Analyzing the economic benefits of sustainable water management practices

Dr. Subhaprada Dash[1]; Dr. Preethi D[2]; Kanchan Awasthi[3]; Vivek Saraswat[4]; Vundela Swathi[5]; Dr. Vinima Gambhir[6]; Dr. Rani J[7]

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Abstract

The Indian Sundarbans, a UNESCO World Heritage Site, is facing severe water management challenges due to climate change, population growth, and economic development. This study analyzes the economic benefits of sustainable water management practices in the Indian Sundarbans. This study examines the economic benefits of sustainable water management practices in the Indian Sundarbans. Using a combination of literature review, case study, and economic analysis, we find that sustainable water management practices can generate significant economic benefits, including increased crop yields, reduced water treatment costs, job creation, and livelihood improvement. Our results show that sustainable water management practices can increase crop yields by up to 30%, reduce water treatment costs by up to 50%, and create up to 10,000 jobs in the region. We also estimate that the ecosystem services provided by sustainable water management practices are valued at up to $1.3 billion annually. Our findings have important implications for policy and decision-making on sustainable water management practices in the Indian Sundarbans. Water protection and management is vital for socioeconomic development and ecological diversity. Groundwater resources are of key importance to sustainable development. While planning for the urban settlement and industries, the occurrence of adequate water resource is the crucial component for the life. The aim of the study is to analyses the rapid

1- Associate Professor, Department of Agronomy, Institute of Agricultural Sciences, Siksha 'O' Anusandhan (Deemed to be University), Bhubaneswar, Odisha, India. Email: subhapradadash@soa.ac.in, ORCID: https://orcid.org/0000-0002-8167-6322
2- Assistant Professor, Department of CS & IT, Jain (Deemed-to-be University), Bangalore, Karnataka, India. Email: preethi.d@jainuniversity.ac.in, ORCID: https://orcid.org/0009-0007-4135-2140
3- Associate Professor, Department of Science, Maharishi University of Information Technology, Lucknow, Uttar Pradesh, India. Email: kanchan.awasthi@muit.in, ORCID: https://orcid.org/0009-0007-0231-4547
4- Centre of Research Impact and Outcome, Chitkara University, Rajpura, Punjab, India. Email: vivek.saraswat.orp@chitkara.edu.in, ORCID: https://orcid.org/0009-0000-6875-1255
5- Centre for Multidisciplinary Research, Anurag University, Hyderabad, Telangana, India. Email: vundelaswathi2024@protonmail.com, ORCID: https://orcid.org/0009-0009-4991-1511
6- Associate Professor, Department of ISME, ATLAS Skill Tech University, Mumbai, Maharashtra, India. Email: vinima.gambhir@atlasuniversity.edu.in, ORCID: https://orcid.org/0009-0007-6832-7180
7- Associate Professor, Master of Business Administration, Sathyabama Institute of Science and Technology, Chennai, India. Email: rani.soms@sathyabama.ac.in, ORCID: https://orcid.org/0000-0002-4144-5845
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industrialization and economic development leading to a tremendous increase in the use of groundwater.

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Introduction

One of the most valuable natural resources and a valued national asset is "water." One essential component of all living things is water. There are two main types of it: groundwater and surface water (Upadhyay *et al.,* 2024). There are many uses for water, including household, agricultural, industrial, and related uses (Stamenkovic *et al.,* 2019). It is most likely the single natural resource that has an impact on every facet of human civilisation, from agricultural and industrial growth to ingrained cultural and religious ideals (Rao and Chatterjee, 2025). Since the beginning of the "Srishti," it has existed on Earth and will continue to do so until the end (Pan and Xu, 2018). For this reason, the earth is referred to as the aquatic planet among all the planets and stars (Khalife *et al.,* 2024). The availability of water varies greatly over time and space. In India, precipitation only occurs for roughly three or four months out of the year. It ranges from 100 mm in Rajasthan state's western regions to more than 10,000 mm in Meghalaya state's Cherrapunji (Li and Huang, 2024). State and national borders are frequently crossed by rivers and subterranean aquifers (Wiek and Larson, 2012). Rainfall, river water, surface ponds, lakes, and groundwater are all components of a single, indivisible water resource (Malhotra, and Iyer, 2024). It is among the fundamental components of planning for development. The national perspective must direct efforts to manage, develop, conserve, and use this vital resource in a sustainable manner as the nation navigates the twenty-first century. Water is seen as a socio-economic resource and is necessary for life to survive. Agriculture, which depends on the availability of water, is the main source of income for the people. With enough water available for irrigation, agricultural output will increase, improving the economic standing of the town (Nwokediegwu *et al.,* 2024). Food security, a decrease in external migration, and an improvement in children's educational standing can all be achieved through increased agricultural productivity and improved economic conditions (Sachdeva and Upadhyay, 2024). The availability of drinkable water will lessen the risks to women's health and their labour. Policymakers, administrators, and scientists across are concerned about the need to boost agricultural productivity in order to supply the nation's growing population with the required amount of food grains and fibre (Narayanan and Rajan, 2024). The only way to improve production given the restricted land resources is to enhance productivity per unit area. The key to completing the difficult process of increasing output is water (Santos, Carvalho and Martins, 2023). All packages of activities that promote growth fail when there is no water. In India, rainfall occurs and is distributed quite unevenly in both space and time. Therefore, one of the main reasons for low productivity is still the insufficient

amount and unpredictable and irregular distribution of short-term monsoon rainfall, which necessitates the additional artificial watering of the soil to meet the moisture requirements of the soil at different stages of growth for a higher yield (Tao *et al.*, 2024). This extra water, sometimes referred to as irrigation water, can be produced by elevating groundwater, storing surface runoff, or doing both at once (Braden and Van Ierland, 1999). Many places are experiencing scarcity as a result of the extreme waste, abuse, and poor management of the water supply. Freshwater is becoming a more scarce resource due to the growing demand for its sources on a global scale.

Sustainable Development Goals

The 2030 plan for practical turn of events embraced by undeniably Joined Countries part states in 2015 gives a common blue print to harmony and thriving for individuals and the planet, presently and into what's in store (Crespo *et al.*, 2022). Out of the 17 Feasible Advancement Objectives (SDGs) the SDG 6 covered/guaranteed accessibility and supportable administration of water and sterilization for all (Figure 1).

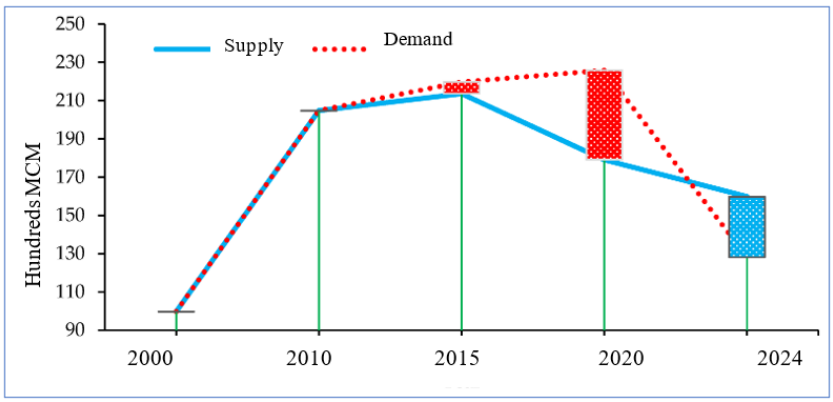

Figure 1: Issues of sustainable management of water.

Though all the above goals are some ways or other connected to render best practices for water resource management, water supply side management, water demand side management and sanitation and wastewater recycle and reuse management, throughout recent many years truly developing requests for water and abuse of water assets have expanded the gamble of contamination and extreme water pressure in many areas of the world. The recurrence and power of nearby water emergency have been expanding with serious ramifications for general wellbeing, natural maintainability, food and energy security and financial turn of events (Cai, McKinney and Rosegrant, 2003). Socioeconomics are constantly changing and unreasonable financial practices are influencing the amount and nature of water available to us, making water an undeniably scant and costly asset particularly for poor people, the minimized and the defenseless. Since water prerequisite is met from different sources, while taking on a Coordinated Water Assets The executives (IWRM) to meet out the stockpile necessity, catchment regions, stream bowls and sub-bowls be created so that neither these block the regular stream and cause catastrophe (Aivazidou *et al.*, 2021). At last, proper water financial plans and

water represents every spring hydrologic adjust ought to be conveyed. Service of Water Assets, Legislature of India figured out NWP (2012) with the accompanying goals (I) to take comprehension of the current circumstance, to propose a structure for making of an arrangement of regulations and organizations and for a game plan with a bound together public viewpoint covering a framework to advance benchmarks for water utilizes for various purposes, i.e., water impressions and water examining ought to be created to advance and boost productive utilization of water.

Sustainability Crisis in Indian Scenario

Down to Earth journal in its August 1-15, 2019 issue brought a detailed report after onsite investigation about Cauvery River. According to the report the extreme degradation of this old and famous river, due to deforestation, urbanization, illegal mining, dumping of effluents along the river brought Cauvery into pathetic status. Decades of degradation, encroachment to its catchment area, manmade developments into its basin and its flow path reduced water flow in its course. This seriously affected 15 million people, living along its bank. due to expanding IT industries and needs of housing for fast growing population of the city is expanding in peri-urban areas in Bengaluru. Since these areas do not have municipal water supply system that is no safely managed water system is available, therefore builders resorted to deep borewells for water supply. Availability of inadequate quantity of water and poor supply arrangement, lack of sanitation, personal hygiene exposes the residents of urban areas at great health risk.

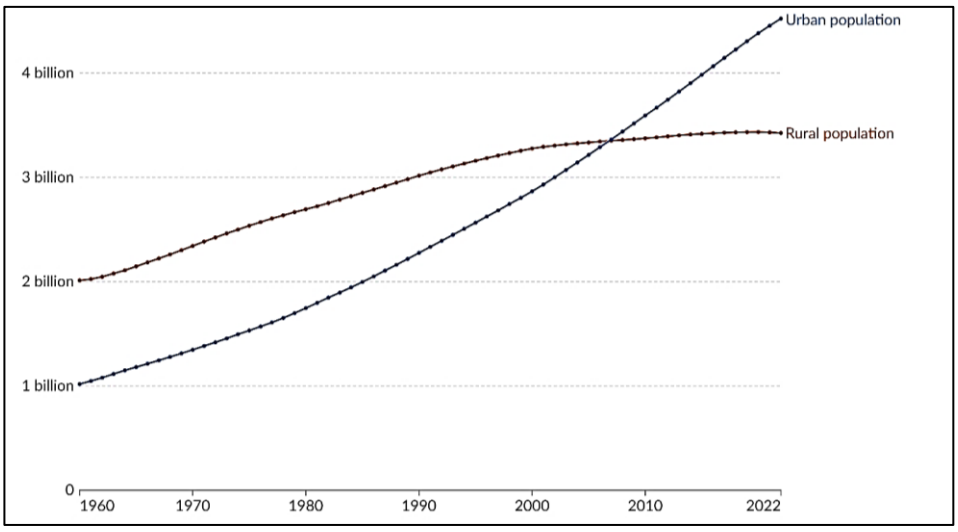

Figure 2: Number of people living in world (source: web).

The above (figure 2) facts hold concerned authorities like municipal corporations, smart city authorities directly responsible to ensure adequate, sustainable, safe water supply all times for the city apart from ensuring proper sanitary conditions of the urban area. Couple of decades ago, due to presence of large number of ponds, green areas, open spaces natural groundwater recharge used to take place, and groundwater used to be quite high. But over the decades, due to excessive concrete structures, concreted

pavements, rain water becomes storm water and gets discharged into local drains and ultimately to the river Ganga, sometimes after flooding the city and creating potential risk for health and other inconveniences in livelihood. These flooding situation compounds the problem of water supply both in terms of quality and quantity which is already in strained situation. For country like India which lacks adequate water resources this normally worsen the situation. Due to ease of access and mostly free from contamination, the groundwater is normally suitable for direct human and animal consumption, groundwater has been used since dawn of civilization. After industrialization and use of mechanical means like pumps, groundwater is being exploited heavily for irrigation, industry, navigation recreation, household needs and so on.

Conclusion

As human development and activities extends in diverse areas, as human settlement shifts from rural areas to urban areas requirement of clean drinking water increases for meeting traditional house hold needs and new requirements. This is compounded with the fast growth of population around city areas. Health and wellbeing of the society depends on the adequate availability of clean and contaminants free water. Water is available in plenty on the earth but usable water for human consumption is limited. Today humanity is facing water scarcity (except few countries like Canada, USA, New Zeeland and Russia) on one hand and sharp increase of water demand on the other hand in almost all parts of the world however, the present water crisis in the world is to large extent, a man-made crisis. Countries and societies are now divided into water rich and water deficient groups. Water deficient regions needs to engineer different consumption strategy than those with rich sources of water availability. Fresh water sources are like, perennial rivers, rain fed rivers, rivers of forest origin and lake linked rivers, lakes, big ponds, dug wells, deep bore wells, and rain water. Present life style of excessive consumption of commodities resulted in excessive exploitation of fresh water resources beyond its natural capacity of replenishment.

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