Impact of climate change on water resources

By

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Happy Earth Day

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About Earth Day- When and why?

- Every year on April 22, across the globe Earth Day is celebrated to fight against the pollution and to restore our planet Earth.

- World climate leaders, grassroots activists, non-profit innovators, industry leaders, artists and the leaders of tomorrow come forward with great ideas and launch movements to save our Earth and provide us a better world.

About Earth Day- Brief History

- Half a century back in 1970, U. S. Senator Nelson Gaylord with college students started this movement (Campus Teach-ins).
- They selected 22 April as the date of the event
- Later many other organizations and faith groups start contributing the movement and they change the name to Earth Day.
- In 1990 Earth Day become a global event.

Theme of 2021

Significance of Earth Day

- Earth Day is celebrated annually to highlight environmental issues like biodiversity loss, increased pollution, environmental deterioration etc.
- According to the UN, “despite ongoing efforts, biodiversity is deteriorating worldwide at unprecedented rates. It is estimated that around 1 million animal and plant species and many water resources are now threatened with extinction.”

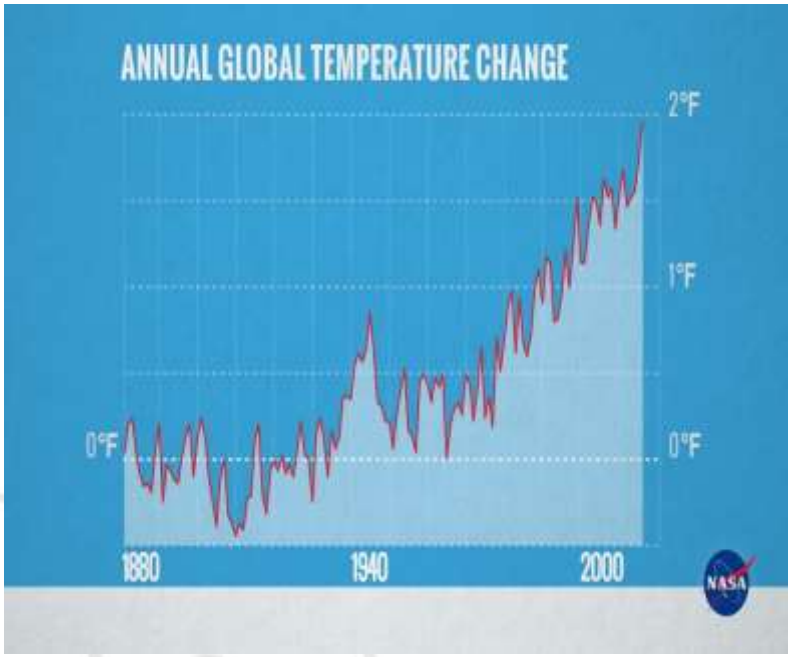
Impact of Climate Change on Water Resources

Climate Change- What

- Climate change is described as a change in the average conditions, such as changes in temp. and rainfall in a region over a long period of time.

- There has been natural fluctuations in the climate, but the research findings indicate that temperatures are now gradually rising faster than at many other times.

- Uncertainty in estimation of extreme events has increased.



Reference: Graph of change in annual global temperatures, compared to the average of global annual temperatures from 1880-1899. Credit: NASA's Goddard Space Flight Centre

What Causes Climate Change?

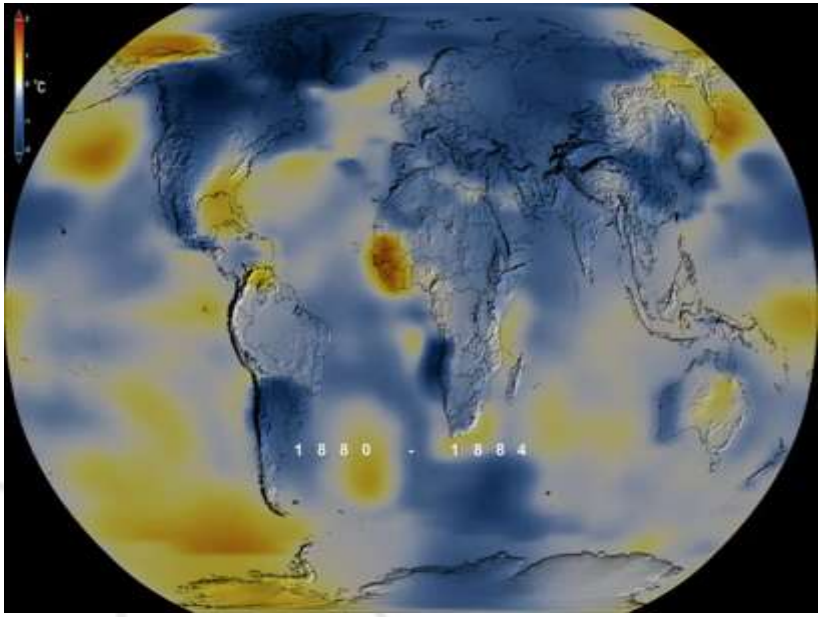
- Earth has been getting warmer in the past 50 to 100 years due to human activities (greenhouse effect).
- Greenhouse effect : Certain gases in Earth's atmosphere block heat from escaping out.
- Human activities (burning fuel etc) are changing the natural greenhouse composition in the atmosphere. These changes cause the atmosphere to trap more heat than it used to be, leading to a warmer Earth.
- Land use land cover is gradually changing.
- Implications on design practices and management of Earth resources

Reference: NASA's Scientific Visualization Studio. Data provided by Robert B. Schmunk (NASA/GSFC GISS).

Climate Change Impact on Temperature

- Scientists have high confidence that global temperatures will continue to rise for decades to come, largely due to greenhouse gases produced by human activities.

- The Intergovernmental Panel on Climate Change (IPCC) forecasts a temperature rise of 2.5 to 10 degrees Fahrenheit over the next century



Reference: NASA's Scientific Visualization Studio. Data provided by Robert B. Schmunk (NASA/GSFC GISS).

Impacts of climate change on water resources

- Water resources on Earth
- Water resources in India
- Why water resources management is important?

Global Overview

While 67% of Earth's surface is covered by water. 97.25% of it is in oceans and less than 2.8% of global water is freshwater. Most of the freshwater (2.05%) are locked in ice caps and glaciers. Only less than 0.7% is available for human use.

Only 7 parts out of 1000

About 1 meter rainfall every year- on an average

Reservoir	Volume of water (10^6 km^3)	Percent of total
Ocean	1370	97.25
Ice caps & glaciers	29	2.05
Groundwater	9.5	0.68
Lakes	0.125	0.01
Soil Moisture	0.065	0.005
Atmosphere	0.013	0.001
Streams & rivers	0.0017	0.0001
Biosphere	0.0006	0.00004

Scarcity of fresh water

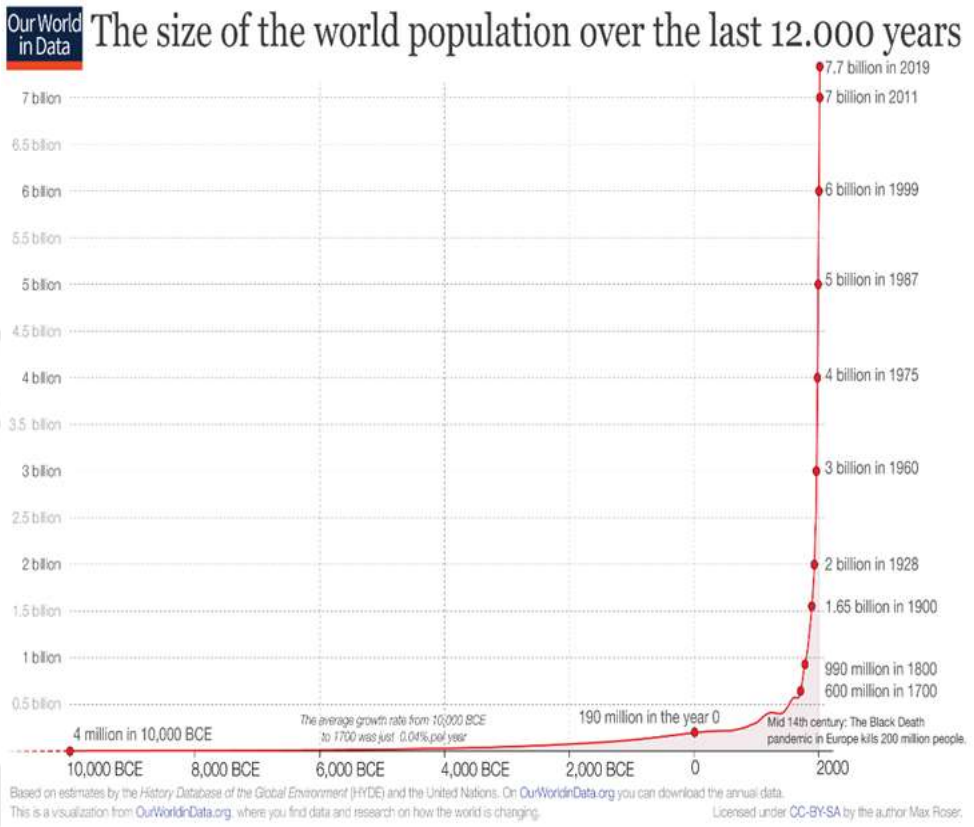
- On a global basis, fresh water is an increasingly scarce resource.

- Per capita availability of water is reducing year by year. Some of the reasons may be attributed to
    - Population is rising
    - Water demands are increasing
    - More and more Urbanisation
    - More and more Industrialisation
    - Demands for consumables, food and energy are increasing
    - Climate Change
- Indian scenario is even worse
    - 2.45% of world's land area
    - 4% world's renewable water resources
    - 17.5% of World's population

Population

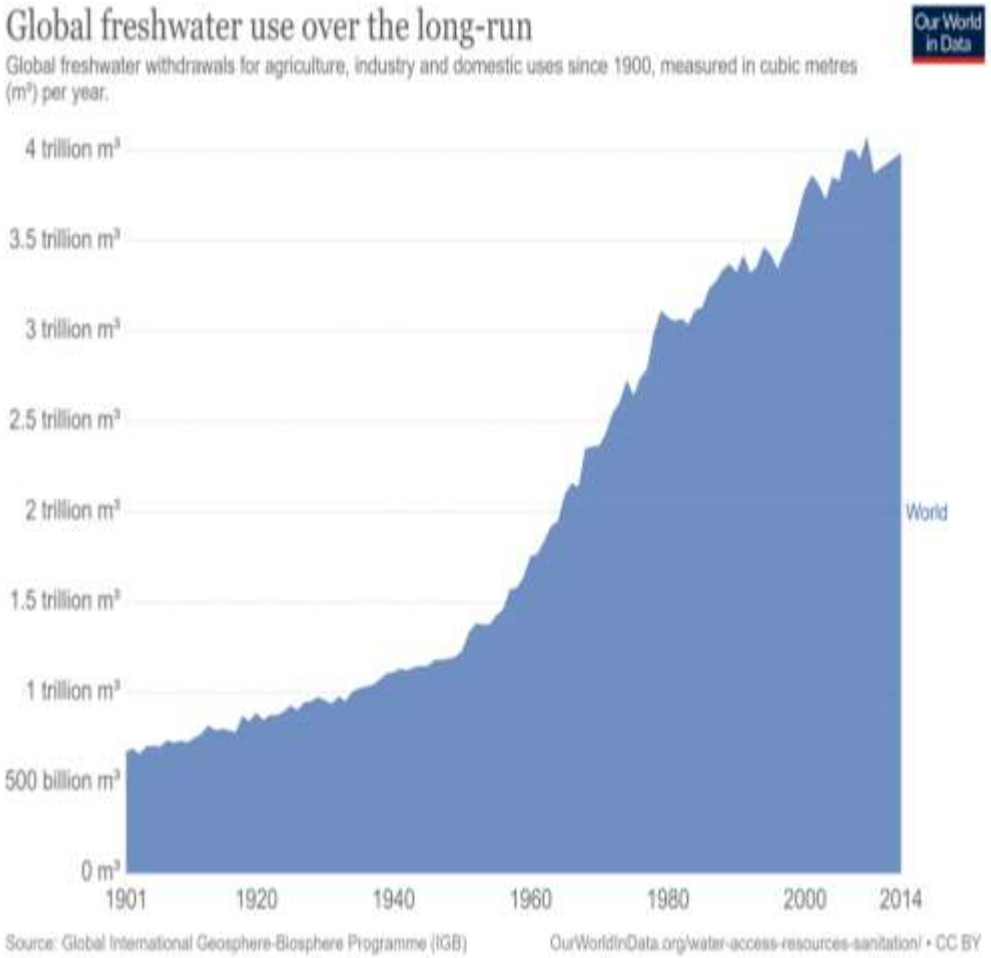
Over last century the world's population has increased from 1.65 in 1900 billion to 7.7 billion; 4.66 times

Undivided India's population in 1900 was 23.8 crores.
Now it 138 (India)+ 21.66 (Pakistan) + 16.3 (Bangladesh) = 176 crores; 7.4 times



Change in Water Demand Over the Years

8 times increase in water demand since 1901



Implications of more population and more demands

Population growth:

More Shelter, More food

- More population ⇒ More urbanisation,
- More food ⇒ More agriculture;
- Urbanisation ⇒ Killing of water bodies in villages, towns and cities;
- More Food ⇒ Use of more fertilisers ⇒ Deterioration of the water quality; Increase in demands for consumables- More industrialisation; More effluents; More deterioration of the environment
- Climate change- Uncertainty in estimation is increasing

Quantity as well as quality is getting negatively affected

Solution: Proper Water Management

Implications- Contd.

- Availability of water in terms of precipitation is not uniform in time and space.
- Availability is only for **30 to 40 days in a year only 1% of the time.**
- **Requirements- 24X7 as water is required for** agriculture, domestic use, industrial use, thermal power plants, hydro-power plants, environmental flow in rivers, mining, livestock;

Problem: Right quantity of right quality of water is not available at right place at right time.

Solution: Store the water where and when it is available and transfer it to place where and when it is required;

Storages and transfers are inevitable. Hydraulic structures like dams, barrages, weirs, canals, drains come into picture.

Implications- Contd.

Structures- design aspects, operation aspects

So the data of hydro-meteorological are required;

Problem: Because of the climate change the requirement of data for design and operation of structures to mange the water problems has increased.

Solution: Strengthening of data networks;

Society and children have role to play.

UPROBE project

Climate Change Impacts on Different Sectors

Impacts of climate change on water

- Increase in annual average precipitation.
- Increase in atmospheric vapor.
- Increase in frequency and intensity of precipitation extremes.
- Decrease in snow cover.
- Increase in melting of ice.
- Increase in Sea level rise.
- Increase in Evapotranspiration.
- Decrease in Soil moisture.
- Changes in geographical patterns of rainfall;
- Spatial and temporal variability of rainfall has increased.

Major Negative Impacts of Climate Change on Water

- More drought events
- More intense floods
- Water supply shortages and distribution
- Poor water quality
- Disturbed hydrological processes

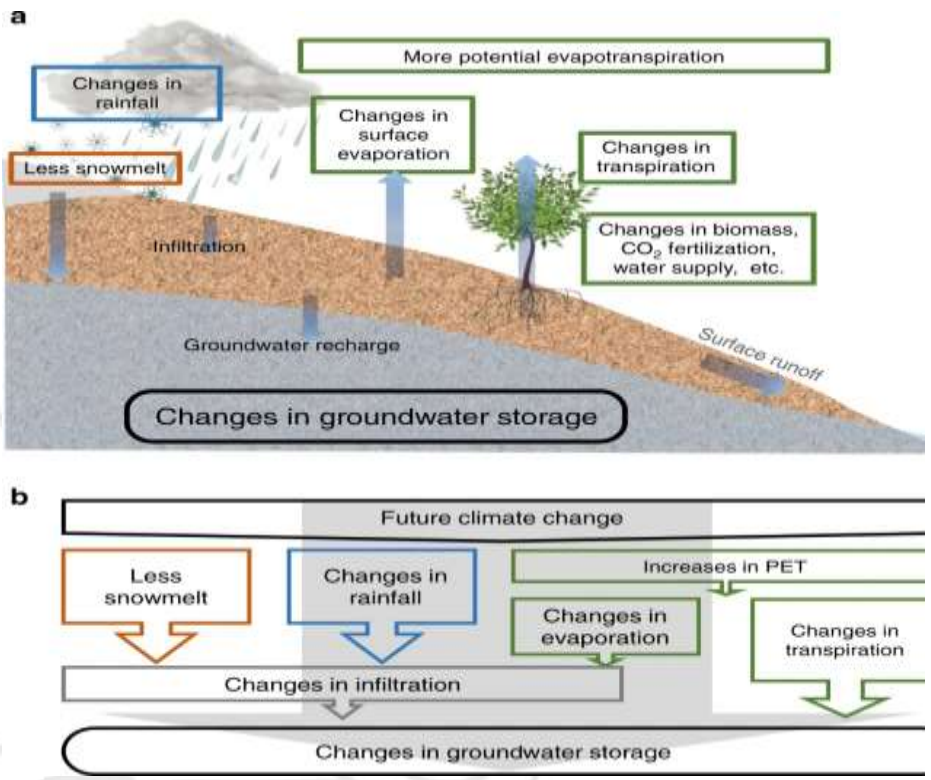
Major Negative Impacts of Climate Change on Water

- Less snow, more rain
- Increased winter flooding, Cyclonic disturbances
- Earlier snowmelt and more evaporation
- Sea level rise
- Increased stream and lake temperature
- Increased risk to aquatic ecosystems and fish species
- Precipitation frequency and intensity

Reference: https://www.wateronline.com/doc/impact-of-climate-change-on-water-resources

Water Related Impacts … cont.

- Change in annual runoff
- Longer, warmer growing seasons
- Increased and decreased forest growth and ecosystem productivity
- Intense droughts



Reference: This figure has been designed using resources from www.Freepik.com

Mitigation and Adaptation Measures

- Increase water use efficiency specially in the agricultural sector.
- Development of crops requiring lesser water and can sustain higher temperature.
- Increased data networks density for better estimation of design parameters.
- Development of advanced information system for floods and droughts forecasting.
- Decrease in seepage from the dams.
- Decrease in evaporation from the water bodies.
- Revival of water bodies in cities and towns.
- Checking encroachment of drains in cities and towns.
- Dam Safety and Rehabilitation

How can children contribute towards environment?

- Support Our Pollinators like bees- Earth Day Theme 2020
- Plant a tree – Google Doodle 2021
- Clean up plastic in your neighbourhood or local Park
- Reduce, Reuse, Recycle in the Garden

How can children contribute towards environment?

- Stop pesticides and chemicals in the garden
- Conserve water
- Observe the nature and try to develop harmony with nature
- Develop love for plants, birds, animals, cows etc.
- We are solely dependent on plant kingdom and this aspect should always be remembered.

Thanks…