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A Study on Approach to Groundwater Management towards Sustainable Development in India

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Abstract – In India its large geographical region (3,287,000 km2), where nearly 1250 million citizens reside, to control groundwater supplies for sustainable growth is a problem. The country is therefore quite often confronted with a shortage of drinking water. This includes management activities for safe groundwater resource production. The aim of this paper is to concentrate on the need to incorporate adequate management strategies for sustainable groundwater resources growth. In view of the condition of groundwater in India expressed in published literature, the causes of scarcity, aquifers and groundwater assessments were clarified in India. This research has proposed a future solution to the conservation of groundwater to fulfill the target of sustainable growth. The study shows that the country sometimes has drinking water shortages, despite the presence of adequate groundwater supplies.

Key Words – Groundwater, Sustainable Management, Approach

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INTRODUCTION

India is an enormous nation (3287000 km2), the fifth largest country in the world (Fig. 1). The nation provides rich natural resources in physiography, geology, rocks, atmosphere and solar power. The Country's rich history and community has been used for human growth since time immemorial. Groundwater is among these, which is used for agriculture, beverage, agricultural supply and home purpases as the most important natural resource for human production (Siebert et al. 2010; Kulkarni et al. 2015; Zaveri and al. 2016; Zhang etal. 2017, Selvakumar et al. 2017). Since the country's population is large (around 1250 million people), freshwater uses have risen in many ways over the past 40 years, contributing to shortage circumstances (Srinivasan etal. 2013; McDonald et al. 2014). India currently has approximately 1250 million inhabitants. It is important to use both surface water and groundwater supplies for achieving the food protection of such a large population. Over the years, Indian Government has established big, medium and small dam projects on the rivers to facilitate irrigation. The actual usage of stored water, from the usable storage of 690 bcm, corresponds to just 396 billion cubic metres (bcm). The existing irrigation dependent on groundwater amounts to 35.4 Mha, with a capacity for irrigation of 25.8 Mha. The gross irrigated area is therefore 61.2 ha, which means that groundwater contributes 58 percent to irrigation. In view of the huge population all existing services need to be used (Vora 1975; Rodell et al. 2009; Imam and Banerjee 2016). This then calls for effective soil and surface water management strategies to be introduced.

Fig. 1 -Topography map of India (www.mapsofindia.com)

Fig. 1 - Carta topografica dell'India (www.mapsofindia.com).

Only with a proper awareness of the regulation factors impacting groundwater supplies will environmental conservation be accomplished.

APPROACHES TO GROUNDWATER MANAGEMENT

Groundwater management problems are multi-dimensional, connected to reliable water evaluation, supply and scope of supply, distribution, reuse/recycling, current scarcity, environmental waste, and safety from deterioration. However, not many systematic attempts for the management of the secret complex underwater resources were made, much like surface water resource management. The two approaches to groundwater conservation are usually appropriate:

Optimal yield: This approach makes it possible to deliberately monitor the short-term storage usage between charging events.

Controlled over exploitation: This strategy accepts the need for a persistent storage decrease if re-charge is quite small to support socio-economic growth. Groundwater management options in metropolitan communities are primarily influenced by groundwater usage trends. As well as entities, liability rests predominantly with local service providers. In general, rural consumers abstract groundwater by possessing and managing ponds. However, large-scale tubes-well construction with public financing continues to be supply-driven; legislative and regulatory requirements cannot effectively be implemented at national level; and increasing the indirect charge may function to reduce the flow of soil water, however, the recovery of deeper structures involves sophisticated injections and alternate high-quality water sources3 3. Two distinct forms of groundwater management methods derive from these features: I instruments such as electricity price, subsidies to productive technology, economic policies to deter water intensive crops, and (ii) to regulate and control particular aquifers through the resource regulator. The creation and maintenance of these services, regardless of the method taken, must be focused on sufficient information regarding and replenishment of a specific general status/situation of the groundwater aquifer system. Two main deficiencies in the management of groundwater arise with important consequences for sustainable development I failure to resolve acceleration of groundwater systems depletion by over-abstraction and effectively depleting supplies by changing efficiency (pollution, salinity, and (ii) failure to re-exercise environment fluctuations and Geographical Variability by droughts).

GROUND WATER MANAGEMENT: NEED FOR SUSTAINABLE APPROACH

Groundwater provides for nearly 89% of the world's estimated fresh water supplies. Yet freshwater loss has existed around the world in recent years because of the extraction of groundwater and the volatile existence of mousson. Land water loss has reached to the stage that the water table cannot be returned. While water from other places can be paid, the method is incredibly slow and can take a year to fill in for one metre. With respect to groundwater conservation in modern years, it has been one of the most relevant concerns. In addition, environmental issues, such as aqua for extraction, infiltration of salt water, loss in base flow, etc are also concerned. For many factors it has been impossible to control ground water supplies successfully by market processes. Against this context, the present article aims to examine India's need for sustainable management of groundwater. The article also addresses briefly the definition of sustainable management of groundwater, factors influencing the supply of groundwater, various approaches to the production and usage of sufficient soil water without affecting the hydro geological equilibrium. Furthermore the paper highlights sustainable groundwater management strategies including aquifer production, rainwater capture and artificial recharge processes. The article gives certain policy guidance for sustainable groundwater management in India.

SIGNIFICANCE OF GROUNDWATER MANAGEMENT

Fresh water in the pore area between soil and rocks or groundwater is the sub-surface water. Water also circulates within aquifers. It was calculated that about 430 billion cubic meters of water entering the soil persists on top of the soil and produces soil moisture, which is crucial to the growth of vegetation. The remaining 360 billion cubic feet, which is the true enrichment of underground water, percolates through the porous layer. Of this only around 255 milliards cubic metres of water can be collected economically. Sustainable management of soil water thus plays an important role in a country's overall growth. The main source of drinking and agricultural water is groundwater. It is a rare, readily accessible resource that provides dryness protection but is strongly related to surface water supplies and the hydrologic cycle. Its stable flow, constant consistency and temperature, relative turbidity and free of contamination, minimum losses of evaporation, and low production costs render ground water more appealing than other sources. But, simultaneously with demographic and economic development, the need for world freshwater supplies has been growing and in many countries major impacts is already being felt due to insufficient groundwater management and/or contamination. Such tendencies can contribute to severe socio-economic costs, often for the poor, especially in developing countries. Groundwater supplies have been susceptible to erosion and deterioration as a consequence of the rapid population increase, urbanization, industrialization and rivalry for economic production. Accessibility and usability in terms of quantities and consistency defines the control of these essential assets. Management methods pose multiple legal dilemmas because of the disparity between demand and supply. Planners and decision-makers have potential tasks to examine inextricable conceptual linkages between water policy and ethical concern in order to ensure an accurate, reliable and enduring production and maintenance of groundwater supplies. Ground water is always a secret resource without clear knowledge of its occurrences in time and space. So ground water conservation is essential to the durability of this critical resource in scientific terms.

GROUNDWATER MANAGEMENT IN INDIA: MAJOR ISSUES

Ground water is essential for a country like India and its proper usage. Unfortunately, no reliable surveys are made of groundwater resources, but India's groundwater deposits are projected to be about 300 million hectares or nearly tenfold of annual precipitation according to projections by the National Commission for Agriculture. The annual demand for exploitation is 45 million hectares. In the early 1960s, tube covers were used progressively by the adoption of the modern agricultural approach. While tube irrigation took place in 1960 just 1% of the net irrigated property, by 1988 approximately 27% of the net irrigated region had tube-well irrigation. In 2001, industrial water demand rose also by about 151 billion liters a day. The steps taken by government to popularize deep water wells have contributed to water tables down and down. Around the same period there was no progress in recharging the groundwater, as well as measures. Groundwater, a complex, retainable resource that may experience production across appropriate systems and that may be subject to hydro-geological and climatic conditions must primarily be measured dependent upon an annual portion recharge. There is no release or access outside governmental institutions, to groundwater data in India. Estimates for extraction and refill are often inaccurate. Discussions over the loss of groundwater are almost often focused on unreal data. But dropping tables and the loss of commercially available freshwater supplies in an agricultural nation like India have significant socio-economic implications. Rural and urban rivalry is growing and contributes to groundwater confrontation. Fallen tables also enhance the division between cultures. Poor farmers are compelled to give up irrigation, provided that dropping water tables restrict access to wells. Deep wells need more power and can therefore contribute to higher economic costs associated with oil. Food stability endangered by more of the depletion of water tables. For food production, assured irrigation is necessary. The fall in water tables renders it impossible for poor farmers to satisfy the tremendous energy demand for deepening wells that eventually contribute to a decline in food output. It is important however to find out that this critical resource to safeguard the ecosystem and sustainable agriculture growth needs to be protected urgently.

GROUNDWATER RESOURCES AND SUSTAINABLE MANAGEMENT ISSUES IN INDIA

Groundwater, as well as the tremendous value to human health and environment, are of vital significance for water and food conservation. Aquifers are the only accessible water resource in many areas, allowing freshwater the world's most abstract raw material for consumption and irrigation. Due to its relative quality and quantity stability, groundwater's position is critical in a changing climate scenario. India is tilted as a nation with its socioeconomic criteria for groundwater. India is the world's biggest groundwater producer with 243 km3 of extraction each year and absorbs more than the combined draught of the second and third highest users, that is, the Republic of China or the United States, respectively. Almost 85% of agricultural drinking needs, 62% of agriculture requirements and more than 50% of the country's urban water demand are fulfilled with aquifers. The past of Indian groundwater is remarkable in its road to food protection. The nation has seen nuclear groundwater grow, through private investment and the construction of its own wells by millions of landowners. Currently, there are more than 25 million irrigation wells in the world. The wells boast both rural economy and employment, as well as irrigation. Rising population, urbanization, industrialization, and overall growth of lifestyle infrastructures have put water more than in other areas of the world in a dynamic sector demand. After the freedom of India, annual per capita supply is drastically decreased from 5177 to 1545 m3. Both global predictions say that most of India will be water poor by 2030. The demands of rising water demand would depend on groundwater production and maintenance as aquifers provide a comparatively healthy drinking water supply and are spread through all forms of landscape and agro-climate regions. Apex agency under Govt is the Central Ground Water Commission. India has a wonderful job to promote the sustainable development of this precious natural resource, including stakeholders, planners, experts and State implementation authorities, in the area of groundwater extraction, monitoring and management.

SUSTAINABLE DEVELOPMENT OF GROUNDWATER RESOURCES IN INDIA

One of the Millennium Development Goals' priorities is to 'ensure environmental protection by incorporating sustainable development values into policies and services to reverse environmental degradation. Although land ownership rights are usually clearly established in most of South Asia, water rights are not defined. Therefore, Water, a kind of free good not regarded as an economic input, is an open access utility. The proprietors of the property are typically believed to possess the water under or across the field. This may be why the function of water was largely overlooked in providing explanation for agricultural growth in South Asia because of the ill-defined property rights to groundwater, thinking it a free commode. In the Asian agrarian economy, irrigation has often played a central role from helping prominent hydropower civilizations in the early 1960s to guiding the Green Revolution. Asia is 70% irrigated in the world and is host to some of the largest and greatest irrigation systems. Although these irrigation systems have played a crucial role in providing food protection to billions of citizens in the past, their current condition is highly desirable.

CONJUNCTIVE USE OF SURFACE AND GROUNDWATER

The 'conjunctive usage' is known as an important method to increase the overall quality of water resources production and management. In this case, groundwater and surface water are (or could be coexistent and established) developed to provide a certain irrigation channel system even if both sources are not generally utilised constantly in time and each specific water user from both sources is not supplied with the supply system. Alternatively, joint usage as 'land water use and groundwater' consists of integrating the use of the two sources of water in a harmonious manner so as to mitigate the negative physical, environmental and cost-effectiveness impact of either approach as well as to optimize water demand/supply balance.' A big problem in connection with effective conjunctive usage of surface and groundwater is to provide some administrative structure and legislative system to help it. In order to create viability for conjunctive usage in India, the number of studies has been performed by institutions and government departments. Studies have shown that the isolated usage of groundwater in irrigation management has contributed to numerous environmental issues including water logging and salinity. Furthermore, it is thought that groundwater control is important and requires a groundwater model as a limitation in the management model and can be used to schedule the conjunctive usage of water efficiently. This strategy must be endorsed by national legislation and must be carried out in a sense that assures a balanced exploitation of capital. This would entail substantial technological feedback, in particular when the consumption pool is evaluated.

GROUNDWATER MAPPING AND APPLICATION OF RECENT TECHNIQUES

Groundwater mapping includes multidisciplinary approaches for understanding, mapping and analysing diverse topics such as, aquifer description, hydraulic criteria, well preservation, resource supply evaluation, content variance, both vertically and particularly, contamination of soil, etc. The usage of modern technologies is growing with the depletion of groundwater supplies and its increasingly rising social and economic meaning. In the area of groundwater, several researchers are continuing to learn science and to establish new technology in order to reliably delineate and classify aquifers by different geophysical methods and isotopic and tractor applications. In specific, the difficulties are to delineate deeper water-bearing fractures that have strong potential for hard rock terrain. There are significant developments for automated water level assessment and telemetry efficiency control. Although groundwater modeling is used to understand the flow regime, broader usage of soluthetic transport modeling is required for the estimation of potential scenarios under different stress conditions and emission studies. Researchers must therefore consider the effect on groundwater regime of the different climate change scenarios and severe precipitation events. Furthermore a tone of research is being built to evaluate the harmful effects in water even at nano-grams. The use of remote sensed data is well known, but with the emergence of gravity satellites the new fields are emerging, which is being extended to the assessment and degradation of groundwater supplies.

CONCLUSION

The goal of sustainable growth has a significant part to play. Much of the time, micro- and municipal water management policies are implemented that disregard regional arrangements and thereby struggle to have eternal remedies. Only by following a geographic strategy is watershed a broad unit in which a number of hydro geographical circumstances occur, i.e. river areas, refueling areas and storage areas. Any zone has characteristics to encourages the recharge of groundwater, e.g. rinsing regions are favorable for building structures for in situ water retention, recharge areas for water management structures like inspection dams are ideal for building surface dikes to avoid simple flow and are also acceptable to enforce sprinkler irrigation activities in order to minimize the risk of sprinkling water dams. And portion of the water shift is handled in a water shift method, such that the whole water management approach is followed.

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