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GROUND WATER MAKE INVISIBLE TO VISIBLE

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Introduction

Over 70% of the earth's surface is covered in water. But of that water, just 1% is readily available for human use, and of that 1%, 99% of it is stored beneath our feet as groundwater. We all rely on groundwater in some way, so it's important that we understand this vital resource.

What is ground water?

Groundwater is the water found underground in the cracks and spaces in soil, sand and rock. It is stored in and moves slowly through geologic formations of soil, sand and rocks called aquifers.

How the ground water is formed

Groundwater is the water located beneath the earth's surface in soil pore spaces and in the fractures of rock formations. A unit of rock or an unconsolidated deposit is called an aquifer when it can yield a usable quantity of water. The depth at which soil pore spaces or fractures and voids in rock become completely saturated with water is called the water table. Groundwater is recharged from, and eventually flows to, the surface naturally; natural discharge often occurs at springs and seeps, and can form oases or wetlands. Groundwater is also often withdrawn for agricultural, municipal, and industrial use by constructing and operating extraction wells.

How much do we depend on groundwater?

1. Groundwater supplies drinking water for 51% of the total U.S. population and 99% of the rural population.
2. Groundwater helps grow our food. 64% of groundwater is used for irrigation to grow crops.
3. Groundwater is an important component in many industrial processes.

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4. Groundwater is a source of recharge for lakes, rivers, and wetlands.

Ground Water availability and its utilisation in India

As per the latest assessment, the annual replenishable ground water resource of country has been estimated as 433 billion cubic meter (BCM), out of which 399 BCM is considered to be available for development for various uses. The status of ground water development is comparatively high in the states of Delhi, Haryana, Punjab and Rajasthan and UT of Daman & Diu and Pondicherry, where the Stage of Ground Water Development is more than 100%, which implies that in these states the average annual ground water consumption is more than average. Delhi is the third most 'over exploited' groundwater state in India after Punjab and Rajasthan according to a report prepared by the Central Ground Water Board (CGWB). Ground water is also now over-exploited for irrigation purpose especially in green revolution areas of Punjab-Haryana-Western Uttar Pradesh region.

Causes for ground water depletion:

1. **Groundwater depletion most commonly occurs because of the frequent pumping of water from the ground.** We pump the water more quickly than it can renew itself, leading to a dangerous shortage in the groundwater supply. As a growing world with a population that continues to rise, the more we pump water from the ground at a rapid rate, the more difficult it is for the groundwater to provide us with the amount of water that we need.
2. **We continuously pump groundwater from aquifers and it does not have enough time to replenish itself:** Water flows freely through the saturated rocks known as aquifers. There are large and small aquifers, and they are the underground water reserves that absorb water and hold it, enabling us to pump it for use.
3. **Agricultural needs require a large amount of groundwater:** It's frightening to think that there isn't very much groundwater left when you consider how much water we use on a daily basis to support our population of billions and our personal lifestyles. A large amount of groundwater goes to farming, but the availability of groundwater is steadily declining.
4. **Groundwater depletion can also occur naturally:** The problems we would face with freshwater shortage is sure to cause problems in every aspect of our lives. The activities

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that lead to groundwater depletion come mostly from humans, but a portion of it also comes from changes in our climate and can speed up the process.

Effects of Groundwater Depletion:

1. **Groundwater depletion will force us to pump water from deeper within the Earth:** The more we extract groundwater right below the Earth's surface, the further down we have to go in order to get more. As we have to extract water from deeper within the Earth, we find that there is less water available. Consequently, we will have to use even more resources to develop alternative methods to reach further into the ground.
2. **Large bodies of water will become more shallow from groundwater depletion**: A groundwater shortage keeps additional water from flowing into lakes, rivers and seas. This means that over time, less water will enter as the existing surface water continues to evaporate. As the water becomes less deep, it will affect everything in that particular region, including fish and wildlife.
3. **Saltwater contamination can occur:** We may pump groundwater instead of sourcing it from lakes and rivers, but that doesn't mean that it isn't connected to larger bodies of water. Groundwater that is deep within the ground often intermingles with saltwater that we shouldn't drink. When freshwater mixes with saltwater, it is called saltwater contamination. This sort of contamination would raise the prices of drinking water for everyone because it will cost much more to pump and filter
4. **As large aquifers are depleted, food supply and people will suffer:** The depletion of the Colorado River and the Ogallala aquifer serve as examples of large groundwater reserves that are being depleted, despite how necessary they are to our economy and well-being. The Ogallala aquifer has been collecting groundwater for thousands of years, and its water resources have to be shared among farmers and citizens.
5. **A lack of groundwater limits biodiversity and dangerous sinkholes result from depleted aquifers:** Aquifers collect groundwater and are extremely important. For example, the residents near the Gulf of Mexico and Mexico City rely solely on aquifers. Wildlife, marine animals, and agriculture continue to suffer near the Gulf of Mexico because the Mississippi River runoff from industrial farming materials finds its way into the water. Parts of Mexico City are falling as the water table lowers and creates sinkholes that destroy buildings and homes.

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Solutions to Groundwater Depletion:

1. **As individuals, one of the things we can do to make a difference is to use less water for luxury purposes.** We must all address the issue of groundwater depletion. Considering the impending crisis of a mass water shortage, everyone should do their part to use less water whenever possible. Water is used so freely that it is often part of outdoor decor ideas and used for major attractions, such as amusement parks.
2. **We should reduce our use of chemicals and dispose of them properly:** Many people are not paying attention and are simply unaware of how important it is to keep pollution from occurring beneath the ground. The water from businesses and private residences that run into the streets and sewage systems are commonly laden with chemicals. These chemicals find their way into larger bodies of water and absorb into the ground, poisoning animals and the soil. By using less chemicals and discarding of them carefully, we keep them from adding toxic materials into our water supply.
3. **More comprehensive research and additional funding can help with groundwater depletion.** The best way to approach the topic of groundwater depletion and to find a solution is to think on both a personal and government level. Laws that are in place for the pumping of groundwater should be more strict and follow specific regulations.
4. **One of the most effective ways to address the issue of groundwater depletion is to find alternative sources of water.** Alternative water sources can be used to help replenish aquifers. Deriving water from other sources would also give aquifers time to refill instead of pumping too much water from them at once.
5. **The pumping of groundwater should be regulated.** If we don't have a better understanding of our groundwater supply, then we can easily use much more than we should. Understandably, more funding should be granted towards researching our groundwater supply instead of just pumping the water, so that we can set limits and better pace our usage. Additional funding should be given to support initiatives that not only study the supply of groundwater we have, but also seek to find sustainable ways to use less of it.
6. **World Water Day 2022: Date, Theme History and Significance.** A principal focus of World Water Day is to support the achievement of United Nations' Sustainable Development Goal 6, which is to ensure safe water and sanitation for all by 2030. The

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theme of World Water Day this year is "Groundwater, making the invisible visible". The events and programmes, organised on this day, focus on the importance of groundwater. Many organisations, groups and leaders call on people to be mindful of this depleting resource

Techniques to recharge ground water:

Method # 1. Spreading Basins:

This method involves surface flooding of water in basins that are excavated in the existing terrain. For effective recharge highly permeable soils are suitable and maintenance of a layer of water over the highly permeable soil is necessary. When direct discharge is practised the amount of water entering the aquifer depends on three factors—the infiltration rate, the percolation rate, and the capacity for horizontal water movement. At the surface of aquifer, however, clogging occurs by deposition of particles carried by water in suspension or in solution, by algae growth, colloidal swelling and soil dispersion, microbial activity, etc. Recharge by spreading basins is most effective where there are layer below the land surface and the aquifer and where clear water is available for recharge.

Method # 2. Recharge Pits and Shafts:

Conditions that permit surface flooding methods for artificial recharge are relatively rare. Often lenses of low permeability lie between the land surface and water table. In such situation artificial recharge systems such as pits and shafts could be effective in order to access the dewatered aquifer. The rate of recharge has been being found to increase as the side slope of the pits increased. Unfiltered runoff water leaves a thin film of sediments on the sides and bottom of the pits, which require maintenance in order to sustain the high recharge rates. Shafts may be circular, rectangular or square cross-section and may be back filled by porous materials. Excavation may be terminating above the water table. Recharge rates in both shafts and pits may decrease with time due to accumulation of fine-grained materials and the plugging effect brought by microbial activity.

Method # 3. Ditches:

A ditch is described as a long narrow trench, with its bottom width less than its depth. A ditch system is designed to suit topographic and geological condition that exists at the given site. A layout for a ditch and flooding recharge project could include a series of trenches running down the topographic slope. The ditches could terminate in a collection ditch

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designed to carry away the water that does not infiltrate in order to avoid ponding and to reduce the accumulation of fine materials.

Method # 4. Recharge Wells:

Recharge or injection wells are used to directly recharge the deep-water bearing strata. Recharge wells could be dug through the material overlaying the aquifer and if the earth materials are unconsolidated, a screen can be placed in the well in zone of injection. Recharge wells are suitable only in areas where thick impervious layer exists between the surface of the soil and the aquifer to be replenished. They are also advantageous in areas where land is scarce. A relatively high rate of recharge can be attained by this method. Clogging of the well screen or aquifer may lead to excessive buildup of water level in the recharge well.

Method # 5. Harvesting in Cistern from Hill Sides:

In this method construction of small drains along contours of hilly area are done so that the runoff in these drains are collected in a cistern, which is located at the bottom of a hill or a mountain. This water is used for irrigation or for drinking purpose and the water is of good quality.

Method # 6. Subsurface Dams:

Ground water moves from higher-pressure head to lower one. This will help in semi-arid zone regions especially in upper reaches where the ground water velocity is high. By exploiting more ground water in upper reaches more surface water can be utilized indirectly, thereby reducing inflow into lower reaches of supply. Ground water is stored either in natural aquifer materials in sub-surface dams or in artificial sand storage dam.

Method # 7. Farm Ponds:

These are traditional structures in rain water harvesting. Farm ponds are small storage structures collecting and storing runoff waste for drinking as well as irrigation purposes. As per the method of construction and their suitability for different topographic conditions farm ponds are classified into three categories such as excavated farm ponds suited for flat topography, embankment ponds suited for hilly and ragged terrains and excavated cum embankment type ponds. Selection of location of farm ponds depend on several factors such as rainfall, land topography, soil type, texture, permeability, water holding capacity, land-use pattern, etc.

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Method # 8. Historical Large Well across Streamlet:

If any historical wells are located near the streamlet, then allow the water into the well from streamlet by connecting drains. In this case the historical wells act as a recharge well so that ground water can be improved.

Method # 9. Check Dams:

Check dams are small barriers built across the direction of water flow on shallow river and streams for the purpose of rain water harvesting. The small dams retain excess water flow during monsoon rains in a small catchment area behind the structure. Pressures created in the catchments area send the impounded water into the ground. The major environmental benefit is the replenishment of nearby ground water reserves and wells. The most common case of check dams is to decrease the slope and velocity of a stream to control erosion.