A Study the Role of Water and the Sustainable Development

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Abstract- Water is a crucial natural resource that serves as a primary source of water for irrigation, drinking, and industrial use in India. Despite its importance, Water resources in India are rapidly depleting due to increasing demand, climate change, and unsustainable management practices. Sustainable development, which aims to harmonize economic growth, social inclusion, and environmental sustainability, is paramount in addressing these water challenges. In this context, it is crucial to revisit the Water laws in India to ensure sustainable resource management. The current legal framework for Water in India is fragmented, outdated, and ineffective. the significance of Water has grown. Currently, private-Water resources provide about 90% of the domestic and commercial water needs as well as around 65% of the irrigation needs. However, people frequently mistakenly believe that this valuable resource is boundless and unbounded. As a result, the general public frequently overlooks crucial Water issues such its scientific management, conservation, and augmentation.

Keywords- Water, Sustainable development, Water laws, Pollutant, climate

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INTRODUCTION

There isn't much need to elaborate on the value of water. Water is life. For the continuation of life on Earth, it is among the most important natural resources. It is a limited, priceless, and naturally replenish able resource that cannot be generated. When it's not available, only then can its genuine value be determined. The effort and time required to travel to collect a pot of water can be used to estimate its worth. Surface and Ground Water are the main sources of water. These are somewhat interconnected because using one source impacts how readily available the other is. Each source is used differently based on its availability. Due to qualities like consistent supply, wide distribution, ease of accessibility close to the area of use, naturally occurring availability in pure form, etc., Water has recently surpassed surface water as a preferred source for irrigation as well as use in home & industrial sectors. Additionally, the contributions of public-surface irrigation have been decreasing as a result of insufficient dam storage capacities & subpar upkeep of the public irrigation systems. However, the significance of Water has grown. Currently, private-Water resources provide about 90% of the domestic and commercial water needs as well as around 65% of the irrigation needs. However, people frequently mistakenly believe that this valuable resource is boundless and unbounded. As a result, the general public frequently overlooks crucial Water issues such its scientific management, conservation, and augmentation.

SCARCITY OF WATER

In India, more than 75 percent of the rural population relies on Water for drinking, yet the aquifers there are not just under a lot of stress, the water they offer is also getting worse. According to government statistics, 94% of the populace has access to better water sources, although this figure does not fully convey the situation. The crisis gets murkier and riskier as you delve farther and question the calibre of the water that is readily available. The fact that surface water is visibly polluted draws a significant amount of attention to its contamination. In India, 19 states had recorded water fluoridation, and at least 10 states have arsenic-contaminated Water.

The importance of water as a global issue was first recognized in the Brundtland Conference of 1987. The UNCED conference in 1992 raised concerns about water and extensively discussed them in Agenda 21s chapter 18. To address these concerns, the World Water Council and the Global Water Partnership were formed in 1995, including governments, international agencies, and individuals. The first World Water Forum was organized in Marrakech in 1997, and the Bonn Conference on freshwater was held in 2001. The Johannesburg Summit adopted the Millennium Development Goals (MDGs) in which access to safe drinking water was a significant target. The outcome of these conferences emphasized the need to create awareness about sustainable development and the importance of preserving renewable water resources while maintaining their quality.

The loss of 109 cubic kilometers of water has been attributed to human consumption, according to a US research. This decrease exceeds Delhi's yearly water demand by a factor of 66. Sixty percent of India's food supply is dependent on water, and the country's tube well population has grown from 6.9 million in 1994 to 25.0 million in 2018. About 645.84 cubic meters of water was drained from India each year in 2000. In spite of the fact that 82% of rural Indians and 96% of urbanites have access to clean water for drinking, many regions of the country still lack this basic necessity, drawing attention to the widespread problem of water scarcity.

Water scarcity has far-reaching societal and economic consequences. The current water crisis in India paints a dismal picture, contrary to SDG 6's purpose of providing universal access to water. There is a water shortage because of the country's unequal distribution of rainfall, and flooding is common in places with a lot of rain, which causes a lot of damage and loss of life. Irrigation and other uses of fresh water saw a spike in demand during India's Green Revolution. Worsening water scarcity is the degradation of water quality caused by pollution. Farmers in water-scarce areas move to cities in search of work, while women in states like Rajasthan still have to walk vast distances to get drinking water.

QUALITY OF WATER

The contamination of India's water supply is a major concern that endangers both humans and the natural world. Government statistics show that arsenic, fluoride, and nitrate levels are much higher in 60% of the nation's water sources. The majority of these pollutants originate from unsanitary farming methods, incorrect industrial waste management, and inadequate water treatment facilities. The situation is made worse by the overexploitation of water, which leads to seawater intrusion and the release of toxins from the soil.

Calcium bicarbonate and mixed-type water from shallow aquifers is the norm in India and serves a variety of uses. Nevertheless, deeper aquifers can vary in quality, and certain uses may not be compatible with certain types of water owing to geological factors. Pollution of water resources is a big problem in India because it has an impact on water supply and is harmful to people's health. Despite the fact that just 5% of water is utilized for household purposes, about 27% of rural areas and 4-6% of urban dwellers lack access to potable water. More than 70% of India's rural population drinks water that doesn't pass the WHO's water quality guidelines, making an already dire situation even more dire. Risky water consumption is directly associated with 80% of rural illnesses, 21% of communicable diseases, and 20% of mortality in children under the age of five, according to studies.

Agricultural over-fertilization and the untreated discharge of industrial effluents and wastewater into water bodies are the main culprits behind India's water contamination problem. An estimated 36 million tons of rubbish are generated everyday in New Delhi alone. Only half of this waste is handled; the remaining half ends up in the Yamuna River untreated. Other cities also have similar situations.

Out of the total wastewater produced by 23 big cities in India, only 31% is treated, and the rest pollutes 18 significant rivers across the nation. The majority of the nation's rivers have been polluted with harmful substances like fluoride, nitrite, and other metals. Major obstacles include water contamination from inadequate sanitation in rural areas relative to metropolitan areas and the prevalence of high fluoride in water, which affects more than 66 million people. Just 30% of people in rural areas have access to toilets, compared to 65% in metropolitan areas. Nitrates and dangerous bacteria from human and percolated excrement get up in open wells and water storage tanks as a result of this.

Overuse of chemical pesticides and fertilizers has contaminated water sources in India, although the exact scope of the problem is unknown. Both the increased fertilizer dosages and the excessive use of irrigation water, which contaminates well water, contribute to the problem. Reduced soil productivity is another consequence of over-irrigation. When water penetrates deeper layers of soil, it dissolves salts, which are then drawn to the surface by capillary action. Sodium soils, which are unfit for farming, are created from soils with excessive salt content. More than 9 million hectares of once rich irrigated land is now sodium-affected; furthermore, the water in these regions is too salty to be used for farming or human consumption. A lot of water-related illnesses affect the local population as a result.

THE SALINITY OF WATER

The driest parts of India's states—Gujarat, Rajasthan, Haryana, Punjab, and Gujarat—are also home to the country's highest concentrations of inland salinity in water. The wettest parts—Delhi, Uttar Pradesh, Maharashtra, Bihar, and Tamil Nadu—are a bit further south. The water's electrical conductivity is higher than 4000 μm/cm, and the impacted region is thought to cover about 200,000 square kilometers. In certain regions, including southern Haryana and Rajasthan, the water is not fit for human consumption since its electrical conductivity levels are more than 10,000 μS / cm. Surface irrigation, which is done regardless of water status, also adds to the salinity inside. Command areas are experiencing waterlogging and salinity issues due to the combination of high evaporation rates in semi-arid zones and the slow but steady increase of water levels over time. New estimates indicate that around 2.46 million hectares of surface water irrigation projects are either now underwater or could be flooded soon as a result of waterlogging.

Estuaries, bays, marshes, dunes, beaches, and deltas are all parts of coastal regions, which are quite different ecosystems. There is a constant state of dynamic equilibrium between seawater and coastal aquifers because of their contact boundaries. An imbalance can be caused by pulling freshwater out of these aquifers, which can then allow saltwater to seep in. From Gujarat's Kutch to West Bengal's Sunderbans, the Indian subcontinent boasts a dynamic coastline of almost 7,500 kilometers. Bottom waters and mud beaches define the west coast's broad continental shelf, whilst deltas and estuaries define the east coast's short continental shelf. Coastal water is found in limited spaces and encompasses many solid and fluid structures. Usually, saltwater bodies are formed by either seawater intrusion, which creates navigational routes along the shore and causes salt leaching, etc., or trapped seawater, also known as congenital water.

Salinity issues have been noted in multiple coastal regions of India. The Minjur region in Tamil Nadu and the Mangrol-Chorwad-Porbandar coast in Saurashtra have both been hit hard by salinity. Within 8-10 km of the shore in Orissa's emissary regions of Subarnrekha, Salandi, and Brahamani, there is salt that seeps into the earth from the upper aquifers. East of the Neyveli lignite mines, in the Pondicherry region, there have been reports of salinity intrusion as well.

OTHER POLLUTANTS OF WATER

Fluorine

Fluorine is a member of the halogen group of elements and is found in the common inorganic fluoride, fluorite (CaF2), which has low solubility and occurs in both igneous and sedimentary rocks. Apatite (Ca5 (Cl, F, OH) (PO4) 3) also contains fluorine. Fluorides are generally poorly soluble and occur in natural water in small amounts.

Arsenic

The compounds of arsenic have found numerous applications, including as pigments, herbicides, metal alloys, and chemical weapons. Arsenic is still a problem for the environment, even if synthetic organic chemicals have mostly supplanted it. The metalloid arsenic is present in pure water in the geogenous state as hydrolysis species of the +III and +V types. Sodium acid (III) and sodium (V) have vastly different dissociation constants. Since most dissolved organisms are either neutral or negatively charged, their transit through the water supply could be slowed down by adsorption and ion exchange. Water is usually devoid of organic arsenic molecules like methyl and dimethyl arsenic acids.

Iron

Iron is a vital element for the metabolism of plants and animals. It is found in trace amounts in most sediments and its concentration in natural water is influenced by both physicochemical and microbiological factors. When iron is present in aqueous solutions, it undergoes hydrolysis, leading to the formation of iron hydroxide, particularly in its ferric form, which has very low solubility. The reaction of iron in water is also influenced by processes of reduction and oxidation, as well as the pH of the solution. In natural water, which typically has a pH ranging from 5 to 9, hydrolysis occurs under oxidizing conditions as the pH is not sufficiently low to prevent it. As a result, almost all iron precipitates as hydroxides, which can exist as colloidal suspensions of ferric hydroxide within the pH range of 5 to 8.

Nitrates

The behavior of nitrogen in aqueous geochemistry is strongly influenced by its vital role in plant and animal nutrition. Nitrate (NO3) is the most common form of dissolved nitrogen found in groundwater, and it is often considered a pollutant. Nitrate in groundwater typically originates from nitrogen sources on the Earth's surface, such as in the soil zone or shallow subsurface areas where nitrogen-rich waste is deposited. In some cases, nitrate enters the groundwater system directly from sources like waste or fertilizers applied at the surface. These are referred to as direct sources of nitrate. In other instances, nitrate is formed through the conversion of organic nitrogen. Processes like ammonification and nitrification, which require abundant organic material and oxygen, generally occur predominantly above the water table in the soil zone.

CLIMATE CHANGE AND WATER

The unique combination of gases in Earth's atmosphere is responsible for the planet's habitability. Life on Earth depends critically on atmospheric nitrogen and oxygen levels. Water vapor and other greenhouse gases, including carbon dioxide, methane, nitrogen oxide, and halocarbons, also help keep the planet's energy balance in check. By absorbing and radiating energy in different directions, these greenhouse gases regulate and maintain a warm atmosphere on Earth. For the formation of a habitable planet that supports life as we know it, this precise gas balance is crucial.

Modern human activities have contributed to a rise in global warming via increasing emissions of greenhouse gases. The climate changes as a result of the rise in temperature. Everyone has heard "weather" used to describe the climate, although we tend to hear "weather" used more often when discussing the former. You can't use the words interchangeably. In a certain location and time, the term "weather" refers to the Earth's physical characteristics, including the air, wind, rainfall, temperature, and humidity. In contrast, a place's "climate" is its average weather pattern over an extended length of time. What we call an area's climate is really just its average weather pattern over the long run. The term "average weather" can describe climate, but a more accurate description would be the quantifiable representation of the mean and variability of key climate variables throughout time.

The ever-changing nature of Earth's climate has been a major factor in determining the parameters under which life can flourish. Changes in the average climate and other factual aspects, such as outliers and the frequency of extreme occurrences, that last for long periods, often decades or more, are all part of it. As one of the most critical environmental issues, this phenomena is of paramount importance not just in India but across the globe. Water resources are not immune to the effects of climate change, which raises the grave danger of water shortage. The consequences for the groundwater system are especially weighty given the forecasts of an imminent water scarcity. The recharge patterns of aquifers are altered by climate change, which impacts the availability and overall functioning of groundwater. Sustainably managing water resources and developing efficient adaption measures are of the utmost importance in light of the growing urgency of the need to track and mitigate the effects of climate change.

Social and economic conditions deteriorate as a result of climate change's many manifestations, such as shifting monsoon patterns, melting glaciers, and heightened susceptibility of coastal people. The temperature-evaporation relationship, which is directly proportional, is one of the main causes of these shifts. Rising temperatures cause evaporation rates to rise, which in turn affects rainfall patterns in a way that is easily recognizable. Extreme weather events like droughts, floods, snowfall, and snowmelt can become more common and severe as a result. Climate change is already having far-reaching effects on weather patterns and related occurrences; thus, we must work together to lessen these effects and encourage sustainable adaption measures. Rising temperatures have an effect on water quality and may hasten the eutrophication process.

COMMERCIALIZATION OF WATER FOR RESOURCE MANAGEMENT

The Water sector as a whole has seen pitiful investment and extremely sluggish infrastructure development. Water facilities were not used to their full potential because of insufficient catchment area development, which led to sedimentation and soil erosion; inefficient water distribution in open channels; flood irrigation; and pricing of water based on the area irrigated rather than the amount supplied. More than 70% of irrigation water is expected to be wasted since other dry areas are not being watered. Traditional irrigation methods employed by farmers in India lead to substantial water loss, soil erosion, fertiliser leaching, pest, disease, and weed infestation, and a decrease in crop output. The political and agricultural communities, on the other hand, are determined to terminate this unproven method. In order to alleviate acute water shortages, it is critical to focus on improving water usage efficiency and transitioning from flood to drip irrigation. When it comes to agricultural water usage efficiency, India lags much behind the more industrialized nations. Floodirrigation, rainfall, inefficient water conservation methods, and plants that need more water all contribute to this problem.

But farmers aren't motivated to save water since they don't see any benefit in doing so. The rising rate of evaporation brought on by climate change means that agricultural water demands will rise as well. There is no way to farm any land on the Himalayan crest since the rivers there are often flooding and then there is a serious water shortage. Because of this, the rivers that come down from these mountains can't handle the water demands of all four seasons. The extensive washing away of soil caused rivers to change their course and ultimately led to flooding. It is critical to address these urgent issues that are reducing the availability of water, even though India has sufficient water resources to meet the growing demand of the nation.

Over the last fifteen years, India has reformed its water sector in accordance with the financial viability model proposed by international institutions. This model has principles such as full cost recovery, rationalization of water tariffs, privatization, and public-private partnerships as agricultural subsectors. Numerous international organizations and national programs have attempted to privatize water services, including the World Bank, the Asian Development Bank (ADB), the International Finance Corporation (IFC), UIDSSMT (urban-development in small- and medium-sized cities), and, more recently, SMART and the AMRUT city plan for urban-development. The reform model's principles are the focus of several state programs in Madhya Pradesh, including CMUWSS and Madhya-Pradesh Jal-Nigam.

Despite widespread public opposition, privatization measures have been put into place in several cities and towns around the country in pursuit of these goals. New Delhi, Mumbai, Bangalore, Latur, and Mysore are just a few of the places where such projects have been canceled in the past as a result of vocal public opposition. Amidst these limitations, privatization continues, and cities such as Nagpur, Hubli-Dharwad, Khandwa, Tiruppur, Shivpuri, Patna, Guwahati, Naya Raipur, Mangalore, Calcutta, Ludhiana, and Dewas have witnessed privately controlled water services being transferred or transferred through. One possible component of the 2012 National-Water-Policy (NTP) is the private water services industry.

The privatization of water services imposes constraints that have a negative impact on the general population in these places, especially the poor and marginalized. These regulations are a part of a larger effort to reform the water sector. Other reforms include putting private companies in charge of domestic water provision, measuring all households, maintaining a constant water supply, increasing water rates, reviewing water tariffs every three years (with a 10% increase), denying access to the poor and marginalized, and banning the use of local water.

Interestingly, no previous projects have addressed the question of how to enhance services for the local population, especially the impoverished and marginalized, or how to expand coverage, quality, or accessibility; instead, they have solely focused on financial matters like increased taxes, usage rights, and entire cost retrieval.

In several parts of the country, community groups, social organizations, and NGOs have recently held and debated events denouncing the privatization and restructuring of public water systems. Efforts have been made in the past to bring together people from different walks of life, including activists, scientists, scholars, community organizations, collective work, and individual and non-governmental organization representatives, for national campaigns and conferences to brainstorm new ways to fight privatization and explore alternatives. In other places, people have been trying to get people to talk about water and privatisation, and the planned conference in Bhopal proved that their efforts were justified.

Fresh water is in high demand due to the world's expanding population, which has prompted some to consider privatizing their water supply. Unfortunately, as a result of water loss, both the amount and quality of water have decreased. People have long misused and taken water for granted, according to some ecologists. Although water pricing has the potential to make people realize how important it is to conserve it, some argue that it will only make access to water more unequal. Water privatization has the potential to create two socioeconomic strata: the well-off and the poor. The development of worldwide "water prospects" is in its infancy, but it will likely be a short while before water is traded on global markets alongside crude oil, oranges, and other commodities.

Water is often seen as a shared resource, and most people are wary of initiatives that would turn it into a state asset. Various institutional modalities, from basic service contracts to full divestiture, have resulted from private sector development and client participation in the arranging of services with private sector involvement. Groundwater extraction via tube wells and bore wells, together with surface water in certain instances, is the main focus of the existing water markets in India. Water markets and the underlying perception of water as a marketable commodity severely unsettle some, while others think this is the way forward. Another example of a water market that may be avoided is the one where private tankers provide water to cities and the one where filtered water is highly traded. Water pricing is an ongoing topic of debate.

This problem needs a solution for water conservation, and the government should be the one to initiate that process. In addition to considering the greater good, people need to figure out how to both offer water to everyone and cut down on water waste. Making sure everyone has access to water is the first and foremost concern, and we must do everything in our power to make that a reality. Water commercialization, and water conservation more generally, will benefit generations to come.

WATER AND SUSTAINABLE DEVELOPMENT

A definition of sustainable development is progress that satisfies current demands without jeopardizing those of future generations. A higher standard of living for everyone is the ultimate goal, which is why it seeks a balance between economic, social, and environmental factors. The water cycle on Earth relies on water, which is also a precious resource for humans. On the other hand, it can be depleted and polluted as a result of human activities like over-pumping, poor waste management, and farming methods. Water resources must be managed in accordance with sustainable development principles so that they can be made available to future generations.

Balancing water demand with available resources is the goal of sustainable water management, which necessitates meticulous planning, monitoring, and regulatory and policy implementation. It also includes safeguarding water quality, reducing wasting, and encouraging the adoption of water-efficient technology. Because it can influence the accessibility of freshwater resources across borders, water sustainability is an issue that affects people all around the world, not only in specific regions. Consequently, attaining sustainable water management requires global collaboration and the exchange of information and best practices. In order to achieve the Sustainable Development Goals (SDGs), such as ensuring food security, reducing poverty, and promoting environmental sustainability, water is an essential resource that underpins a wide range of economic, social, and environmental endeavors. Overexploitation, pollution, and depletion of water resources occur when people fail to recognize and appreciate water's importance. Multiple United Nations Sustainable Development Goals (SDGs) rely on water in some way or another. For example, SDG 6 seeks to guarantee that everyone has access to water and sanitation, as well as to promote their sustainable management. Ensuring water security is crucial, especially in regions where surface water is scarce or unreliable, and water is a major supply of water for many populations.

Goal 2, which seeks to eliminate hunger and enhance food security, also involves water. Irrigation uses a lot of water, and how to keep this precious resource available for farming in the long run is to manage water resources sustainably. For instance, SDG 2 (Zero Hunger) relies heavily on agriculture, and water is an essential resource for that sector. Water is essential for irrigation, which in turn produces around 70% of the world's food, and supplies 80% of the drinking water in rural parts of developing nations. But water contamination and overexploitation endanger agricultural output and food security. Goal 11 (sustainable cities and communities), Goal 13 (climate action), and Goal 14 (life below water) are just a few of the numerous SDGs that are affected by water. In addition to supplying expanding populations with a steady supply of water, water supports ecosystems and acts as a buffer against floods and droughts, all of which can lessen the severity of the effects of climate change. Yet, irresponsible water usage is not without its dangers, such as the exhaustion of water supplies, the decline of water quality, and the destruction of ecosystems. Sustainable management of water resources and a fair distribution of water's benefits and costs are two cornerstones of a water-related set of Sustainable Development Goals (SDGs). Goal 6 (Clean Water and Sanitation) cannot be attained without water, which is why governments, communities, and other stakeholders must work together and provide resources to effectively monitor, manage, and administer water resources. For billions of people throughout the world, water is essential for drinking and for many other uses in the home and in industry. The dangers to human and environmental health from water contamination and overexploitation are substantial, though. Achieving the SDGs would necessitate the sustainable and integrated management of water resources. It recommends involving stakeholders in decision-making and developing policies and management techniques to improve sustainable water use. Water recharge and artificial recharge are two examples of the kinds of cutting-edge technology and methods that can help make water supplies last longer, which is crucial for long-term sustainability.

Preserving water supplies for both current and future generations depends on adhering to sustainable development principles. We can promote economic growth and social well-being while ensuring the continued availability of this crucial resource by implementing sustainable water management techniques. To sum up, groundwater is an essential resource for SDGs and a driving force behind numerous other sustainable development goals. Overexploitation, pollution, and global warming are only a few of the major obstacles to this resource's proper management and protection. Integrated and holistic approaches are necessary for groundwater management due to the interconnections between groundwater and several SDGs. In order to make decisions on groundwater management that are sustainable, it is essential to include all relevant parties, including communities. To achieve the Sustainable Development Goals (SDGs) pertaining to water security, food security, poverty reduction, and environmental sustainability, it is crucial to implement sustainable groundwater management methods, such those suggested in the Framework for Sustainable Water Management. To guarantee Water's sustainable usage and accomplish the SDGs, immediate action is required on a global, regional, and local scale.

CONCLUSION

Overall, water supplies are greatly affected by a number of factors. The storage and movement of water are determined by a variety of geological factors, including the type and permeability of aquifers. The recharge and availability of water are affected by hydrological and climatic conditions, such as the patterns of rainfall, the rates of evaporation, and the interactions of surface water. Water dynamics are significantly influenced by human activities, including water abstraction for irrigation, industry, and household consumption. The water table can drop due to overexploitation and unsustainable pumping techniques. The water supply can be jeopardized due to contamination caused by inappropriate waste disposal, industrial runoff, and agricultural methods. For water to be used and protected in a sustainable manner, methods for managing water resources must be integrated, taking into account hydrology, geology, and socioeconomic factors. In order to regulate extraction and avoid contamination, it is necessary to establish frameworks for water monitoring, water conservation practices, water recharge methods, and regulatory frameworks. Municipalities, researchers, researchers, and water resource management organizations are all important parties that must work together to solve water's problems. To sum up, the intricate relationship between geology, hydrology, climate, humans, and the environment must be taken into account for water resource management to be effective. We can work towards a future where water is more reliable and safe by attending to these characteristics and implementing sustainable practices.

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