

# Contents



Water availability



Over utilization and pollution of surface and ground water



Hydrological cycle



Floods



Drought



Sustainable water management



Advantages with reservoirs/dams

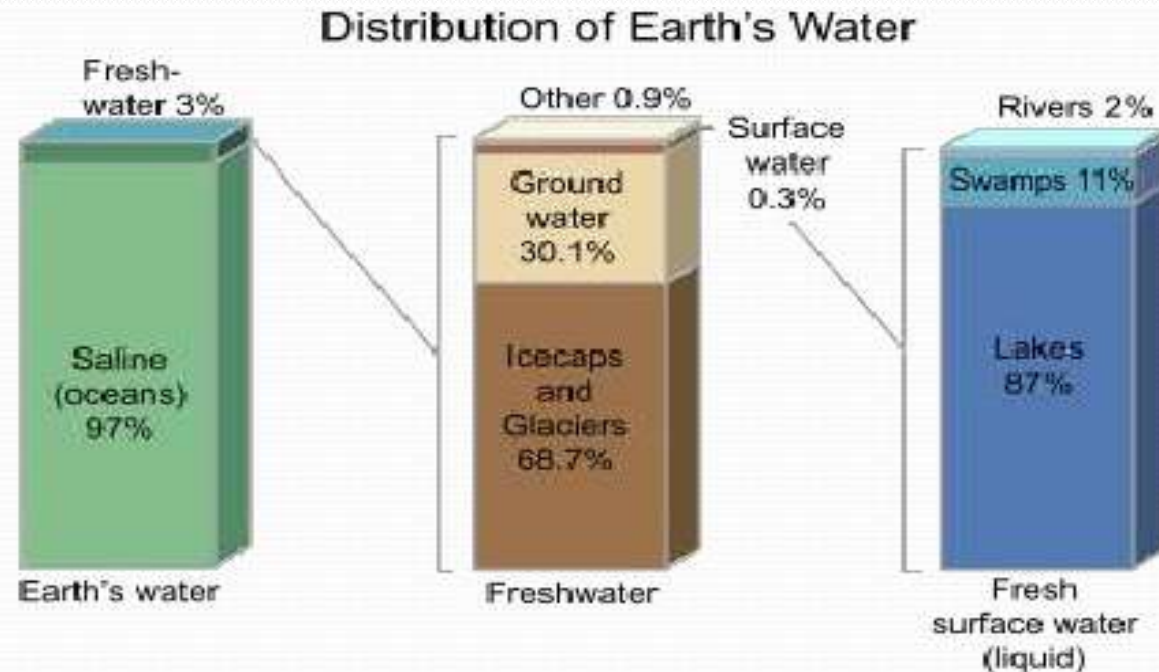


Problems with reservoirs/dams

# Water availability

- 70 % land mass in earth under water
- Only 3 % fresh water and 97% saline water
- Out of this 2 % is entrapped in polar ice cap
- 1 % water is the flowing water in rivers, lakes and ground water

India is expected to face critical levels of water stress by 2025



# Water Stress & water Scarcity

- **Water Stress:**
  - Annual water supplies is less than  $1,700\text{m}^3$  per person.
- **Water Scarcity:**
  - Annual water supplies is less than  $1,000\text{m}^3$  per person.
- **Absolute scarcity:**
  - Annual water supplies is less than  $500\text{m}^3$  per person.





1995



2025



water withdrawal as percentage of total available



# Water use in India

## Uses of Fresh Water

### Types

**Agricultural:** The 69% of water is use for irrigation.

**Industrial:** The 15% of water is use for industrial things. The major use of industrial is power plants. Oil refineries which is use with a chemical process. Manufacturing plants which use water as a solvent.

Industrial water is lower than agricultural water.

**Household:** The 15% of water is use for household. Household uses are:

Drinking  
Bathing  
Water  
Cooking  
Sanitation  
Gardening

**Recreational:** Recreational water has a small use. Recreational use is mostly needed for reservoirs. This type of use of water is specific for places and good times.

**Environmental water** has a small use. Environmental water is use mostly for:  
Artificial wetlands  
Artificial lakes  
This is to create a wildlife habitat.

### d. Mining

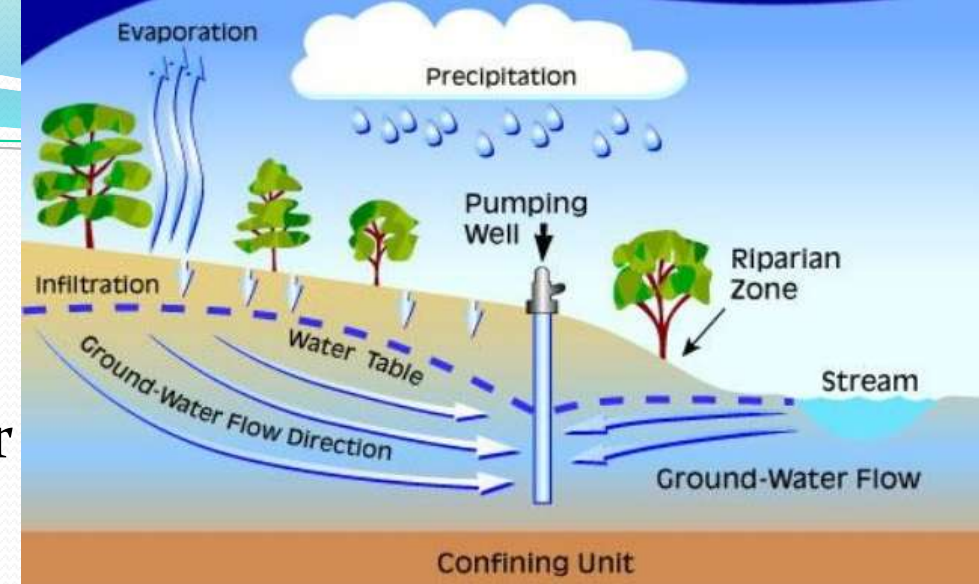
• Water is used for the extraction of minerals that can be in forms of:

- Solid: coal, iron, gold, sand - etc.
- Liquid: crude oil.
- Gas: natural gases.

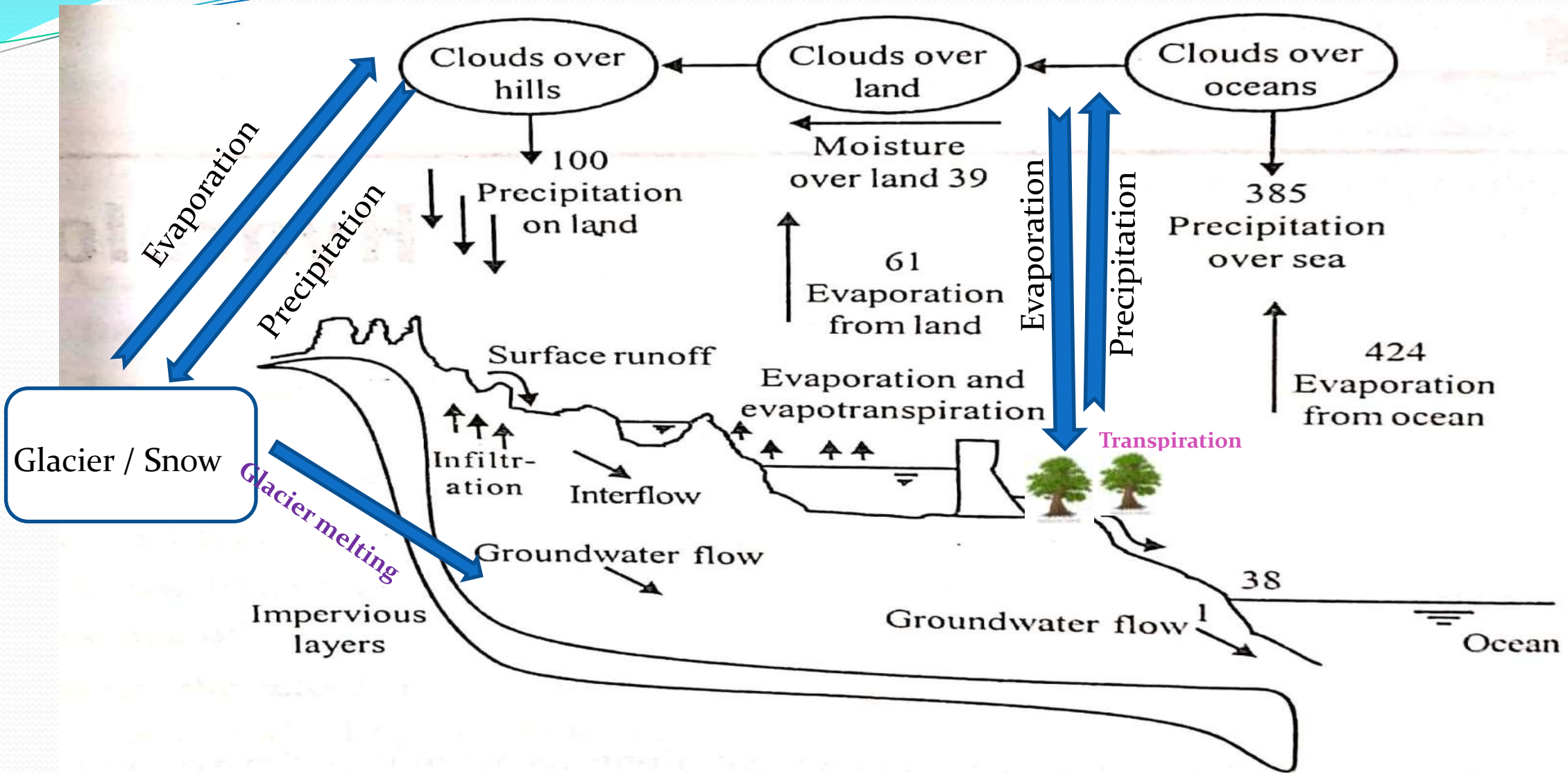


# Hydrological cycles-components

- **Evaporation:** The transformation of water in to water vapour at all surface at all temperature
- **Transpiration:** Evaporation of water from vegetative surfaces like plant foliage
- **Infiltration:** The movement of water into the interior of soil to the ground water regime.
- **Precipitation:** Water vapour forms cloud and results in precipitation in the form of rain fall and snow fall.
- **Run off:** The portion of precipitation percolates ground as ground water and the major portion leaves in different stream as run off.
- **Precipitation** = Evaporation+ Transpiration + Infiltration+ Run off



# Hydrological cycle



**Fig. 4.1** Hydrological cycle with global annual average water balance given in units relative to a value of 100 for the rate of precipitation on land.

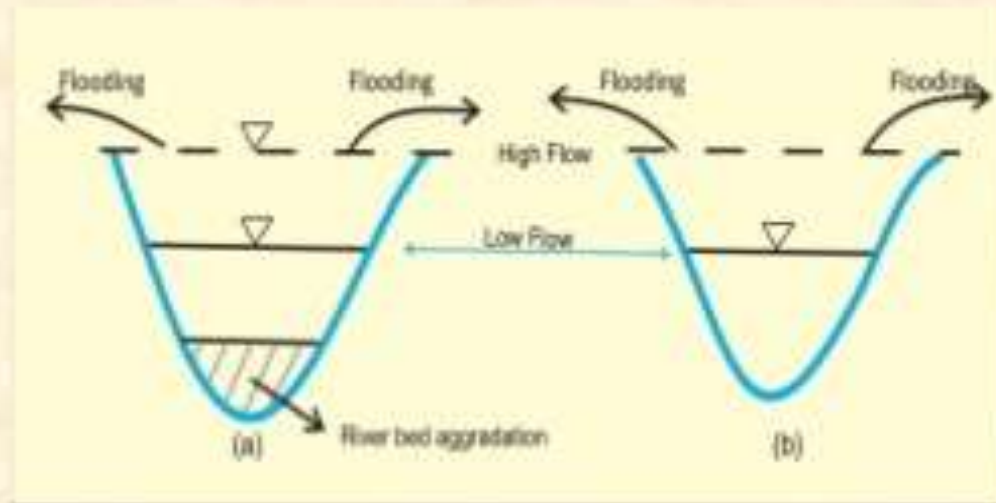


# FLOODS

**FLOODS ARE NATURAL PHENOMENA.**  
FLOODS ARE WATER RELATED DISASTER

A flood occurs when the Geomorphic Equilibrium in the river system is disturbed because of intrinsic or extrinsic factors or when a system crosses the geomorphic threshold.

- (a) Flooding in a river due to aggradation of river bed (intrinsic threshold);
- (b) Flooding in a river due to heavy rainfall (extrinsic threshold)





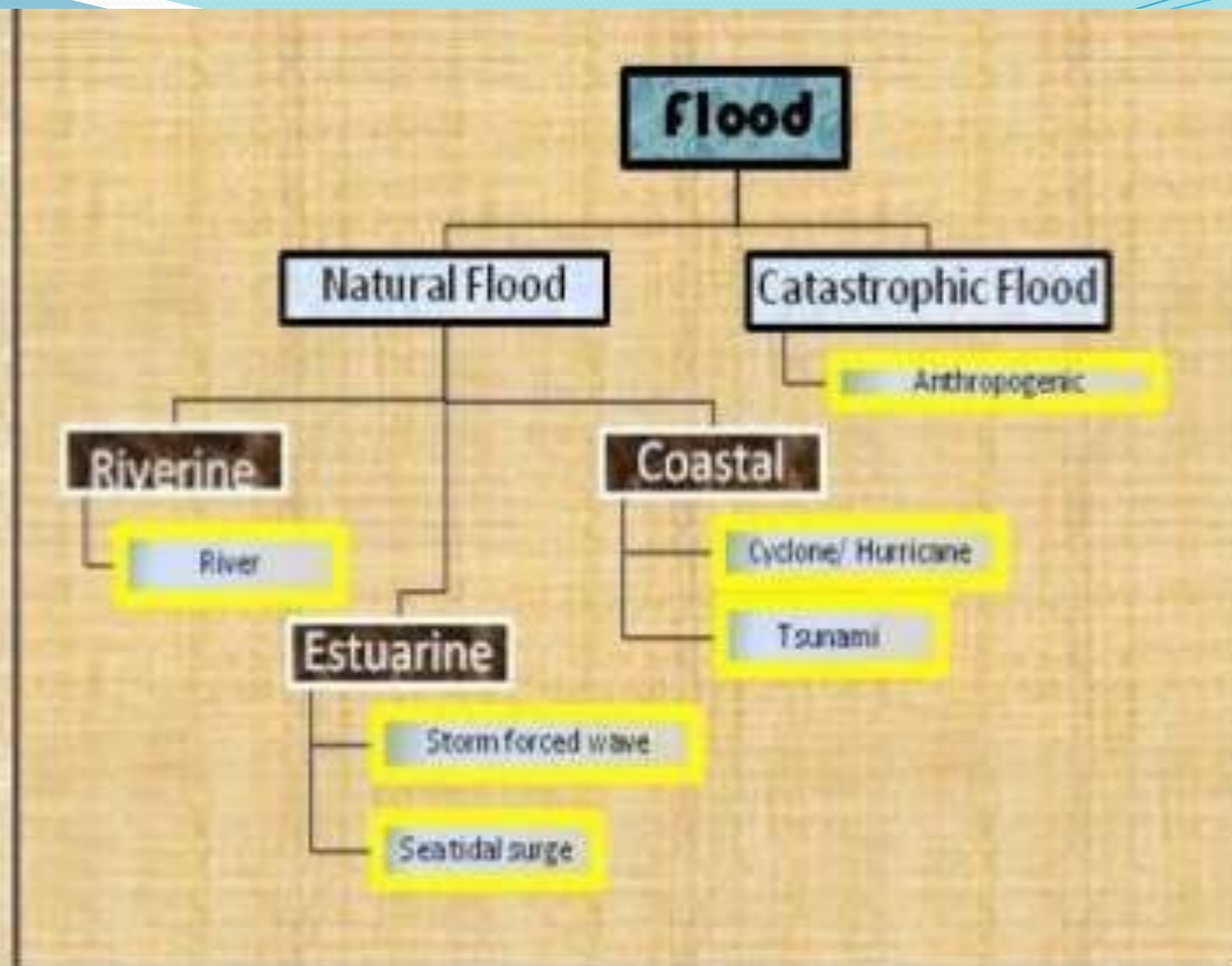
# TYPES OF FLOODS

## Types of floods

- Flash floods
- River floods
- Coastal Floods
- Urban Flood

According to their duration flood can be divided into different categories:

- Slow-Onset Floods:** Slow Onset Floods usually last for a relatively longer period, it may last for one or more weeks, or even months.
- Rapid-Onset Floods:** Rapid Onset Floods last for a relatively shorter period, they usually last for one or two days only.
- Flash Floods:** Flash Floods may occur within minutes or a few hours after heavy rainfall, tropical storm, failure of dams or levees or releases of ice dams. And it causes the greatest damages to society.





# Factor affecting Flood

## VEGETATION COVER

This varies seasonally. The type and amount will affect interception and stemflow/throughfall. Overland flow is reduced. Lag time will be increased.



## ROCK TYPE

Impermeable rocks prevent groundwater flow and encourage through flow and overland flow. These rocks will decrease lag time. Permeable rock will have the opposite effect.



## CLIMATE

The distribution of rainfall over the year and the temperatures will affect the lag times.

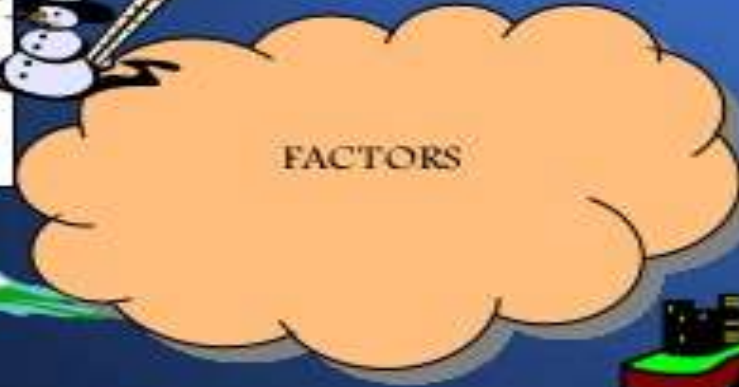


## SLOPES

Steep slopes will encourage overland flow and gentle slope will slow run off down.



## FACTORS



## LAKES & RESERVOIRS

These will store floodwater and thus reduce lag time and control river response to heavy rainfall.



## RAINFALL INTENSITY & DURATION

Intense rain will increase overland flow and reduce lag times. Gentle rain over a longer time will allow more infiltration.



## LAND USE

Impermeable surfaces created by urbanisation will reduce infiltration and encourage overland flow. Different types of crops affect interception rates e.g. cereals 7-15%.



## SOIL TYPE & DEPTH

Deep soils store more water, pipes in the soil encourage through flow. Soils with small pore spaces will reduce infiltration and increase overland flow.





# Impact of Floods

- Human Loss
- Property Loss
- Affects the Major Roads
- Disruption of Air / Train / Bus services
- Spread of Water-borne Communicable Diseases
- Communication Breakdown
- Electricity Supply Cut off
- Economic and Social Disruption
- Increase in Air / Water Pollution

# Drought

- It is an unpredictable climatic condition and occurs due to the failure of one or more monsoons.
- Rains are very unpredictable. This leads to periods where there is serious scarcity of water.
- Drought prone areas are faced with irregular periods of famine as farmers have no income.
- Drought prone areas Development Programs:
- Under this scheme, people are given wages in bad years for activities like building roads, minor irrigation works and plantation programs.
- It is a major problem in arid and semi arid regions.
- Drought affects home, agriculture, industry, leads to malnutrition problems in children due to food shortages



# Causes of Drought

## Natural / Physical causes:

- Weather: increased amount of *anticyclone* weather (hot + dry) means air holds less moisture so you get less rain
- Global warming: weather patterns change (e.g. Sahel is becoming hotter + drier)
- Hotter weather = more evaporation than precipitation
- El Nino: random weather event that reverses normal weather patterns (e.g. Australia has years of drought + then years of flood)

## Human causes:

- Overpopulation: too many people living in an area using too much water
- Overcultivation: planting too many crops which use up too much water
- Overextraction: removing too much water from wells so they dry up
- Deforestation: cutting down trees which otherwise store water + hold soil together
- Politics: fighting over water, or companies being greedy + taking too much water to then sell on



# Causes of Drought

- Major factor responsible for drought is deforestation.
- Due to denuded forest cover the rainwater rushes down the river and is lost.
- Forest cover permits the water to remain in the same area and gradually seep into the ground.
- This charges the underground stores of water in natural aquifers. Which later can be use during the period of no monsoons.



Drought

Soil and water management and afforestation are long-term measures that reduce the impact of droughts



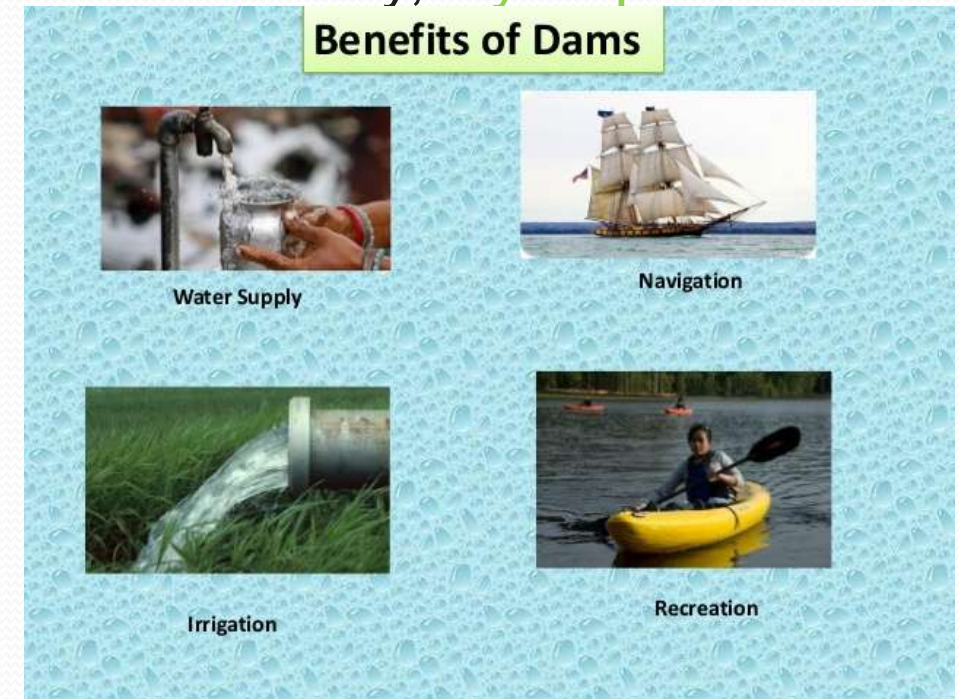


# Advantages with reservoirs/dams

India's increasing demand for water for intensive irrigated agriculture, for generating electricity, and for consumption in urban and industrial centers, has been met by creating large dams.

The major **advantages of Dams** are

- Water supply to intensive irrigated agricultural land
- Generation for cheap and non-polluting source of electricity, **Hydropower**
- Water supply to cash crops
- Domestic water supply
- Water supply to big industries
- Fishing activities



# Problems with reservoirs/dams



- Submergence of forest land with valuable loss to biodiversity
- Sediment deposition in rivers lead to flood and soil erosion
- Serious impacts on riverine ecosystems.
- Displacement of tribal people.
- Water logging and salinity of surrounding lands leading to infertility of the soil.
- Dislodging animal populations, damaging their habitat and cutting off their migration routes.
- The emission of green house gases from reservoirs due to rotting vegetation

## Changes to Earth's Rotation

NASA geophysicist Dr. Benjamin Fong Chao have found evidence that large dams cause changes to the earth's rotation, because of the shift of water weight from oceans to reservoirs. Because of the number of dams which have been built, the Earth's daily rotation has apparently sped up by eight-millionths of a second since the 1950s. Chao said it is the first time human activity has been shown to have a measurable effect on the Earth's rotation.



# Sustainable water management

Make people aware of the dangers of water scarcity.

## Measure for sustainable water management

- Building several small reservoirs instead of few mega projects
- Develop small catchment dams and protect wetlands
- Soil management, micro catchment development and afforestation permits recharging of underground aquifers thus reducing the need for large dams.
- Treating and recycling municipal waste water for agricultural use.
- Preventing leakages from dams and canals.
- Preventing loss in Municipal pipes.
- Effective rain water harvesting and ground water recharging.
- Water conservation measures in agriculture such as using drip irrigation.
- Pricing water at its real value makes people use it more responsibly and efficiently and reduces water wasting.
- In deforested areas where land has been degraded, soil management by bunding along the hill slopes and making 'nala' plugs, can help retain moisture and make it possible to re-vegetate degraded areas