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A CASE STUDY

Causes of water pollution : Ecological restoration and rejuvenation of rivers in context with India

■ **Hari Om Sharma**

SUMMARY

Clean water is the basic need of life. It is the main natural source for the survival of human beings.Water has multifunctional role in daily life. Now-a-days water pollution becomes a very gigantic problem in India.This problem going on increasing very fastly due to rapid growth in industrialization, urbanization and a huge population. The Indian constitution article 21 provides that every person has the right to life and right to pure water for drinking. Pure water is the basic need and hope for a healthy life. Polluted water causes a number of diseases in living organisms. It is the duty of state government to provide clean water to public and to raise the level of nutrition and standard of living. Shortage of clean water in country, lack of awareness and lack of strict implementation are the main reasons for choosing this topic for research purpose.

Key Words : Climate change, Industrialization, DBFO, Urbanization

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Causes of water pollution:

Population:

In current scenario India has a second largest population in the world, almost 1366417754 people. It constitutes about 17.71 per cent of the total world population. The population explosion is the main cause of water pollution today. The Ganga river flows through 29 cities in which cities population leaving above 10 lacs. A large proportion damp the solid and liquid waste in ganga river like domestic usage (bathing, loadring and public defeaction) Sewage waste, unburntdead bodies. According to UN report released on March 22, 2016 on World Water Day, 80 per cent of urban waste in India ends up in the country's rivers, and unchecked urban growth across the country combined which poor government oversight means the problem is only getting worse.

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Industrialization:

Industries discharge a variety of pollutants in their waste water including heavy metals, resinpellets, organic toxins, oils, nutrients and solids. Discharges can also have effects especially those from power stations and these reduce the available oxygen.Industries are taking major

part to pollute water. In industry, in the production department, so much water is required in the production department. In industries toxic, metals and oil are produced, which has solids and phynols so that used water is not cleaned and it was applied into the river and sea, lakes directly. City areas water pollutes 75 per cent of the rivers and industries are pollution 25 per cent of that. That is more harmful. Bhopal Gas Tragedy is the World's worst industrial disaster. Study by official scientific agencies shows that ground water contamination has spread over 40m deep and upto 3.5 km from the abandoned factory. There are many industries In recent years water pollution has become serious problem across a country mostly due to the presence of untreated effluents, chemicals and pesticides in it (Laws and Hoboken, 2018).

Climate change:

Saline water in oceans, seas and saline groundwater make up about 97 per cent of all the water on earth. Only 2.5 to 2.75 per cent is the fresh water, including 1.75 to 2 per cent frozen in glaciers, ice and snow, 0.5-0.75 per cent as fresh groundwater and soil moisture and less than 0.01 per cent in lakes swamps and rivers. Due to global warming the glaciers become narrow day by day. Glaciers and seasonal snow cover change their water storage capacity under a warning climate when glacier mass balances are negative, glaciers contribute additional water to rivers and they are a main source of fresh water. However, negative mass balances lead to a reduction in glacier volume and are, which eventually, reduces the total melt water from glaciers. A warning climate may, therefore, lead to either rising or decreasing river flows (Mitra, 1992 and Panda *et al.*, 2013).

Human and natural activities affect virtually all sections of water cycle after with additive effects. Over time human activities such as forest clearing have disturbing influences on the water cycle including evaporation flow regimes, ground water table and sea level. The term draught may refer to a meteorological drought, hydrological draught. The socio-economic impacts of the draught arise from the interaction between natural conditions and human induced climate change factors such as changes in land use, land cover and demand for and use of water (Bandyopadhyay and Perveen, 2008 and Hingane *et al.*, 1985).

Urbanisation:

Increasing urbanization in the river basin is followed by a number of serious impacts Alteration in hydrology and geomorphology of the streams as well as deterioration of its water quality are the most detrimental effects identified due to urbanization. Due to urbanization there is a large amount of garbage is produced which is not recycled and even dumped at river banks or left open. Finally it pollutes the river water or underground water.

Future plan for river rejuvenation:

Reusable water from domestic wastewaters:

The used water should be first purified and the released into river or reused. In consideration of the magnitudes of domestic wastewater generation from different urban locales, urban settlements have been divided into Class I Towns having population over100,000 and Class II having population between 50,000 to 100,000. For Class Ithe following main steps concerning sewage treatment for medium to long term (over the next 25 years) are recommended as follows:

The unit cost of the above tertiary treatment was worked out for year 2010 price levels at approx. Rs.10/- per m^3 (or 1 paisa/litre). This cost should be borne by the users of treated water, while the cost of fresh water should be at least 50 per cent higher considering the minimum cost of full treatment of such wastewaters in the natural environment.

These costs should be chargeable from water-users especially urban and commercial users'thereby ensuring economic use of water and safety of the environment. The water pricing mechanism may be periodically reviewed. By adequately treating wastewater and re-using it instead of dumping the untreated or partially treated wastewater to sully the environment, urban wastewater treatment can achieve Zero Liquid Discharge or ZLD and recover the value of water as a resource (Karnanathan *et al.*, 1985 and Rao,1992).

Additional recommendations for actions on sewage treatment :

To implement the above concept effectively, it is envisaged that the conversion of urban sewage to usable and saleable water should be effected by independent agencies contracted to supply and operate the required wastewater treatment systems. Expensive, unaffordable, energy extensive urban local bodies cannot afford 1 Paisa per liter for zero liquid discharge Vs expensive household water treatment.Such agencies should be paid for the actual quantity of usable quality water produced and not

for merely providing or running the treatment facilities.

The following steps have been formulated to fulfill this task in urban centers:

– All new sewage treatment plants and their pumping stations should be constructed and managed by the same agency, adopting the DBFO (Design–Build–Finance–Operate) model.

– The sewage pumping and treatment infrastructure should be built in a modular fashion such that the pumping and treatment capacity is approximately the same as the actual sewage collected/available.

– As per the proposed DBFO Model, payments will be made to the service provider in annuities spread over the contract period during the operation and maintenance phase of the project. The payments will be linked to the actual amount of treated sewage (of specified quality) produced by the service provider.

– All necessary clearances, permissions, etc. for funding of sewage pumping stations and treatment plants using the DBFO model should be obtained from NGRBA.

– The process of empanelment of qualified or reputed service providers interested in construction, operation and maintenance of sewage treatment plants for usable water quality production through the DBFO route should be started soon.

Recommendations for Actions on Urban River Management Plan (URMP) for all Class I Towns A URMP should have 'actionable' items to ensure that the riverbank in the town is cleaned, developed and beautified such that it is easily accessible to the citizens as a public space suitable for various spiritual, religious, recreational, socio-cultural and other outdoor activities. Furthermore, 'actionable' items to ensure prevention of discharge of treated or untreated sewage into the river either directly or indirectly and 'actionable items' to ensure that treated sewage is reused and recycled should be a part of the URMP (Soni, 2019 and Basu, 2016).

Zero liquid discharge and reusable water from industrial wastewaters:

Effluents generated by industries are widely varying in nature, depending on the industry's products, raw materials used, processing technologies adopted, etc. While some industrial wastewaters can be adequately treated for reuse very economically, others have dissolved impurities that are more expensive or difficult to remove. Nonetheless, these impurities and other recalcitrant pollutants are hazardous and their removal is essential for reuse or environmental disposal of the treated water. But once the wastewater is treated upto the level of safe environmental discharge, there is little point in discarding the water rather than reusing it.

An attempt has been made in the GRBEMP to assess technology options and work out the indicative costs of the required effluent treatment for different types of industries. Since the treatment level needed may be different for different industry types, the focus has been on those effluent-generating industries with high pollution potential that have a significant presence in the NRGB. These include Tanneries, Pulp and Paper Industries, Distilleries and Textile and Dyeing Units. At present, the work for Pulp and Paper Industries has been completed, while the others are in progress. Pulp and paper Industries, particularly agro-based ones, are major polluters of rivers, e.g. of Rivers Ramganga and Kali which lead to pollution of River Ganga in its middle stretch. The results of existing effluent treatment practices have been highly unsatisfactory so far, and National River Ganga continues to get polluted. The prevailing discharge standards are based on the premise that the background river water quality is almost pristine and at least 10 times dilution water is available in the river. However, these conditions are not met in many rivers including National River Ganga except during the monsoons. By adopting the Zero Liquid Discharge criterion (full treatment and reuse of wastewater), not only will the river water quality be saved from further deterioration, but groundwater abstractions will also reduce significantly, enabling higher base flows in rivers during dry seasons.

Ecological restoration:

The ecological balance in the Ganga river network has been critically affected in recent times, with major indicator species (including fishes and dolphins) having dwindled or disappeared from many river stretches in recent history. In order to assess the ecological status of the Ganga river network, historical changes in the biodiversity of the river system need to be known. However, historical data being scarce, only some recent changes in biodiversity can be identified. They include the disappearance or reduction of several indicator species in various stretches of the river such as Dolphins, and the Trout, Indian Major Carp and Hilsa fishes. The following important reasons are of significance: break in longitudinal connectivity of rivers due to dams or barrages

(such as the Maneri Bhali, Pashulok, Bhimgauda and Farakka barrages and the Tehri and Koteshwar dams) affecting the mobility of aquatic species, abstraction of large amounts of water into canals in the middle Ganga stretch, pollution of river waters through urban and rural discharges, bio-magnification of toxic compounds, habitat degradation, over-fishing/overexploitation of species, introduction of exotic species (such as Chinese Carp and Tilapia) and loss of spawning, feeding and nursery grounds. These reasons indicate that the primary requirement for restoring the ecological status depends largely on adherence to the principles of "Aviral Dhara" and "Nirmal Dhara". Additionally, protection of spawning and breeding grounds of native species, variability in flow regimes and elimination of competing exotic species from the river network are needed (Bagla, 2014).

Geological safeguarding:

Modern anthropogenic ventures can threaten geological formations supporting the river basin in new ways. Notable among these are underground explosions, excavations, tunneling, mining and rock fracturing. Likewise, over-withdrawal of ground water from confined or semiconfined aquifers may create unbearable overburden pressures, causing the aquifer matrix to partially collapse with consequent land subsidence. Another potential threat is due to large reservoirs. Operation of such reservoirs involving their filling up during high flows and emptying during lean periods produces significant variations in soil water pressures, which build up additional cyclical stress patterns.

Geomorphological features of rivers and wetlands are more vulnerable than the underlying geologic strata to both natural and manmade stresses. While natural phenomena such as wind, storms, cloudbursts, seismic pressures, landslides and avalanches may not be controllable, various land use practices that are potentially geosensitive need to be checked.These include land-uses that significantly affect the physical properties of catchments such as denudation/ deforestation and construction activities on fragile slopes and in floodplains, agricultural tillage and consequent soil erosion, sand mining from river beds, embankments for flood control and river bank modifications for other purposes (Pervez and Henebry, 2014).

Sustainable agriculture:

India is a largely agricultural country, with most of its arable land (more than 60% of the country's landmass) being used for agriculture. This is unlike many other large, agriculturally productive countries, much of whose arable land may be pastures. For instance, the United States, which has more arable land than any other nation (and about 44–45% of her landmass), uses more than half of her arable land for livestock grazing. In NRGB most of the arable land lies in fertile alluvial plains with high annual rainfall and it has been mainly deployed for agriculture since long. With developments in large-scale canal irrigation during British rule, increasingly more arable land was brought under cultivation. Consequently, agriculture is the prime sect oral user of water in India, accounting for more than 80 per cent of her water use. Hence, water resource depletion in India and in NRGB may be significantly attributed to agricultural use, calling for efficient irrigation practices. Simultaneously, agriculture is also a potentially major source of water pollution. These two aspects underline the unsustainability of modern agricultural activity in NRGB.

Agriculture along with animal husbandry, aquaculture, etc. can also be a major source of contaminant discharge. Apart from traditional agro-residues, animal refuse and eroded soil, modern chemical fertilizers and pesticides can be significant pollutant contributors to water sources through surface runoff and percolation through soil. Pollutants from fertilizers are mainly as nitrates, phosphates and sometimes heavy metals such as lead and cadmium. Pesticides have a wider range of polluting chemicals, which may be highly toxic, chemically stable and biomagnifying through the food chain. But pesticides are used not only in agriculture; they are also used extensively for grain storage.

Action plan by government for rejuvenation:

An act to provide for the protection and improvement of enviornment, the decisions were taken at the United nation conference on the human enviornment held at stockholm in june, 1972. In India an enviornmental safety act was enacted in 1986.

Namami gange:

Its implementation has been divided into Entry-Level Activities (for immediate visible impact), Medium-Term Activities (to be implemented within 5 years of time frame) and Long-Term Activities (to be implemented within 10 years).

The key achievements under Namami Gange

programme are:

Creating sewerage treatment capacity:

63 sewerage management projects under implementation in the States of Uttarakhand, Uttar Pradesh, Bihar, Jharkhand and West Bengal. 12 new sewerage management Projects Launched in these states. Work is under construction for creating sewerage capacity of 1187.33 (MLD). Hybrid Annuity PPP Model based two projects has been initiated for Jagjeetpur, Haridwar and Ramanna, Varanasi.

Creating river-front development:

28 river-front development projects and 33 Entry level Projects for construction, modernization and renovation of 182 Ghats and 118 crematoria has been initiated.

River surface cleaning:

River surface cleaning for collection of floating solid waste from the surface of the Ghats and River and its disposal are afoot and pushed into service at 11 locations.

Bio-diversity conservation:

Several bio-diversity conservation projects are namely: Bio-diversity conservation and Ganga Rejuvenation, Fish and Fishery Conservation in Ganga River, Ganges River Dolphin Conservation Education Programme has been initiated. 5 Bio-Diversity centres' at Dehradun, Narora, Allahabad, Varanasi and Barrackpore has been developed for restoration of identified priority species.

Afforestation:

Forestry interventions for Ganga through Wildlife Institute of India; Central Inland Fisheries Research Institute and Centre for Environment Education has been initiated. Forestry interventions for Ganga has been executed as per the Detailed Project Report prepared by Forest Research Institute, Dehradun for a period of 5 years (2016-2021) at project cost of Rs.2300 Crores. Work has been commenced in 7 districts of Uttarakahnd for medicinal plants.

Public awareness:

A series of activities such as events, workshops, seminars and conferences and numerous IEC activities were organized to make a strong pitch for public outreach and community participation in the programme. Various awareness activities through rallies, campaigns, exhibitions, shramdaan, cleanliness drives, competitions, plantation drives and development and distribution of resource materials were organized and for wider publicity the mass mediums such as TV/Radio, print media advertisements, advertorials, featured articles and advertorials were published.

Industrial effluent monitoring:

Real time effluent monitoring stations (EMS) has been installed in 572 out of 760 Grossly Polluting Industries (GPIs). Closure notice has been issued to 135 GPIs so far and others have been given deadlines for compliance to stipulated norms and for installations of online EMS.

Ganga gram:

Ministry of drinking water and sanitation identified 1674 Gram Panchayats situated on the bank of river ganga in 5 state (Uttarakhand, Uttar Pradesh, Bihar, Jharkhand, West Bengal). Rs. 578 Crores has been released to Ministry of drinking water and sanitation (MoDWS) for construction of toilets in 1674 Gram Panchayats of 5 Ganga basin states. Out of the targeted 15, 27,105 units, ministry has completed 53,397 toilets. Consortium of 7 IITs has been engaged in the preparation of Ganga River basin plan and 65 villages has been adopted by 13 IITs to develop as model villages. UNDP has been engaged as the executing agency for rural sanitation programme and to develop Jharkhand as a model dtate at an estimated cost of Rs. 127 Crore.

National Mission for Clean Ganga, endeavors to deploy best available knowledge and resources across the world for Ganga rejuvenation. Clean Gangahas been a perennial attraction for many international countries that have expertise in river rejuvenation. Countries such as Australia, United Kingdom, Germany, Finland, Israel etc. have shown interest in collaborating with India for Ganga rejuvenation. Memorandums of Understanding were signed with various Central Ministries *viz*.,- Ministry of Human Resource Development, Ministry of Rural Development, Ministry of Railways, Ministry of Shipping, Ministry of Tourism, Ministry of Ayush, Ministry of Petroleum, Ministry of Youth Affairs and Sports, Ministry of Drinking Water and Sanitation and Ministry of Agriculture for synergizing the Government schemes (Soni, 2019).

Conclusion:

The present study stresses that the awareness about the causes and effects of water pollution should be spread all over the country. Government, NGO and intellectuals should have done efforts to aware people about the water pollution and its harmful effects. The NGO green earth organized competitions programme, poster making, slogan writing and an environment quiz for creating awareness about the environment, health and sanitation among the public. The toxic and hazardous waste generated from industries, urban and rural areas should not be dumped directly into earth. Article 21 and 32 of the constitution of India is a great safeguard to provide shield to the fundamental rights. It is a weapon to protect the right to access the clean water. No law or authority can get success in removing water pollution unless the determination of people not to pollute water. Every industry, urban and rural areas should dump the toxic and hazardous waste at waste collection centre. There should be strong implementation and enforcement of water quality laws, water pollution laws and to stronger the penal provisions. There should be separate environmental courts in each state should be established.

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