

Unveiling the Crisis: Pollution in the Yamuna River and the Path to Restoration

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Abstract - Rivers have historically nurtured civilizations and continue to provide critical economic cultural and ecological services. However in India, rising pollution load in the rivers threaten their health and sustainability. Among these, the Yamuna River faces critical degradation in recent decades. Despite supplying 70% of Delhi's water, the Yamuna receives 80% of its pollution load within just 2% of its stretch in the city. Factors such as untreated sewage, industrial effluents, and poor waste management have pushed its water quality beyond permissible limits, rendering it unfit for consumption or bathing. This article examines the complex challenges facing the Yamuna, including lack of coordinated governance, inadequate sewage treatment capacity, and ecological disturbances. It highlights the alarming impacts of pollution, such as the formation of hazardous froth and bioaccumulation of toxins. Proposed solutions emphasize watershed management, afforestation, modernizing sewage treatment infrastructure, and implementing a graded action plan for continuous pollution monitoring. Drawing on international frameworks like the Clean Water Act, the article advocates for robust legislative reforms and collaborative efforts to restore the Yamuna's vitality. The restoration of the Yamuna is not only an ecological imperative but also a cultural and spiritual duty, requiring collective action from citizens, institutions, and governments. This article underscores the urgency of reversing this crisis and embracing sustainable practices to ensure the river's future as a symbol of life and purity.

Key Words: water pollution, sewage treatment, bioaccumulation, watershed management, ecological restoration, governance

1. INTRODUCTION

Rivers played a very significant role for growth of human civilization since ancient times. All the major civilizations of the world like Indus Valley or Mesopotamia had been nurtured by rivers like Indus, Euphrates and Tigris. Moreover, rivers had helped in emergence and flourishing of the cities from medieval to modern times. Apart from historical significance, rivers also have geographical and ecological significance. They had been providing various ecosystem services within their catchment areas. They provide provisioning services like water for drinking, industrial and irrigation. They also provide with food and fiber. Also, they

help to regulate the water quality through natural filtration. Moreover they support a variety of flora and fauna and their habitat thus maintaining the biodiversity within its vicinity.

India has also witnessed the cultural significance of rivers since time immemorial. These rivers have been worshipped and revered as Mother Nature. The titles like Ganga Maiyya or Maa Ganga, highlights the status that citizens provide to these rivers. Moreover rivers are also associated with religious practices like disposing of human ashes in rivers, taking holy bath during Kumbh Mela, submerging the Hindu god idols into rivers and so on.

2. The Rising Crisis: Pollution in Indian Rivers

However, in the recent decades, there has been a rising phenomenon of increasing poor health of Indian rivers. According to CPCB, in 2022, out of 603 rivers, 311 stretches on 279 rivers have been identified as polluted. There have been overexploitation and mistreatment of rivers by various anthropogenic means. Some of these factors are dumping of waste in the river, effluent discharge from industries, over extraction of water or groundwater for irrigation and industrial use, excessive use of fertilizers ultimately leading to polluted river waters, riverbed sand mining, and illegal construction in the catchment areas. Moreover, there has been lack of political will and citizenship engagement to resolve the issue of river pollution. This has led to deteriorating health of rivers and unfortunately, our rivers are gradually migrating to the status of polluted from being pristine.

2.1 The Yamuna River: Lifeline Under Threat

One such river is River Yamuna. It has been a major part of Indo Gangetic plains and supports the local population due to its fertile lands and Indo-Gangetic doab between Ganga and Yamuna. A majority of population depends on it for agriculture, household water consumption and industrial water usage. Major metropolitan regions and other city areas like Delhi National Capital Region (NCR), Mathura, Agra, Prayagraj fulfill their water needs from Yamuna. Moreover, it has been associated with the spiritual centers of Vrindavana and Mathura and it has spiritual significance due to pastimes of Lord Krishna.

The Yamuna River has been lifeline for National Capital Territory of Delhi (NCT) region as it provides 70% of water supply to the region. According to Central Pollution Control Board, the river covers only 2% of its entire stretch in Delhi

but receives 80% of its entire pollution load in this region. According to Ministry of Jal Shakti, Yamuna receives no freshwater downstream of Wajirabad barrage in Delhi and there is a critical path of 22km in Delhi where 18 major drains discharge pollutants into the river. Moreover, there has been challenges due to lack of installed capacity of sewage treatment plants and operational and maintenance issues of existing treatment plants to treat the discharge load. As per Ministry of Jal Shakti, around 940MLD of sewage is discharged untreated into the river. Moreover, the common effluent treatment plants (CETPs) installed in the industrial cluster in Delhi also have noncompliance issues as per the report.

2.2 Impacts of Yamuna Pollution

These factors have impacted the purity of Yamuna's water in the region. The physicochemical parameters of river water are beyond the permissible limits. There are high levels of bacterial coliforms in the water and the biological oxygen demand (BoD) and Chemical Oxygen Demand (CoD) levels are also above the permissible limits. It means that the water is not fit for both drinking and bathing purpose. Moreover, the recent year activity of froth formation in the NCT region during Chatt Puja is a case in point about the existing issue of water pollution in the region. This is another example of rampage of the river ecosystem beyond its carrying capacity. The recent formation of a thick layer of white froth is mainly due to high levels of water pollution in the river. The froth forms when organic matter from decaying plants and pollutants like phosphates and surfactants mix with the turbulent water. It creates a layer of foam which is highly concentrated with harmful chemicals. This foam consists of heavy metals and volatile organic compounds. It can harm aquatic life as well as people which are in contact with this water for mundane usage. It can cause skin irritation, allergy, and rashes and may impact nose throat and lungs. Moreover, the pollutants can also bio accumulate in aquatic life and human bodies and impact in long terms neurological disorders or kidney diseases.

2.3 Governance and Coordination Challenges

The Waterman of India, Rajendra Singh pointed out that major cause for these problems in Yamuna is lack of coordination amongst government agencies. There are multiple agencies which are working in silos and lack a comprehensive collective approach to resolve the challenges of water quality in river Yamuna. There have been three phases of Yamuna action plans but more needs to be done for bringing back the purity of Yamuna waters.

2.4 Path to Restoration: Strategies and Solutions

To bring back life to river Yamuna in NCT region, we need to act fast. Firstly, the principles of watershed management and groundwater recharge shall be considered on a serious note for the catchment area of Yamuna river. Moreover, there shall be steps for dense afforestation and greenery with native species along the banks of Yamuna river. These two steps will help to improve the water quality and quantity in a environment friendly manner. Also, we can organize Yamuna

water councils to enhance awareness about river conservation and rejuvenation amongst the citizens and local government bodies.

Secondly, operation and maintenance of effluent treatment plans and sewage treatment plants shall be made functional as a preventive measure to water pollution. Moreover, we can seek to establish best-in-class Sewage treatment plants (STPs) and Effluent treatment plants (ETPs) to enhance the operational capacity of water load handling. Also, the water can be circulated and used in public spaces like parks and gardens with aeration methodologies like fountain, running streams. It will help to dilute the pollutant load in the water.

Also, there is a need to establish a graded action plan based on continuous water pollution monitoring just like we have GRAP for air quality in the NCR region. It shall be drafted by collaborative work of stakeholders which may include municipal bodies like Delhi Jal Board and Municipal Corporation responsible for sanitation. Moreover, in long term, Delhi NCR region needs to adopt a robust waste management model by learning from Indore or Bhopal waste management models. It will reduce the waste dumping in Yamuna River over a period of time. Finally, amending the Water (Prevention and Control of Pollution) Act in lines with Clean Water Act of United States and Water Framework Directive on European Union can help to provide regulatory push to clean the rivers.

The rivers are treated as pious and revered in Indian civilization. Much water has been flown in our rivers which is toxic and polluted. We are running out of time to tackle this challenge. There shall be harmony among citizens, institutions and government to bring back the purity of our rivers. As there is a saying that river's never go reverse. So let's collectively try to live as a river, forget the past and focus on present to shape our future of rivers.

3. Conclusions

The Yamuna River, a symbol of cultural heritage and ecological significance, now stands as a stark reminder of the consequences of unsustainable practices and neglect. Its deteriorating health in the National Capital Territory of Delhi is a pressing challenge that demands immediate and concerted action. From untreated sewage to industrial pollution, the factors contributing to its plight are numerous but not insurmountable.

Restoring the Yamuna requires a multipronged approach that integrates watershed management, afforestation, advanced treatment technologies, and robust policy reforms. The adoption of best practices, such as graded action plans and enhanced inter-agency coordination, can pave the way for its rejuvenation. Citizen awareness and participation are equally critical to fostering a culture of responsibility and reverence toward our rivers.

As we stand at this juncture, the revival of the Yamuna is not merely an environmental necessity but a testament to our commitment to sustainable development and cultural preservation. By uniting as stakeholders in its restoration, we can ensure the Yamuna flows with purity and vitality for generations to come, reinforcing its place as a lifeline and spiritual anchor for the communities it nurtures.

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