

REJUVENATING RIVER GANGA

A Himalayan Task



MOTHER GANGA

River Ganga is the most sacred river of India with many sites of historical, cultural and religious importance - from Gangotri - the source to Ganga Sagar at the mouth of the river, and Haridwar, Allahabad and Varanasi in between. River Ganga is so deeply ingrained into India's socio-cultural ethos that it is impossible to perceive the nation without Ganga. The basin of River Ganga constitutes 26% of India's land mass and supports 43% of the country's population. The river carries 28% of the nation's surface water resources.

However, River Ganga is extensively fragmented and exploited. 'Mother' Ganga has been deprived of her blood, her arteries have been blocked, poisons have been injected and wounds inflicted on the body. 'Mother' Ganga is too sick to be able to perform her functions. The water known for its unique antimicrobial and non-putrefying properties is laden with deadly toxins. Most of its tributaries, especially Yamuna, are in nearly similar or worse states.

When the British started constructing the first flow diversion structure at Bhimgoda, upstream of Haridwar, the entire Indian society under the leadership of Pandit Malaviya succeeded in forcing the British rulers to allow for ever an un-interrupted, natural flow at Haridwar. Unfortunately, Ganga has been tamed and its flow blocked fully upstream of Rishikesh at Tehri, and at several places further upstream. The sanctity of sacred 'Prayags' within its Himalayan sojourn has been compromised. And 'Prayagraj' - the confluence of Ganga and Yamuna near Allahabad has to beg for water for the devotees to bathe.

Rejuvenation of Ganga is a Himalayan task and must start from the Himalayan reaches and tributaries. Ganga needs un-interrupted natural flow, restoration of its floodplains, and total prohibition of discharge or disposal of any kind of waste that includes religious offering and idols on a commercial scale. 'Mother Ganga' needs a surgical treatment; pills and tonics in the form of isolated, scattered efforts cannot succeed in rejuvenating her. The economic development models based on exploitation of river flows need to be re-examined. The enormous contribution of unimpacted Ganga to the national GDP needs to be evaluated against the gains from obsessive emphasis on flow storage and diversion.

While Ganga Manthan is a welcome step in consultation with various stakeholders, it is absolutely necessary that these stakeholders become active partners in the rejuvenation efforts. This requires that the information on the daily flow in Mother Ganga, its tributaries as well other rivers is brought out of the strictly guarded closets and placed in the public domain.

Human Civilisations started along the Rivers

The earliest human civilizations developed along the rivers in Asia. Humans depended upon the rivers for water and fish since ages and had learned their role in the assimilation of organic wastes. Agriculture had its origin on the floodplains whose fertility was renewed annually by the rivers. Later, humans learned of irrigation by taking water from the rivers and an irrigation system was perfected by the Indus valley civilisation. Indians recognised the critical importance of rivers to the human sustenance in their reverence for rivers as sacred, 'mother' and 'goddess'. Hence any kind of polluting activity was prohibited.

What is a River?

Nature's water cycle continuously re-distributes water over the earth's surface - although highly unevenly over space and time. Water falling over the land must return to the oceans. Rivers collect water from large land surfaces and carry it back to the oceans carving out their own course. Rivers are an indispensable link in the global hydrological cycle. Yet, rivers are not mere channels. They carry energy, sediments, nutrients and organisms whose interactions among themselves transform rivers into complex and dynamic ecosystems which also change gradually and continuously from the source until the mouth. Each small or large river has its specific characteristics which are determined primarily and largely by its flow regime (volume, timing, duration of flow), besides geology, climate and catchment characteristics.

Benefits from Rivers

Humans benefit most from the use of their water by diverting the flows for agriculture, domestic and industrial supplies and energy generation. However, people forget that rivers are not all about water alone. They are living ecosystems, teeming with enormous variety of life - from microorganisms to mammals. As ecosystems, they provide innumerable benefits which accrue because of their various functions resulting from specific physical, chemical and biological processes. Humans cannot obtain these benefits in any other manner or without serious adverse consequences for themselves.

Table: Economic Benefits from Rivers

| River Function | Benefits to Humans |
|--|--|
| Carrying water to different areas down slope | Requires no engineering or energy; Also, moderation of microclimate along the rivers |
| Assimilation of wastes discharged into the river | Saving costs on wastewater treatment, uncluding energy |
| Groundwater recharge with simultaneous improvement of the water quality | Saving costs of water harvesting structure and recharge wells; Higher groundwater level saves on energy for withdrawal of water |
| Converting boulders and gravel to fine sediments and transporting them to distant areas | Saving costs on crushers (besides avoiding pollution caused by them), and transport (including infrastructure and energy) <i>Note: Sediments trapped behind flow diversion structures reduce storage capacity of reservoirs and require dredging and transport costs.</i> |
| Supply of sediments and nutrients downstream that sustain soil fertility and production of natural vegetation, fisheries, and crops. | Saving costs of fertilizers; Direct benefit from vegetation and fish |
| Transporting materials (e.g., logs from forests) and people | Saving on cost of transport and energy |
| Supporting large proportion of biodiversity (15-20% of total) Providing natural fisheries (about 50% of total freshwater fisheries in India) of large variety | Multiple benefits from aquatic organisms; Saving costs on feeds, aeration, nurseries, chemicals, maintenance for gaining only a few species |
| Production of plant resources on floodplains and along the river banks (for humans, cattle and wildlife) Also assimilation of organic wastes and nutrients and hence, improving water quality. <i>Note: Floodplains are kidneys of the landscape</i> | Direct benefit from the plant and animal resources; Savings on cost of agrochemicals, irrigation management and energy for fodder production Improvement in river water quality |
| Sustaining the mangroves (with freshwater and sediment inputs) along the sea coasts | Savings on enormous costs of infrastructure for defense against the cyclonic storms; Reduced damage to life and property |
| Transporting organic matter and fine sediments to the coastal waters | Direct economic benefits from marine/coastal fisheries |
| Returning freshwater to the sea to cause a salinity gradient that influences the monsoon | Benefits from timely rainfall |

Indirect and Intangible Benefits

Apart from the above direct economic benefits, humans obtain many social, cultural, religious, and recreational benefits many of which translate into economic benefits as well. These benefits are too large and diverse, and usually vary not only between rivers but also between different reaches of the same river. Large number of communities, especially the poor and backward communities, depend for their innumerable livelihoods on rivers and river-dependent resources. The benefits of the tranquil, aesthetically soothing environs of the naturally flowing rivers that provide peace and relief from the stressful modern urban life, cannot be valued in economic terms.

Why are Rivers Dying?

Technological advancements made during the last century have intensified the exploitation of rivers because no human developmental activity can occur without water.

Small scale freshwater abstractions have gradually turned into huge storages and long distance diversions. Humans take pride in “making the rivers dry and deserts bloom”. The growing obsession with hydropower as a ‘clean and green’ source of energy by exploiting the Himalayan headwaters of all Indian rivers, has rendered long stretches of rivers totally dry or turned them into a cascade of reservoirs, and leave the rest of rivers almost ‘headless’.

The waste assimilating property of the rivers has been over-exploited without considering the limitation imposed by the declining flows. Whereas the river flows have been brought down to zero, the discharge of domestic and industrial effluents continues to increase. The elimination of scavenging organisms (including turtles and alligators) has only aggravated the problem of river pollution. On one hand, unplanned urban and industrial growth

with inadequate and inefficient wastewater treatment and the growing diversity of non-degradable pollutants rapidly degrade the water quality, and on the other, humans have encroached upon the space required by the rivers to carry their flows and sediments. In many stretches, the floodplains have been eliminated almost completely and the rivers are forced to flow through narrow straightened channels like canals. In the remaining floodplain areas also, the vegetation along the rivers has been cleared, the fish and other wildlife have been over-exploited and their natural habitats greatly altered. Further threats come to the rivers from excessive, unregulated, irresponsible over-abstraction of sand and gravel from the river beds which affects the stability of river channels, and destroys the hyporheic biodiversity that plays an important role in improving water quality.

Lastly, but equally important is the anthropogenic degradation of catchments of the rivers. All human activities ranging from clearing of natural vegetation to agriculture and mining, besides urbanisation and industries, promote erosion and hence, increased inputs of sediments and nutrients into the rivers.

Rivers as Common Pool Resource to Open Access Resource

It is important to point out that all rivers are essentially a Common Pool resource which have all attributes of local and transboundary/global commons. As a common pool resource, rivers are multipurpose in nature with technical, socioeconomic, cultural, political and environmental interdependencies. They suffer with spatial and temporal externalities (pollution, encroachment), natural and created conflicts, misspecification of property rights regimes/tenure arrangements, entitlement systems and mechanism for adjusting allocation of water resources. Most of the use and non-use values for conservation and preservation often do not have any ready market expression to convince different stakeholders.



Rivers have become an Open Access resource (exemplifying the tragedy of commons) due to weak property rights regimes, inadequate and ineffective institutional arrangements and breakdown of authority system. Here lies the key to the cause of degradation or demise of the rivers.

How to Rejuvenate a River?

The key to rejuvenation of the rivers lies in a paradigm shift in our approach towards the rivers, and a multipronged action plan (see Figure).

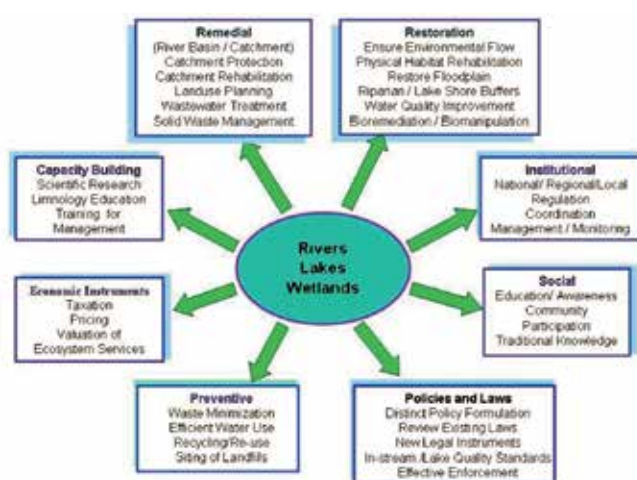
Following actions require immediate attention:

- Treat rivers as natural living ecosystems with specific spatial boundaries.
- Allow their natural flows and seek alternatives to large scale storage and diversion structures so as to ensure near natural flow regimes.
- Restore floodplains by removing encroachments, permanent constructions,



and re-naturalising the river stretches as much as possible.

- Regulate agriculture in the floodplains and allow only organic farming..
- Regulate sand / gravel mining from river beds on sound scientific principles and based on the assessment of current sediment transport.
- Set up river conservation zones according to flood zoning and regulate all pollution causing activities within identified river conservation zones.
- Reduce pollution: Ensure treatment of all wastewaters at source. All urban/municipal local bodies should be treated as industries in the matter of their water use and wastewater treatment.
- Develop and encourage the use of irrigation technologies which significantly lower the water requirement without affecting the agricultural production.
- Promote Smart Cities on the basis of zero waste discharge (liquid, solid and gas). They must follow recycle-and reuse of all wastes.
- Follow ecological approaches to flood control, water quality management, and river front development instead of engineering approaches
- Include Ecosystem Services of rivers in the cost-benefit analysis of all development projects which in any manner impinge upon the river ecosystems.



Measures for the conservation of rivers and associated ecosystems

- Environmental audits of all projects should also consider the costs of environmental damage done by the project over time.
- Establish an institute for research and training in river science that promotes a holistic, ecosystem approach to river conservation and management.
- Develop a hierarchy of institutions from the level of river basin through states to groups and individuals to deal with property rights, entitlement system and allocation mechanisms.

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About the National Institute of Ecology

The National Institute of Ecology (NIE) is an interdisciplinary professional association devoted to environmental conservation through education, research and management, since 1978. Its worldwide membership includes researchers, teachers, managers and policy makers from all fields of ecology and environment.

The NIE promotes interaction between researchers from diverse disciplines of natural sciences, social sciences, economics, law, public health and Engineering as far as they relate to environment and its conservation and management. The NIE organises regular meetings, conferences, symposia and workshops, undertakes research and demonstration projects, and conducts training courses. It actively collaborates with the Central and State governments, universities, research institutions, international organizations, NGOs and also the corporate sector in its various activities.

The NIE has also promoted three specialised Centers: *Center for Application and Research in Ecotechnology & Ecological Engineering (CARE-E)*, Lucknow; *Centre for Integrated Natural Resources Management (C-INRM)*, Raipur; and *Centre for Inland Waters of South Asia (CIWSA)*, Jaipur. CIWSA has its field and laboratory facilities near Khajuraho (M.P.).

The National Institute of Ecology has been a leader in the area of ecology and conservation of all aquatic ecosystems – lakes, wetlands and rivers. It organized the world's First International Wetlands Conference (New Delhi 1980) under the aegis of INTECOL. It was also the first in India to discuss Environmental Flows (jointly with IWMI (Colombo) in New Delhi, March 2005). River basin management and river habitat degradation, and especially the environmental flows, in the context of natural fisheries resources, were discussed at a South Asian workshop, organised jointly with the FAO. The NIE conducted the first of its kind Training Workshop on Environmental Flows (December 2012) for the officers of the hydropower projects, researchers and NGOs.

Research conducted at the NIE has covered areas of river and wetland ecology, river conservation, catchment degradation, ecological economics, remote sensing & GIS, biodiversity assessment, protected area management, and climate change.

The NIE publishes two online journals - ***International Journal of Ecology and Environmental Sciences*** (ISSN: 0377-015X) and the ***Bulletin of the National Institute of Ecology*** (ISSN: 0379-7937). Visit www.nieindia.org/Journal/index.php/

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