

## UNDERSTANDING WATER RESOURCES IN INDIA

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### ABSTRACT

*Water is a prime resource that sustains every form of life on earth. The availability of this finite recyclable resource depend upon its proper development and management. Water is available in different forms and most importantly its every form is essential for the sustenance of hydrological cycle. As a solid it piles up as glaciers and when it melts it flows as a liquid in streams forming rivers and ultimately falling into seas and oceans. Sun transforms this liquid into clouds and these fly over different land forms and fall as rain. This rain water moves on the surface as runoff and part of it percolates to become groundwater. A natural water distribution system moves this resource and every form of life find suitable habitat to live. India is a big country with large population. Although resources are finite but the population is ever increasing and this has resulted in rapid urbanisation and industrialisation. As a result demand for water is continuously increasing and with rising pollution the quality of water has also deteriorated. This has adversely affected the availability of water resources in our country. Even the ground water table has declined in several areas. An efficient water management system is needed for sustainable development.*

**Keywords:** *Water Resources, Hydrological Cycle, Water Distribution, Population, Water Management.*

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### Introduction

Water covers about 2/3rd of the Earth's surface. Oceans contain 97% of all Earth's water while freshwater is only 3% of it. About 69% of the total fresh water is piled up as glaciers and icecaps and rest of the fresh water is available as ground water. It has been observed that only 0.3% of the total fresh water is available in rivers and lakes which we can utilise in our daily life. It is also assumed that anywhere on Earth there are chances of groundwater at some depth. More than 50% of the total population of Earth lives in developing countries and the poor living here mostly exploit the local water resources. As a result ground water is being overexploited and this has led to intrusion of salt water in coastal aquifers. The groundwater resources are continuously declining leading to decrease in river flow. The per capita availability of surface water in our country is reducing continuously. It was around 2210 cu m (cubic metres) in 1991 and 1820 cu m in 2001. In 2011, 2015 and 2021 it fell to around 1651 cu m, 1508 cu m and 1486 cu m respectively and is projected to be around 1367 cu m in 2031, 1282 cu m in 2041 and 1228 cu m in 2051.

Water is equally important for economy and ecology. Water is a central issue in all the developmental programmes. India has around 17% global population and has only 4% of global water resources. Water is in great demand for agriculture and industry and to sustain our economic growth demand for water is consistently increasing in all towns, villages and cities. About 54% of our population earn their living from farming and their share in national income is just 14%. Thus a better management

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of our water resources is needed to continue our developmental programmes. The falling per capita availability of water depicts that our country is under water stress and requires tight measures for water management. To push its gross domestic product (GDP) India also needs to promote its *Make in India* (MII) mission. Here manufacturing sector needs to be consolidated and for this proper utilisation of our water resources is essential.

### **Water Resources: Availability and Management**

India has about 2.4% of the total surface area of the world. The annual precipitation that our country receives including snowfall is around 4000 bcm (billion cubic metres) and this includes monsoon rainfall of around 3000 bcm between June and September.

#### **Sources of Rainfall**

In India the winds that originate from Bay of Bengal, Arabian Sea and Indian Ocean carry moisture along and bring rainfall.

- **South- West Monsoon:** These are also called long rains. They occur from June to September and bring around 75% of annual rainfall.
- **North- East Monsoon or Retreating Monsoon:** These are also called short rains. They occur from October to December and bring around 25% of annual rainfall.
- **Shallow Cyclonic Depressions and Disturbances:** These are mostly the tropical cyclones and the western disturbances. Tropical cyclones occur in April-May during pre- monsoon period and in October-November during post-monsoon period. The storms mostly occur in the months of May-June and October-November.
- **Local Storms:** These include thunderstorms that come together with strong winds that blow with the surface and are even accompanied with hailstones. These are termed local to differentiate them from cyclones. Some local storms that occur in hot weather season include: (i)Mango Shower (ii) Blossom Shower (iii)Nor Westers (like Kalbaisakhi and Bardoli Chheerha) (iv) Loo

#### **Categorisation of Rivers**

The rivers in India fall broadly in the following four categories with regards to their places of origin:

- **Himalayan Rivers:** These are fed by rain, snow and glaciers. e.g., Ganga, Yamuna, Alaknanda, Bhagirathi, Indus and Brahmaputra.
- **Deccan or Peninsular Rivers:** These are rain fed rivers. e.g., Narmada, Tapti, Godavari, Krishna, Kaveri, and Mahanadi.
- **Coastal Rivers:** These are also rain fed rivers. These include rivers originating from the coastal sides of Eastern and the Western Ghats and falling into the Bay of Bengal, Arabian Sea and the Indian Ocean. Here these rivers have catchment area draining through the narrowcoastal regions of India.e.g., Nagavali, Vaigai and Netravati.
- **Inland Drainage Basin or Endorheic Basin Rivers:** These include those rivers that flow in the interior parts of our country and fall in some lake or an inland water body. They do not fall in a regular ocean or a sea. e.g., Luni and Ghaggar River.

#### **Need for Water Management**

Our country has around 1122 bcm of annually utilizable water resources and this includes 690 bcm of surface water resources and 432 bcm of ground water resources. It has been observed that annually around 75% of rainfall occurs in a short span of four months during monsoon period. Here it can be mentioned that around 2000 bcm of natural runoff annually flows in river systems of our country and of this over 70% of water flows during the short span of monsoon period. This results in flooding of the rivers in these monsoon months. In the rest of the months only less than 30% of water flows in our river system resulting in drought like situation in most of the areas. This even declines the ground water recharge in these months as compared to monsoon period. Thus amount of surface flow and ground water availability show large variations during the year. Even after huge network of river system together with voluminous aquifers we find fresh water unevenly distributed. The demand for water is increasing with alarming rise in our population. A large portion of water is needed for irrigation and gradually we are heading towards fresh water scarcity in our country. To cover our rising domestic demand for water we are over- utilizing our ground water resources. This has resulted in diminishing water tables with

increasing instances of ground water pollution. The reduction in groundwater has also led to sinking of land. Efficient use of water can improve water availability in future. We need to develop a good and an efficient water management system that can even improve the quality of water.

#### **Main Resources of Water**

- **Surface Water:** Against the total annual precipitation that our country receive, around 50% is lost by evapotranspiration and as a result only around half of it actually remain as a balance flow. Now only between 50-60% of this balance water is further available due to topographic hindrances and is seen as utilizable water resource. Here around 60% of this available utilizable resource remains as surface water and rest of it percolates to become ground water resource.
- **Underground Water:** Out of the total utilizable water resource almost 40% moves below the ground and constitute lower portion of the hydrological cycle and contribute to ground water and soil water. The water that percolates to greater depths below the water table is referred to as underground water. The water that is up to the water table is termed as ground water and it can be accessed by human beings through wells. Even soil contains both water and air in its pore spaces and there is capillary water in this soil which can only be extracted by plants through their roots. Out of the total available ground water resource around 16% is provisionally available for domestic and industrial uses and rest of it is available for irrigation purposes. Ground water resource is being exploited differently in different regions of India. This uncontrolled extraction of groundwater sources need to be checked and require a strict government regulation.
- **Atmospheric Water:** Hydrological cycle is a global process that connects land, ocean and atmosphere together and in it water cycles from clouds to land to ocean and then back to clouds. In this atmospheric process water transforms into its different forms resulting in exchange of energy between the three connected platforms causing climate variations. It includes precipitation and evaporation along with freezing, melting and condensation where the Earth, since its evolution, controlled the atmospheric circulation of water and associated both surface water and groundwater. Thus water remains in the atmosphere in the form of water vapour and is observed as moisture content denoted as humidity. Then clouds are formed and water precipitates on the ground mostly as rain, snow or hail.
- **Oceanic Water:** Ocean is a major component of water cycle. It contains 97% of total water on Earth and 78% of total precipitation occurs over it. By controlling the atmospheric water vapours ocean regulate the rainfall. 86% of total evaporation happens from the ocean thereby cooling the ocean surface and subsequently consuming major quantity of heat content released from global warming.

#### **Water Resource Management**

We need an efficient water resource management system to sustain over a billion population of our country. It is necessary for ensuring ecological balance and achieving sustainable development. Per capita water availability is falling and in some states we are water stressed and unless an integrated water management policy is adopted we are gradually moving towards water scarcity. Some basic ideas that need to be adopted for efficient water resource management include:

- Management of Flood
- Management of Drought
- Management of Ground Water
- Checking Water Quality Deterioration
- Conservation of Water
- Recycle and Reuse of Water
- Reduction in Water Demand
- Watershed Management
- Desalinisation of Water
- Rainwater Harvesting

## Conclusion

Water scarcity has been indicated by Falkenmark Water Stress indicator which is compared in terms of per capita availability of water in cu m per year. The condition is assumed safe if water availability per capita per year is more than 1700 cu m. It indicates a condition of water stress if per capita availability of water becomes less than 1700 cu m and if per capita availability of water falls to less than 1000 cu m then it becomes a condition of water scarcity. In India per capita availability of water is continuously decreasing. It was safe over 1700 cu m up to 2001 but the value fell below 1700 cu m in a decade and in 2011 it was around 1651 cu m and our country entered into a state of water stress. In 2021 this value fell to 1486 cu m and we are continuously nearing 1000 cu m mark with passage of time. Presently as per the Falkenmark Water Stress indicator India is a water stressed country but we are possibly standing at the verge of turning into a region of water scarcity. This will together bring an era of food insecurity in our country. We need to ensure sustainability in managing our water resources and for this demand and supply of our water resources need to be balanced.

Even global warming has led to variations in temperature and this has resulted in bringing changes in the pattern of precipitation. As a result serious variations have been observed in the hydrological cycle and this has led to drastic impacts on regional water resources of our country. This has influenced the demand and supply of water and quality of water has also shown a change. This has been observed more in arid and semi-arid regions which have very little precipitation. Arid regions include the desert of Rajasthan, Rann of Kutch and the rain shadow regions of the Western Ghats including Maharashtra, Karnataka and Tamil Nadu. These arid regions have rainfall less than 25 cm per year. The semi-arid regions are included from the state of Punjab and Gujarat where rainfall is between 25 to 50 cm per year. Global warming is causing rise in the temperature and more than 50% glaciers in the Himalayas have retreated and the melting of glaciers in the Himalayas have caused abrupt impact on the availability of water in the rivers that flows through the Gangetic plains thereby affecting the residing population drastically. The climate change has resulted in extreme rainfall events in certain major river basins of our country leading to increase in floods. Frequency of precipitation has increased causing more intense floods and since last few decades natural disasters are also more frequent. This also has a serious impact on our economy. In 2015 the member states of the United Nations (UNs) have pledged implementation of Sustainability Development Goals (SDGs) to end poverty. By 2030 these SDGs are projected to ensure peace and prosperity to all our people and protect our planet. There should be some regulatory body to efficiently control water by different stake-holders. Limits should be fixed for all type of users like domestic, industrial and agriculture otherwise there is strong possibility for conflicts among them.

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