

Ecological restoration and management challenges of the river Ganges in India

Les défis de restauration écologique et de gestion de la rivière Ganges, en Inde

S. K. Sharma

Department of Geography, Greenwood Hills School, Dehradun, India
sks105@rediffmail.com

RÉSUMÉ

La rivière Ganges est connue pour avoir une capacité d'auto-purification, est la rivière la plus sacrée vers les Hindous. Il s'élève dans l'Himalaya occidental dans l'état indien de l'Uttarakhand et coule vers le sud et l'est dans la plaine du Gangetic du nord de l'Inde, couvrant une distance totale de plus de 2525 km avant de tomber dans la baie du Bengale. Il s'agit d'une source d'eau potable, d'activités économiques, spirituelles et culturelles en Inde et aussi d'une corde de sauvetage pour des millions d'Indiens qui vivent sur son parcours et en dépendent pour leurs besoins quotidiens. L'industrialisation rapide, l'urbanisation, la construction de barrages hydroélectriques et l'utilisation d'engrais chimiques et de pesticides pour stimuler la production agricole dans le pays après son indépendance en 1947 a non seulement dégradé la qualité de l'eau de la rivière mais aussi posé un grand défi au maintien de l'intégrité écologique l'écosystème de la rivière. Le bassin du Ganges est l'une des régions les plus peuplées du monde en raison de ses terres fertiles renouvelables et de son agriculture. Il soutient des milliers d'espèces aquatiques de flore et de faune. Le dauphin de la rivière Ganges, qui existait en grand nombre, est maintenant sérieusement menacé par la pollution et la construction de barrages. Le document traite de l'évaluation de l'impact, des problèmes et des défis des déchets liquides et solides non traités, de la construction de barrages et barrages sur l'écosystème Ganges, en plus des mesures de suivi visant à minimiser la dégradation écologique de la rivière.

ABSTRACT

The river Ganges is known to have self-purifying capacity, is the most sacred river to Hindus. It rises in the western Himalayas in the Indian state of Uttarakhand, and flows south and east through the Gangetic Plain of North India covering a total distance of over 2525 km before falling into the Bay of Bengal. It is a source of potable water, economic, spiritual and cultural activities in India and also a lifeline to millions of Indians who live along its course and depend on it for their daily needs. Rapid industrialization, urbanization, construction of hydroelectric dams and use of chemical fertilizers and pesticides to boost agriculture production in the country after it gained independence in 1947 has not only degraded the river water quality but also posed a great challenge to the maintenance of ecological integrity of the river ecosystem. The Ganges basin is one of the most thickly populated areas of the world due to its renewable fertile land and agriculture. It sustains thousands of aquatic species of flora and fauna. The Ganges river dolphin, which used to exist in large number is now seriously threatened by pollution and dam construction. The paper deals with the evaluation of impact, issues and challenges of untreated liquid and solid wastes, construction of dams and barrages on the Ganges ecosystem, besides follow-up action to minimize the ecological degradation of the river.

KEYWORDS

aquatic species, ecosystem, Ganges, pollution, restoration

1 INTRODUCTION

1.1 Present status of the river Ganges

The river Ganges is the most sacred river to Hindus and along with her many tributaries, has been the source of physical and spiritual sustenance of Indian civilization for millennia. And all through the ages, Indians held the munificent river Ganges as a Divine Body known to have self-purifying capacity. It rises in the western Himalayas in the Indian state of Uttarakhand, and flows south and east through the Gangetic Plain of North India covering a total distance of over 2525 km before falling into the Bay of Bengal (Fig.1). It is a lifeline to about 500 million people inhabiting its basin. The river Ganges provides water for drinking, domestic needs, agriculture, livelihoods, industrial use, fishing, boating, recreation, religious, cultural activities, and for energy. The natural resources of the Ganges Basin are its abiotic or physical resources (mainly soil/silt, water, and the nutrients bound up with them) and its biotic resources (plants, animals and microbes). These resources are interdependent through various ecological processes linking them with one another. Besides the humans, the river supports rich fauna and flora, including the endangered Ganges river dolphin (*Platanista gangetica gangetica*) and *Gavialis*, and at least nine other species of aquatic mammals, reptiles (including three species of crocodiles along with one species of monitor lizard (*Varanus bengalensis*) and different freshwater turtles. This mighty river also has the richest freshwater fish fauna which is not found elsewhere in India. The paper reviews the various ongoing activities taken up for the ecological restoration and management of the river Ganges.



Fig.1 Course of the river Ganges

1.2 Impacts of deteriorating quality of the river Ganges on the ecosystems

The ecosystem integrity and the goods and services offered by the river are getting adversely affected by the changes in its water quality and flow regime. Invasion of exotic species is another big threat for the river biota. However, since 1950s the river is facing threats of erosion of its ecological integrity due to anthropogenic pressures in the form of water abstractions for existing and proposed hydropower projects, Fig. 2 Dead dolphin in the Ganges



barrages and embankments. With many dams and barrages the river has become lean over the years, with 60% of its water being diverted before it enters the plains. The blind Ganges River dolphins are being accidentally caught in nylon gil-nets with very fine threads that the dolphins cannot sense through echo-location (Fig.2). The very water they swim in is decreasing as more is being siphoned off to fields, canals and dams, separating and decreasing the dolphin populations. This reduced flow and the declining flow has badly affected the assimilative capacity of the river and the river has lost its self-purifying capacity. Some other major ecological problems are the loss of forest cover in its catchment area leading to heavy siltation, pollution from industrial effluents and domestic sewage degrading the water quality to the extent that the river water is not fit for even bathing purposes what to talk about drinking purposes. About 12 billion liters of wastewater are released into the Ganges every day and 80% of this is untreated. Pollution and excessive usage transforms the Ganges water into toxic sludge This has led to a rise in the pollution load. The services rendered by the Ganges can only be maintained if the freshwater ecosystems maintain their resilience under stress. Apparently, the biota and river both have resilient capacity. The functioning of and resilience of ecosystems is strongly dependent on the level of biodiversity.

2 THE ECOLOGICAL RESTORATION AND MANAGEMENT

Ecological management within the Ganges River Basin includes the restoration and conservation of its natural resources (biotic and abiotic), the natural river landscape, protection of natural biodiversity, including the vast array of aquatic, plant and animal life dependent on Ganges. The protection of all living organisms thriving and living within the Ganges River Basin is critical to protecting the natural river system, as the two are intricately connected. Since ecosystem processes are driven by the types

and number of species in an ecosystem and the relative abundance of organisms within these species, hence species biodiversity plays an important role in ecosystem functioning.

The Gangetic dolphin *Platanista gangetica gangetica* was declared a National aquatic animal by the Ministry of Environment and Forest on May 10, 2010. The threats to its population include Human-Dolphin conflict (Poaching, accidental killing, use of dolphin products), habitat degradation, pollution and riverine resource extraction.

3 THE WAY FORWARD

3.1 Ganga River Basin Management Plan

Since, the Gangetic Dolphin requires sufficient year round water flow to move, forage and carry out activities that ensure reproductive success and recruitment into breeding population, therefore, the River Development and Ganga Rejuvenation (Government of India) has prioritized rejuvenation of Ganga river with the objectives of taking comprehensive measures for restoration of the wholesomeness of the Ganga ecosystem and improvement of its ecological health, with due regard to the issue of competing water uses in the river basin. The wholesomeness of the river can be grasped in terms of four defining concepts: "Aviral Dhara" (Continuous Flow), "Nirmal Dhara" (Unpolluted Flow), Geologic Entity, and Ecological Entity. A massive public awareness program has been launched (Fig.3) to cover the wholesomeness of the river by defining following four concepts :

Continuous Flow (Aviral Dhara) - A direct violation of it is due to dams and barrages, which snap the longitudinal connectivity in rivers and alter river water and sediment flows. Available data indicate that human water use has been increasing rapidly of late, and probably increasing beyond the renewal capacity of the basin. Hence, either water availability in the basin must be increased through increased storage of locally manageable and eco-friendly water bodies and aquifers or water demands must be reduced through more efficient water use.

Unpolluted Flow (Nirmal Dhara) - The Ganges river's present-day water quality is abysmal due to anthropogenic wastes polluting the river network in various ways. Urban and industrial wastewaters emanating from major polluting industries such as tanneries, pulp and paper units, distilleries and dyeing units are



Fig.3 Public awareness program

major point sources of pollution that need immediate remediation.

It is economically feasible to treat industrial wastewaters to the point where they can be re-used for providing reusable-quality water over a reasonably long period.

Geologic Entity - The mining activities damages the geological formations supporting the basin's aquatic systems. Land-uses needing immediate control are deforestation, construction activities on riverbanks and fragile slopes, agricultural practices that increase soil erosion, sand mining from river beds, urban, industrial and Infrastructure projects that adversely affect drainage patterns, and local flood control works and river bank modifications.

Ecological Entity – The ecological balance in the Ganges river network has been critically affected in recent times, with major indicator species (such as Dolphins, Trouts, Carps and Hilsa fishes) having dwindled or disappeared. It is clear that the ecological status can be largely restored by adhering to the principles of "Aviral Dhara" and "Nirmal Dhara" by ensuring unpolluted environmental flows and variable flow regimes, protection of spawning and breeding grounds of native species, elimination of competing exotic species from the Ganges river network, and protection from human encroachments

4 CONCLUSION

It is concluded that the need for ecological conservation and protection is dire together with the increase flow and reduce pollution load of the Ganges river. This is possible only if water-efficient agricultural practices are opted which will reduce abstraction of river water in irrigation canal, mass scale plantation is undertaken in catchment area of the river, stringent measures are taken for pollution abatement to save the flora and fauna of the river Ganges. A recent high court ruling in India that gives the Ganges personhood status may lead to environmental redemption.

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