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HYDROECOLOGY IS AN EMPHATIC WEAPON TO MITIGATE THE DETRIMENTAL EFFECTS OF HUMAN INTERFERENCES ON RIVER GANGA IN UTTARAKHAND

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ABSTRACT

This research manuscript evaluates various aspects of human interferences on the health of river Ganga. Hydro ecology of Ganga, besides being immensely significant, was never ever given required attention. The several types of human interferences as domestic/municipal house hold waste water and sewer discharge, hydroelectric power plants/dams and dumping of toxicants in Ganga, responsible for increasing pollution in Ganga, were intensively studied, however, issues like off monsoon flow, continuous minimum water flow and water resources for Ganga and their consequential impacts on river hydro ecology were not addressed. The reasons for failure of Ganga Action Plan (GAP) and remedial measures for mitigating the pollution crisis are prominent issues of special consideration. Hydro ecology is discussed as the frontline science for mitigating the water pollution crisis of Ganga. The objective opinion of author, to curb down the pollution crisis of lifeline river Ganga, has been significantly portrayed for further perusals and executions.

Key words Hydroecology of river Ganga, Human interferences, Hydroelectric power plants/dams, Toxicants in Ganga, Pollution crisis in Ganga, Upper Himalayan regions, Failure of Ganga Action Plan, Holy city Rishikesh, Uttarakhand.

Introduction

Water is an elixir on earth and mandatory for life. Approximately 79% of earth is covered with water and nearly same amount of water is present in our body. Therefore, our body is considered as the fresh water *Ecology* or *Limnology*. Since the inception of human civilization, Ganga –the lifeline for billions, has remained India's river of faith, devotion and worship. Millions of people depend on this great river for physical and spiritual sustenance. The Hindu religious ceremonies and rituals are celebrated and blessed with its water. It will not be hyperbolic in mentioning that Indian cultural and monumental identities are incomplete without Ganga. Ganga is a river for billions. The *soul is liberated* from worldly complication simply by *viewing at Ganga*. The faith of people in Ganga for soul deliverance makes it to be worshiped like a deity. Ganga is embodied as “*flowing form of Brahm*” on earth in our great religious epics and valued immensely for the concepts and sustenance of life. This river is a blissful gift of Nature for us-the Indians and others. According to our *Hindu Mythology*, a dip in this river cleans up our body and soul by destroying the sins committed in life. River Ganga, with great socio-religious significance, is the source of emotionality, eternal peace and spirituality for mankind. This river has earned the name, fame and respect from all over the world (Rehana, 1996). Kumbh and Mahakumbh, the biggest religious assemblages of holy

people in India, further signify the importance of Ganga and other rivers.

Historical perspective of Ganga

Himalaya is the origin source of major Indian rivers including Ganga and Brahmaputra. Bhagirathi is the main tributary of Ganga. It originates from Gangotri glacier in Gomukh (30_360 N; 79_040 E) of Uttar Kashi, Uttarakhand, at an altitude of about 3800 m above mean sea level in Garhwal Himalaya (Vass et al., 2010). Many streams like Mandakini, Alaknanda, Dhauliganga, Pindar and Bhilangana make confluences at several places in Himalayan region and thus Ganga is ultimately formed (Trivedi, 2010). Alaknanda makes confluence with Bhagirathi in Devprayag and from here river is named as Ganga. It runs nearly 2525 km on its journey destination from origin source- Gomukh, to the Sea. The main tributaries of Ganga such as Yamuna, Ramganga, Gomti, Ghaghara, Gandak, Kosi and Kali-East and sub tributaries- like Chambal, Sindh, Betwa, Ken, Tons (beyond Five States), Sone and Kasia-Haldi contribute immensely to the glory of Ganga. People from all places carry Ganga water because of the *holy nature* and *curative* properties (Singh et al., 2011; Ha'usler, 2006). This water destroys the sins committed in various phases of life (Aitken and Sobsey, 2007; Das et al., 2007, Lerner et al., 2007) and liberates the soul from the complications of birth and death. River Ganga has been described in Rigveda in the

continuous Saraswati-Indus civilization dating back to 7500 BC (Ha'usler, 2006). Hippocrates, prior to 500 BC, stated the therapeutic and healing properties of Ganga water for diseases.

The national scenario of Ganga pollution

The proceeding of the meeting on river Ganga Basin Authority in 2012, clearly stated that every day 29,000 trillion litres of wastes- dirty and polluted water and effluents, are being drained in Ganga from Gomukh to sea. Statistically, domestic house hold wastes, municipal sewage sludge wastes etc., containing nearly all types of pathogenic coli form bacteria, are considered as the most dreaded cause of about 78- 80% pollution in Ganga and 15% pollution is due to disposal of chemical/ industrial wastes (Agrawal et al., 2010). Further, nearly 5% is agricultural waste pollution and 2- 3% solid waste pollution. Approximately 90 cities of various sizes from Gomukh to Sea are in the closest vicinity of Ganga and Kanpur, Varanasi, Patna and West Bengal are badly polluting the river. Nearly 142 industries of Uttar Pradesh drain approximately 260 million liters of industrial wastes in Ganga each day. Coli forms in Ganga water at Varanasi were observed way back in 1986 as 10,000 % higher i.e. 50,000 CFU/ 100 ml of water (Sinha, 1986). Due to these water pollution problems, clean water associated parameters like Biological Oxygen Demand (BOD) and Dissolved Oxygen (DO) are changing drastically.

Human interferences to Ganga in Himalayan region

The wrong activities and unethical interferences of human beings as lust, luxury, gluttony, materialism, modern lifestyle etc. cause serious damage and spoil the normal fabrics of Ganga. Activities like widening of the roads, deforestation, land mines' blasts etc., are unethically damaging *Mountain Ecology* and construction of big dams are severe harmful causes to the natural and normal ecological water flow intensity of Ganga. The consistent pressure of static and transient human population in hilly regions and forest fire are badly affecting Ganga. Millions of Kavariyas, tourists and pilgrims coming to this region further worsen the condition. In Uttarakhand, approximately five hundred fifty five hydroelectric power plant projects of various capacities (constructed, under construction and pipe line) caused tunnelization and obstruction to the continuous natural water flow of about 1, 300 Km river stretches etc., damage like weapon of mass destruction to *Ganga* and the living beings including human beings. Likewise, drainage of sewage, domestic and industrial effluents and washing of clothes in river Ganga from Gomukh of Gangotri, Uttarakhand to the Sea, passing though Uttar Pradesh, Bihar, Jharkhand and West Bengal, adversely affect the river water quality (Rehana et al., 1996). An eye opening study on pollution scenario in river Mandakini at Kedar Valley in Rudraprayag, Uttarakhand was performed by us (Tripathi and Gupta, 2002) and the eventual

observations profoundly affected me to take up intense research studies on various aspects of Ganga in Uttarakhand.

Ganga pollution in Rishikesh

Rishikesh is situated on the bank of Ganga and nearly 20% of population does not have sewer lines. Approximately, 85% pollution in Ganga at Rishikesh is because of dirty domestic waste water and sewer discharge. From Tapovan to Shyampur, around 18 drains directly discharge in Ganga. The severity and panic of water pollution in Rishikesh can be gauged by recalling the historical facts that *Saraswati Stream*- a tributary of Ganga at Triveni Ghat, conferring the name Triveni Sangam in the heart of city- Rishikesh, has been converted into the ever biggest drain of the city with all dirty house hold domestic and municipal sewage sludge wastes. Due to these ill impacts on the health of Ganga, there is an alarming increase in the number of patients of diarrhoeal diseases in and around the city as surveyed from two prominent hospitals. In Rishikesh, total sewage generated is nearly 10.70 MLD whereas the STP capacity is only of about 6.3 MLD. However, the proper and effective functions of these STPs always remain questionable.

Reasons for pollution increase in Ganga

The rising standards of living and exponential growth of industrialization and urbanization have exposed water resources in general and rivers in particular, to various forms of contaminations and degradations. This river runs through almost 52 densely

populated and polluted cities and 48 towns to merge in the sea. Thus, Ganga is used as dumping site for untreated sewer, municipal/ domestic and industrial effluents, besides several ills and evils of human noxious activities. These toxicants cause serious health hazards to both river and the dependent biotic communities including the human beings. The population pressure and urbanization etc. are consistently increasing the load of organic and inorganic matters as contaminants to the river causing serious pollution damages. The untreated municipal sewage is accountable for nearly 75% pollution in Ganga. Important to note that 88 % municipal sewage was found coming from 25 Class I towns/ cities situated on alongside of the river. Only a few of such cities and towns were found having sewage treatment facilities, however, in very less numbers and that too with non functional sickness. Industries are accountable for only less than 15% of the total pollution in Ganga. Further, the industrial effluents from industries, tanneries and factories, situated at Kanpur and Kolkata, were found extremely toxic and hard for the treatment. The high coli form contamination is a result of domestic/sewage discharge in Ganga (Srivastava et al., 1996, Kulshrestha and Sharma, 2006). The solid garbage dumped in the river, defecation along the sides of Ganga by economically weaker and under privileged people, mass bathing and ritualistic practices, animal dead bodies/half burnt and un-burnt human body remains thrown in Ganga, water from agricultural lands with residues of harmful pesticides

and fertilizers etc., are known as the prominent sources for polluting the river.

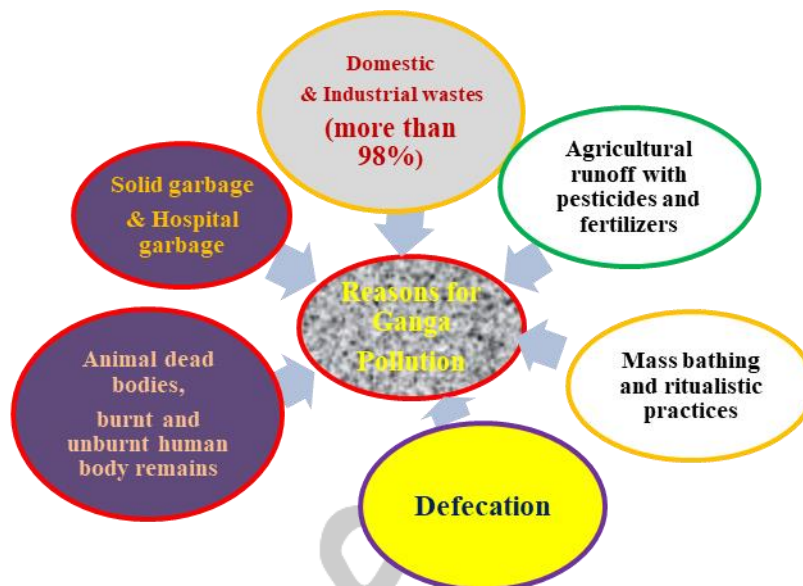


Figure 1 showing various causes of river Ganga water pollution

Harmful effects of water pollution

Industrial effluents and sewage cause harmful aquatic eco-toxic effects on aquatic bio-communities immediately after entering the aquatic reservoirs and disrupt the quality of water (Sinha and Paul, 2012). The usable water quality immensely affects the human health (Sharma et al., 2005). The organic matter, toxic metals, suspended solids and microbial pathogens are the main water pollutants disrupting the aquatic biology of Ganga. In India, water pollution and contamination caused water borne infections are held accountable for 90% diseases and 80% deaths. Nearly 80% of entire health

problems and 1/3rd of deaths in India are caused due to water borne diseases (CSE BS, 2009). Diarrhoea, a water borne infection/disease, is considered as the second biggest killer disease mainly of children less than five years of age after pneumonia. Nearly 400 million people, besides many more biotic community indirectly, other faunal and floral diversity and large enough land etc. are dependent and hence affected by Ganga (Cheng, 2003). Ironically, from Haridwar onwards, Ganga flow to downhill is called as the *journey of pollution* (Rehana et al., 1996).

Recent approaches for mitigation of Ganga water pollution

Namami Gange, Nirmal Ganga, Aviral Ganga, Sparsh Ganga, Ganga Rejuvenation, Mission Ganga are plans to purify Ganga by diminishing the pollution crisis. Various programs like public participation, mass awareness campaign and infusing the moral, ethical and spiritual values appear relevant in achieving the goal. The restoration of Dolphins in river Ganga again may be symbolic identity of past purity standards of Ganga. The composite research program

must be started on several aspects of river Ganga, together with its tributaries and distributaries, like sources and nature of pollution, use of the resources of Ganga in agriculture, animal husbandry, fisheries, forests, water sports, rafting, tourism, navigation, ecological flow and hydroecological relations, demographic, cultural and human settlements in the closure vicinity of river. Govt. of India is pumping huge money for Ganga purification but time will testify the success.

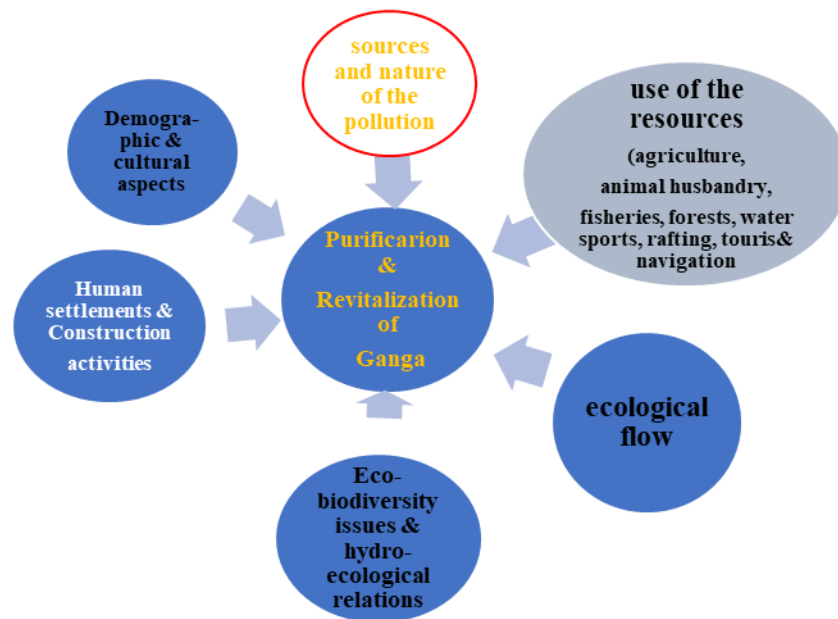


Figure 2 showing several ways to make Ganga pure and revitalized.

Conclusion

This research article attempts to scientifically evaluate the detrimental impacts of human interferences on hydroecology of river Ganga particularly in Uttarakhand. Several reasons and sources

polluting this river, in terms of the types of pollution and related hazardous health effects, have been analyzed. The painful condition of Ganga pollution in Uttarakhand and Rishikesh have been portrayed. Further, the reasons for failure of Ganga Action Plan

(GAP) are specially deliberated. The strategic ways for mitigation of pollution in Ganga river have been largely described. Recent approaches for protecting Ganga from pollution hazards, through sustainability and restoring its hydroecology, have been explained. The opinion of the author is put forth for meaningful perusal and execution to neutralize the water pollution complications so as to make Ganga better and healthier for us and the entire humanity.

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