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## EMERGING GROUND WATER CRISIS IN INDIA AND ITS SOLUTION

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**ABSTRACT**

There is a total of 1,46,00,000 cubic kilometers of water present on the earth. Out of this, 97 percent is in the oceans, which is not useful for us due to being saline, and 1.6 percent is under the water and 0.001 percent is in the form of vapor and clouds and other glaciers and mountain peaks are in the form of ice. Even in this minimum quantity of available water, the question mark of quality is being raised at some places and the life of every living being found on earth depends on water. Hence its availability is absolutely necessary. The free or free gift of nature, which we consider water, is not free but a valuable gift. So we should understand that every drop of water is precious. If we do not use and conserve and manage water judiciously, then our very existence will be threatened. Thus, in view of the increasing water pollution and the lack of water quality, many types of campaigns and programs have been run by the government from time to time, out of which **Heli-Born Survey technology**, '**Jal Shakti Abhiyan: Catch the Rain**' campaign on World Water Day 2022, **Bhujal Badhao Payjal Bachao**' (Enhance Ground Water, Protect Drinking Water) Limca Book of Records in February 2020 is the main campaigns to improve the quality of groundwater. The Union Minister, Dr. Jitendra Singh launched the state of the art Heli-Born Survey Technology on October 5, 2021.

This project has been developed with the objective of mapping potential groundwater sources and its management to provide safe drinking water to the people in water scarce arid regions of India. This project will make a positive contribution to CSIR's water technologies "**Har Ghar Hal Se Jal**" scheme from water source discovery to water purification as well as "doubling farmers' income targets".

**Keywords:** *Ground water, Glaciers, Conserve, Abhiyan, Heli-Born*

### **STUDY AREA AND METHODOLOGY**

In this research paper, we have used them wisely in our research paper, describing the campaigns undertaken by the government from time to time to improve the quality of water in order to improve groundwater. All these campaigns were related to all those parts of the country and the state where there is aridity, water table going down and water quality is deteriorating day by day. We have used the data of the research paper presented by the Government of India, a journal related to underground water and a geographer. Heli Survey Technology was introduced for

groundwater management. This technology is developed by CSIR-NGRI Hyderabad. This survey will help in using groundwater for drinking purposes. This technique (Heli-Born geophysical mapping technique) will provide a high-resolution 3D image for the subsurface up to a depth of 500 m below ground level. Maps based on QGIS have also been used with the help of these data. For this research paper, I have taken the help of primary data as well as secondary data.

### **OBJECTIVES OF THE STUDY**

- High-resolution aquifer mapping and identification of sites for artificial

recharge using Heli-Borne geophysical studies.

- The main advantages of the Heli-Borne Geophysical Survey are that it is fast, highly data intensive, accurate and economical.
- Preparation of 3D geophysical models and geophysical thematic mapping based on horizontal and vertical plains.
- Aquifer geometry of major aquifers with demarcation of unsaturated and saturated aquifers.
- Rocks in which groundwater accumulates are called aquifers. These are usually made of gravel, sand, sandstone or limestone.
- The spatial and intensive distribution of a paleochannel (river bed) network, if it has any connection with the aquifer system.
- A paleochannel is a remnant of a dry river or stream channel and is filled by new sediments.
- Selecting suitable sites for groundwater extraction and water conservation through artificial or managed aquifer recharge.
- This study is likely to generate groundwater data in a very short time and will help CGWB to speed up the groundwater management plan in water scarce areas.

## INDIA AND GROUNDWATER

- India is the largest user of groundwater in the world and is being exploited at the rate of 253 billion cubic metres (bcm) per year.
- This accounts for about 25% of global groundwater extraction.
- Out of a total of 6584 assessment units, 1034 are classified as 'over-exploited', 253 as 'critical', 681 as 'semi-critical' and 4520 as 'safe'.
- The remaining 96 assessment units are classified as 'Saline' due to non-availability of fresh groundwater due to salinity problems.
- Water Availability:
- India has about 1123 bcm of water resources available, of which 690 bcm is surface water and the remaining 433 bcm is groundwater.
- 90% of the available groundwater is used for irrigation purposes, mainly for agricultural purposes.
- The remaining 10% is used for both domestic and industrial purposes.

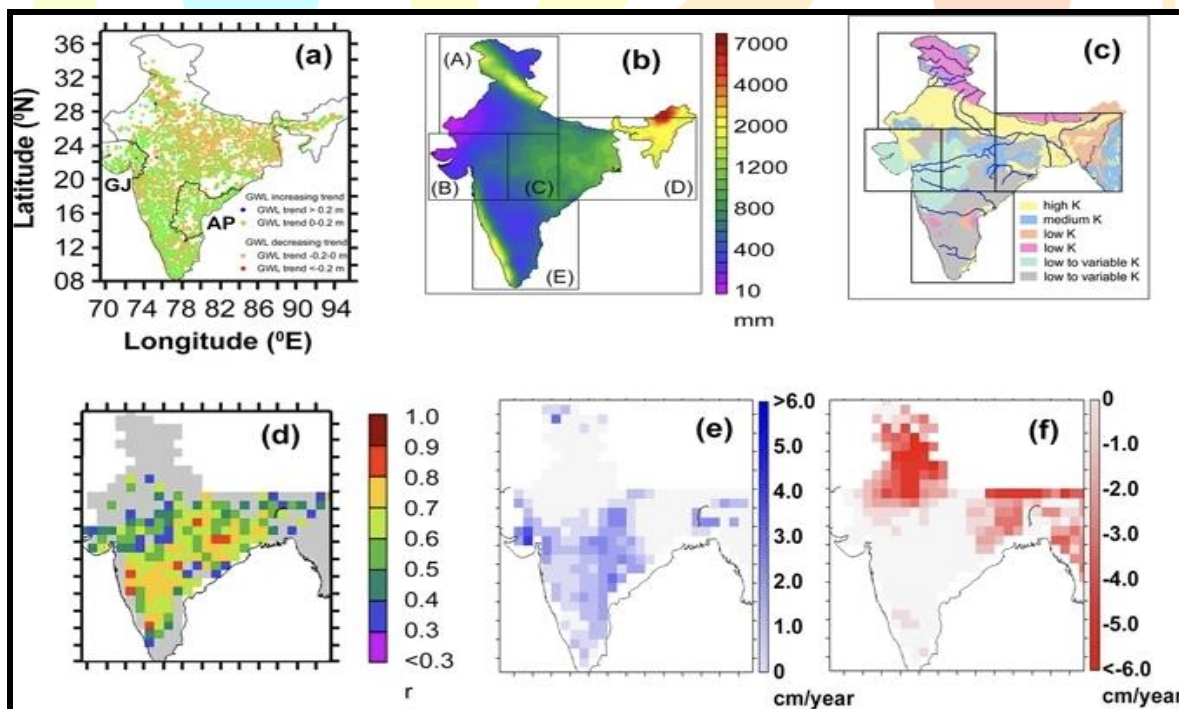
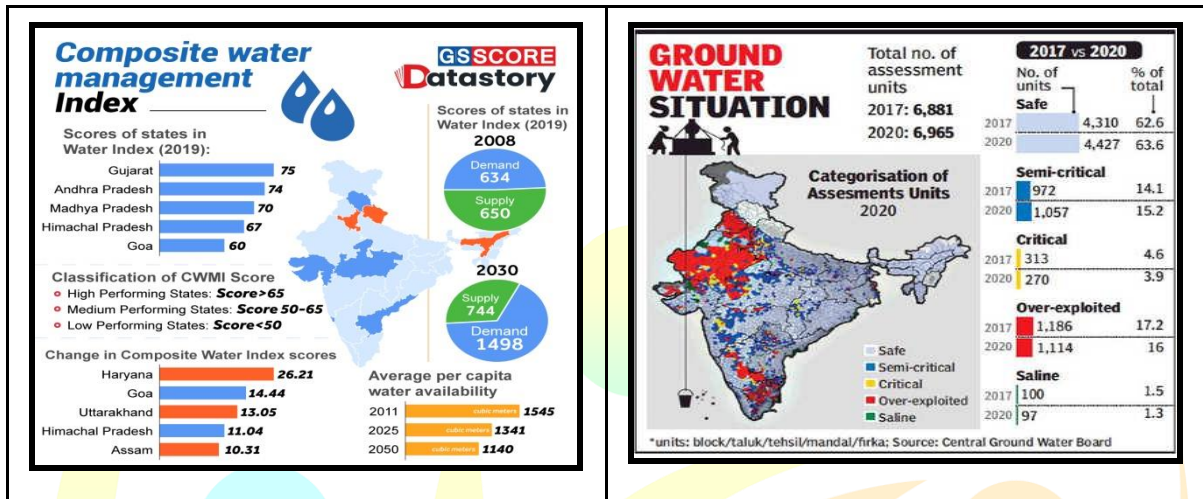
## WATER CRISIS IN INDIA

- According to the Composite Water Management Index (CWMI) report released by NITI Aayog in 2018, 21 major cities (Delhi, Bangalore, Chennai, Hyderabad and others) have reached zero groundwater level by the

year 2020. About 100 million people are likely to be affected.

- The CWMI report also states that the country's water demand is expected to double the available supply by 2030,

leading to severe water shortages for millions of people and 6% of the country's GDP. loss may occur.



Source : By QGIS software on secondary data

- Almost half the country including Maharashtra is facing water scarcity. Apart from Maharashtra, Tamil Nadu, Karnataka, Rajasthan, some parts of

Gujarat, Punjab and Haryana are facing water scarcity at unprecedented levels.

- (a) The study area including groundwater level (GWL) trend (calculated based on culled, temporally continuous groundwater level measurements [n = 4316] between 1996 and 2014).
- (b) annual mean precipitation (mm/year) between 1979 and 2014. Rectangular outlines indicate the five hydro-meteorological zones (A to E) delineated based on the duration of the hydro-meteorological seasons (monsoon, post-monsoon and pre-monsoon).
- (c) map of different aquifer types, classified based on hydraulic conductivity (K). Major rivers are marked by blue lines.
- (d) map of significant correlation coefficient (r, p value 0.05) between GWSobs and GWSsat.
- Maps of trends of (e) positive (blue), and (f) negative (red) GWSsat anomalies, respectively. All the maps were made using the Ferret program (NOAA), QGIS software 47 and standard graphical illustrators.

#### REASON OF FALLING STANDARD OF GROUNDWATER

- At the time of the first census conducted in 1901, the population of India was 238 crores, which increased to 400 crores at the time of independence in 1947. In 2001, the

population of India was 103 crores. At present the population of the country is 130 crore (1.30 billion). According to an estimate, the population of India will reach 139 crore by 2025 and 165 crore by 2050. This increasing population will put tremendous pressure on drinking water, especially on ground water.

- While the need for water has increased due to an increasing population, the availability of water per capita is also decreasing with time. According to the total estimates, the water requirement in the year 2000 was 750 billion cubic metres (cubic kilometres) i.e. 750 GCM (million cubic metres). This water requirement will increase to 1050 GCS by 2025 and 1180 BCM by 2050. At the time of independence, the average per capita availability of water in the country was 5000 cubic metres per year. In the year 2000, it came down to 2000 cubic metres per year. By 2050, the per capita availability of water is expected to be less than 1000 cubic metres per year.

- Water level is falling due to increase in population .

- Increasing industrialization and rapid migration from villages to cities and expanding urbanisation have also put pressure on ground water sources along with other water sources. All

these factors have also been responsible for the rapid fall of the ground water level.

- The problem of water pollution gave birth to the culture of bottled water. Companies selling bottled water exploit groundwater heavily. As a result, the groundwater level declines. Significantly, India is the tenth largest consumer of bottled water. The per capita bottled water consumption in our country is five liters annually as against the global average of 24. The bottled water business in the country till 2013 was 60 billion rupees. It is expected to grow to 160 billion by 2018.
- Earlier there were many ponds, whose tradition has almost ended now. The water of these ponds was absorbed into the ground and worked to enrich the groundwater. But, with the changing times, the greed for land and wealth increased among the people, which worked to destroy the ponds. However, due to deteriorating rainfall, many ponds dried up. The land mafia did the right thing. They bridged the ponds and erected big buildings on them or made agricultural farms.
- Groundwater is created only due to the water received from different sources reaching the ground from the surface. One of these sources is rain water

which seeps through permeable rocks and reaches inside. Water also collects in rock stomata. When a rock is completely filled with water, it is called a saturated rock. Due to the closure of the rock stomata, water cannot seep down. In this way the water gets collected as the water does not seep down. This collected water is called an aquifer.

- The growing modernization environment has also increased the consumption of water to a great extent, such as if we look at our past, then in the morning and evening we used to go to the toilet in the open with a bottle of water. During which the maximum amount of water was used by a person up to 1 liter. It is believed that defecation in the open cause's air pollution, if during that time the soil is molded on the defecation, and then it very quickly converts into manure and increases the fertility of the land as well as the vegetation grown in that area is beneficial for all of us. Would have acted as a curtain and today we would not have needed to build toilets in every house and could keep the ground water from getting polluted every day. But today, in view of the increasing cleanliness campaign, we often get to see toilet facilities in

every house and once a person goes to the toilet to get fresh, the quantity of seven to ten liters of water is used once in flush. . Thus, if there are four to five persons in a family, 40-50 liters of water is used during a time (Morning / Evening). Which is proving to be very dangerous for the quality of groundwater.

- At present, the increasing solar plate (Surya energy) is also having a bad effect on the ground water because due to the installation of solar plate in the farmer's field, there has been a change in his psychological attitude. The medium was diesel oil, canal irrigation or rain, which affected the economic condition of the farmer, due to which there was not much change in the fertility of the land and water level and water quality due to limited amount of water on the land.
- But due to the installation of solar plates, the same thing is going on in the minds and hearts of the farmers that my crop does not have to face drought, as a result of which the same farmer is giving water in the field six to seven times in the crop which requires irrigation four times. At the same time, this farmer wants to strengthen his economic condition by giving the water received by the sun energy on rent to other farmers. The

consequences of which are coming in front of us in the present too, but in future a very big problem of groundwater is going to come in front of us such as the water level going down and the water quality decreasing due to excessive drainage, that is the salinity of the water increase in quantity.

- Apart from rapidly increasing population, increasing industrialization, expanding urbanization, climate change resulting from global warming is also responsible for this.

#### **EFFECTS OF CLIMATE CHANGE ON DIFFERENT SOURCES OF WATER**

- Climate change resulting from global warming has disturbed the water cycle of rainfall, reducing the amount of rainfall. On the other hand, due to indiscriminate cutting of trees, forest areas are turning into concrete forests. As a result, the rain water is not absorbed inside the land, which is of no use due to being saline.
- Every year one percent of the earth's area turns into a desert due to the cutting of forests.
- The soil moisture is decreasing due to cutting of firewood for cooking, due

to which the groundwater level is depleting rapidly.

- The situation is even direr in the hilly areas. At the same time, every year, forest wealth worth cores is destroyed due to forest fires, natural water sources also dry up. Due to lack of water storage inside the ground, the ground water level gets affected badly. Most of the forest land in the mountains is covered with pine trees. Due to this rain water is not properly absorbed inside the land. Not only this, there are other disadvantages of pine trees. In summer, fire breaks out in pine trees, due to which the forest wealth worth crores is destroyed, many traditional water sources also dry up. It indirectly affects the ground water level. Pine trees are also good conductors of electricity. Therefore, there are more incidents of cloudburst near the pine forests. Thus, there are many reasons behind the falling level of groundwater.
- But I also believe that 30-40 years ago, the amount of rainfall was so low that our family members used to know as a famine (drought). Whereas at that time there was a lot of trees and plants on the earth or I can say that during that time the erosion of trees was negligible and at that time the sources of pollution like industries, factories ,

petrol-diesel and coal. There were also very few means of movable transport.

I want to say that in the confusion of this nature, when industries, business and means of transport were less, then dust particles, poisonous smoke, carbon particles and other invisible types of particles in the form of pollution in the atmosphere, which act as hygroscopic nuclei. Their quantity was less. Due to which the amount of water in the cloud could not be fully absorbed. But at present the opposite situation remains, the decreasing number of trees and plants is increasing day by day, while the quantity of industry, factories and means of transport is increasing manifold every year. Due to which the pollutant particles in the atmosphere are increasing day by day in the atmosphere, which play an important role in absorbing the water vapor present in a cloud. Due to which, before the arrival of the rainy season, these pollutants bring high results of temperature in front of us and during the rainy season or a few days before it, they cause a flood-like situation by breaking the record rain which lasts for 30-40 years. Earlier there was a situation of famine, quite the opposite condition remains in front of us today.



For which we ourselves are responsible for climate change.

### **GROUND WATER STATUS IN DIFFERENT STATES**

- Though the Central Ground Water Board and State Ground Water Organizations (CGJSGOs) have also taken several steps in the direction of ground water development since the last few decades, the overall status of ground water development in the country is hardly 58 per cent. The status of groundwater exploitation has been found to be different in different states. The situation of groundwater in some states is such that it is not fully utilized while in some other states situations of over-exploitation have arisen. Orissa, West Bengal, Assam, Bihar, Tripura, Kerala and Madhya Pradesh are examples of states in which groundwater is not fully exploited. On the contrary, in Punjab, Haryana, Rajasthan, Gujarat, Tamil Nadu, Karnataka and Uttar Pradesh over-exploitation of groundwater has led to environmental crisis. In particular, Ropar, Fatehgarh Sahib, Ludhiana, Gurdaspur, Nawanrahar, Jalandhar, Patiala, Sangrur, Amritsar, Ferozepur, Monga, Mansa, Kapurthala and Faridkot districts of Punjab state, which cover 90 percent of the state's

area, have over-exploitation of groundwater. Has happened. Similarly, in the following districts of Haryana State, Kurukshetra, Mahendragarh, Panipat, Rewari, Karnal, Kaithal, Gurgaon, Bhiwani, Yamunanagar, Fatehabad and Sonipat have over-exploited groundwater.

- Over-exploitation of groundwater has given rise to many problems. Actually, groundwater should be used like a deposit in a bank. What happens if more money is withdrawn from the bank than the deposited amount ? So your check will bounce straight away. Similarly, the amount of water that is conserved inside the earth should be drained accordingly. At present, less water is being stored inside the ground and more is getting discharged through various means. Due to which the ground water level is also going down due to over-exploitation of water.

### **PROBLEMS ARISING OUT OF OVER-EXPLOITATION OF GROUNDWATER**

- Many problems are arising due to excessive exploitation or misuse of groundwater. Over-exploitation not only results in depletion of groundwater levels, but also creates the problem of drying up of shallow

wells. Along with this, due to the entry of sea water into the groundwater, it is becoming saline and this water is also getting polluted due to polluting elements.

- Apart from wells and hand pumps, groundwater is also drawn through tube wells. Tube wells can also be used to drain water from great depths. But tube wells affect shallow or low depth wells as the water from these wells goes into the tube well. As a result, wells dug at shallow or low depths dry up. Most of the farmers have dug wells of less depth. Due to the drying of these wells, the crops of the farmers are destroyed and they reach the verge of starvation.
- The salt water of the sea enters the groundwater by digging deep wells in the seaside states of Gujarat etc. Far from living, such water is not even suitable for irrigation. Rivers are drying up due to over-exploitation of groundwater and trees standing on the banks of the river are drying up. It is believed that the Sabarmati River in Gujarat is drying up due to over-exploitation of groundwater.
- Due to the water being drawn from more depth by tube wells, harmful chemicals like arsenic, fluoride etc. lying in the womb of the earth come

up which pollute the groundwater and give rise to many diseases.

- Small amounts of fluoride are essential for the development of our teeth and bones. The upper layer of teeth, the enamel, is formed by fluoride. The amount of fluoride in the body is acceptable from 0.5 to 1.0 ppm (parts per million). But if its quantity exceeds ppm, then it is harmful for teeth and bones. Excess fluoride causes tooth loss and also affects the bones of the spine, legs, ribs and skull. This disease caused by excess fluoride is called fluorosis.
- Arsenic is also very harmful for health. Diarrhoea, vomiting, body cramps, etc. can be seen as initial symptoms. It affects the lungs, kidneys, liver and skin. It can also lead to kidney and liver cancer.
- The presence of nitrates in groundwater is also harmful to the body. This is a carcinogenic factor and due to this a disease called cyanosis occurs in young children, due to which the skin of children turns blue. Hence, it is also called 'blue baby syndrome' in children. It also affects cattle, causing a drastic reduction in their milk production.
- Heavy metals like cadmium, mercury, lead, and copper are also

present in groundwater. They give rise to various diseases in the body.

- Thus the ground water situation in the country is very serious and worrying. Necessary steps need to be taken in this direction at the earliest. There are also some suggestions which can be followed to improve the level and quality of groundwater.

**SOME MOST IMPORTANT SUGGESTION TO IMPROVE GROUND WATER:-**

- In order to improve the present condition of groundwater, we will have to make arrangements for groundwater enrichment with proper measures, apart from working in this

direction to ensure that the level of groundwater does not fall further.

- Rain water conservation - Depth of wells and tube wells has to be fixed. Drilling should be done only up to about 400 feet (120 mtrs). But due to water resources being a state subject, the Centre should give guidelines and strictly follow it for the notified areas, at present it is not possible after a limit. But, awareness ("Jal Hai To Kal Hai") can be created among the people at the local level by NGOs. Such crops should be grown by farmers in which water consumption is minimum. Efforts should be made to popularise drip and sprinkler irrigation systems for irrigation.



- In addition, it is also necessary to adopt groundwater recharge

techniques. Rainwater harvesting can be an effective measure in this direction. This can be accomplished

by harvesting both the heavy rooftop rainwater and surface runoff received on the roof. In this way, the quality of ground water will improve by stopping the wasted water during the rainy season and its recharge capacity will also increase.

- Rainwater harvesting in saline or coastal areas reduces the salinity of groundwater. and helps in maintaining the hydro chemical balance between freshwater and saltwater. Due to the limited amount of freshwater in the marine archipelago, rooftop rainwater harvesting is the most important source for domestic use. In deserts where rainfall is very less, people get relief from rainwater harvesting. Rooftop rainwater harvesting is generally preferred in mountainous areas.
- In hilly and hard rock areas, there are many possibilities of groundwater augmentation through artificial recharge. In the coming decades, more and more emphasis will have to be given on augmentation of groundwater resources through these techniques. Through artificial recharge, especially in rural areas, the work of groundwater enrichment can be carried out by saving the wasted water through slopes, rivers and streams. Alley plugs, contour dams, gabion

structures, check dams, percolation tanks, recharge i.e. recharge shafts, well recharge i.e. dug well recharge, ground water dams, creek dams, subsurface dykes are some of the techniques of artificial recharge. By adopting these, groundwater enrichment work can be promoted.

- As mentioned earlier, one of the reasons for the depleting groundwater level is the rapidly depleting forest areas. In hilly areas, preferring planting of oak (Baanj) and rhododendron (Buransh) and other types of broad-leaved trees instead of pine trees can help in the task of groundwater enrichment.
- At the time of independence in our country, a mixture of surface and groundwater was used in almost equal quantity. By adopting this, the increasing pressure on groundwater can be reduced.
- Water obtained from ground water is also used for various activities of daily living like gardening, car washing, bathing, brushing, washing utensils etc. This water should be used very sparingly. It is necessary to spread awareness about using water sparingly, so the saying "**drop-drop water is priceless** " speaks to all the family members' can be very helpful in spreading this awareness. In this

way, avoiding wastage of water will indirectly encourage the work of groundwater enrichment.

- Exhibitions, documentary films, informational advertisements etc. can also be taken to make the general aware about the groundwater resources and to educate them about the importance of water. In recent years, remote sensing, satellite-based image analysis and geographic information systems (GIS) have helped in the management of groundwater resources. There is a need to promote such advanced techniques in future in the monitoring and management of ground water.

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