigation technology is very much useful to conserve water.
- Afforestation activities also improve the potential of water in drought areas.
- Mixed cropping and dry farming are the suitable methods which minimize the risks of crop failures in the dry area.

## CONFLICTS OVER WATER

Water is so essential for our existence and is fast becoming a scarce resource. Freshwater is considered to be the most environmental issue of this century. Nearly 1.2 billion people do not have access to safe drinking water. This is due to an increase in population and decrease in water resources, conflicts over water starts.

### Causes of water conflicts

(i) **Conflict through use:** Unequal distribution of water has often led to inter-state or international disputes.

Example:

#### (a) International conflicts

- India and Pakistan fight for the rights to water from the Indus.
- Mexico and the USA have come in conflict over the Colorado river.
- Iran and Iraq contest for the water for Shatt-al-Arab water.
- India and Bangladesh are fighting for the Brahmaputra river.

## CONFLICTS OVER WATER

### (b) National conflicts

- Sharing of Cauvery water between Karnataka and TamilNadu.
- Sharing of Krishna water between Karnataka and Andhra Pradesh.
- Sharing of Siruvani water between Tamilnadu and Kerala.
- Construction of Dams (or) Power stations.
- For hydroelectric power generating dams are built across the rivers, which initiates conflict between the states.

### (ii) Conflict through pollution.

Besides the production of electricity and shipping, rivers and lakes are also used for industrial purposes. Not only act as reservoirs for the supply of fresh water but also as a means of disposing of wastewater and industrial rubbish. With increasing decline in the quality of the water crossing borders, the problem of cleaning the water takes on an international dimension (conflicts).

## CONFLICTS OVER WATER

### (iii) Management of conflicts over water.

- Efforts are mainly concentrated to enact laws to check these practices to control water pollution.
- The conflict over sharing of river water in the country has been studied by many organizations and several solutions are suggested. The interlinking of rivers has been one such solution.
- Demand for Nationalisation of water needs serious consideration. Therefore power must be given to the National Water Authority and River Basin Authority for equitable distribution of basin water.



## CONFLICTS OVER WATER

### (iv) Local managers & Types

- In India, there are several villages where water management is done by the local avengers and not by the irrigation department.
- Neerkatti: In South India, a Neerkatti manages the traditional taniks very efficiently. They give preference to the tail end fields and decide per capita allocation of water based on the stock of available water in the tank and irrigation needs.
- Havalgars: In Maharashtra, a havalgar manages and resolves conflict by overseeing the water channels from main canal to the distributary canals.
- Churpun: In Ladakh, a churpun is empowered over allocation of available water.

## CONFLICTS OVER WATER.

### (v) Conflicts on Indian River

According to a United Nations (UN) report, the fresh water is gradually becoming a matter of serious concern. Nearly one billion people worldwide still lack adequate supply of clean drinking water and nearly two billion people do not get water for proper sanitation.

According to the Central Control Board, 90% of the water supplied in India to the towns and cities is polluted, out of which only 1.6% gets treated.

## CONFLICTS OVER WATER

### Examples:

- A. **Damodar river:** It is the most polluted river, carrying discharged from 43 major industries.
- B. **Yamuna river:** Daily 19,000 cubic meters of water containing DDT derivatives from agriculture are dumped in the river.
- C. **Ganga river:** Daily 1000 cubic meters of untreated water from 68 industrial units are discharged in the river, which make Ganga unfit for bathing.
- D. **Periyar river:** The life of the river is dying a slow death due to mining of nearly 4,37,000 tonnes of sand everyday. This ongoing mining has caused the river to sink by 12 feet in the last 7 years. Since the river bed is choked with clay, the sand carried by the river has no place to get deposited, says Periyar Protection Society (PPS).
- E. **Suriyapalayam river:** The Madras High Court has ordered the state government seeking a direction to close down 34 tanneries located in and around Suriyampalayam river in Erode. These tanneries contaminate drinking water and render the soil unfit for agriculture and cultivation.
- F. **Thamirabarani river:** It is the first major victim of brick kilns. A continuous brick making on its bank has converted the river into shapeless grouping of mud pools.

## DAMS - BENEFITS AND PROBLEMS

Dams are constructed across the river in order to store water for irrigation, hydroelectric power generation and flood control. Dams are called as the Temples of modern India by the country's first Prime Minister. Jawaharlal Nehru.

### Benefits in the Construction of Dams:

- i) Enhanced production of electricity: The construction of dams and reservoirs increases the source of power generation.
- ii) Increase in irrigational source: The supply of water from the reservoir for irrigation purposes can be increased.
- iii) Drinking water sources: Several metropolitan corporate cities like Delhi, Chennai, get the supply of drinking water from dams.
- iv) Increased source of employment: Since the construction of reservoirs and dams would require massive sources of manpower which would solve the employment crisis to some extent.
- v) Used for recreational purposes and to develop fisheries in the dam areas.

## DAMS - BENEFITS AND PROBLEMS

### Problems in the Construction of Dams:

- i) Loss of biodiversity: The construction of dams would lead to environmental degradation which in turn would result in the loss of biodiversity.
- ii) Greenhouse effect: The felling of trees due to dam construction causes deforestation which in turn leads to enhancement of greenhouse effect.
- iii) Dislocation of people: Tribal communities would be forced to dislocate to new living places, thereby subjecting them to miseries.
- iv) Effects on environment: The River Valley Projects cause water logging which leads to salinity and in turn reduces the fertility of the land.
- v) Sometimes, due to structural defects the dam may collapse suddenly and destroy many living organisms.
- vi) Fertility of land along the river is reduced due to the sediment deposition.
- vii) Salt water intrusion at river mouth.



## Video link:

Hydrological cycle: [https://www.youtube.com/watch?v=HOtQ\\_iRq4Tk](https://www.youtube.com/watch?v=HOtQ_iRq4Tk)

Over utilization of water: <https://www.youtube.com/watch?v=RjsThobgq7Q>

*Sairam*

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**THANK YOU**