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Cusec-Megawatt River Can we fish in the troubled waters of the Ganga?

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Introduction

Modern river management, in the South Asian subcontinent, is often characterised as being defined by reductionist engineering and comprehensive water control. In technological terms, this has meant the introduction of infrastructures such as weirs, barrages, canal systems and inevitably large dams.[1] The hydraulic principle underlying these varied structural interventions, however, has remained disarmingly simple: regulate flows either through diversion or impoundment in order to then harness the volumes as cusecs or megawatts. That is, from its emergence in the nineteenth century, modern river management in the region has been overwhelmingly biased towards commandeering river flows for irrigation and hydro-electricity.

The *Ganga* basin, cut through by a broad , capacious main stem is tangled with many fluvial arms and innumerable tributaries that are regularly opened up with shifting mouths. The basin is, in fact, densely packed with close to 500 million people, who are spread along the river's banks in eastern India.[2] Prior to the consolidation of colonial rule from the late eighteenth century onwards, the Ganga system served as one of most significant means for river navigation in the region. In Jean Deloche's two volume classic on transport in the Indian subcontinent before the railways, there is abundant mention about a thriving trade along the numerous arteries of the Ganga through a varied collection of small and large boats. Most of these sleek water borne craft were manoeuvred, glided and moved along the surface by enabling them to catch currents, ebbs and pulses that coursed through the silt laden muddy waters. The Ganga system, however, was also prone to violent mood swings; either becoming a wild raging torrential force during the precipitation soaked monsoon season or when snapped of its elemental energies in the dry months, the river almost dramatically acquired the sullen motion of a sluggish python.

Ganga as the Cusec River

The quest for pursuing perennial irrigation in post independent India has resulted in a systematic approach towards harnessing the Ganga waters. At present, there are more than 47 major and medium irrigation projects along the main stem and various tributaries of the system.[3] Summed up differently, this involves 12 major storage and diversion projects,[4] with perennial irrigation provided to an area of 546,820 sq km, which constitutes nearly 56.6% of India's net irrigated area. These 12 major diversion/storage projects in the Ganga basin represent a total of between 2556.6 to 2581.8 m3/s water diverted and 6797 MCM stored annually.[5]

Oddly enough, while surface irrigation has been paid much official attention to in most of the Five Year Plans, groundwater has been the more preferred form of irrigation for the cultivators in the region. According to a Central Water Commission report of 2010, groundwater extraction is the most extensively used in the Ganga with approximately 65% of the cultivable areas being irrigated in such a manner.[6]

Despite the claimed benefits of canal/intensive groundwater irrigation in the Ganga basin, there are several irreversible implications caused by diversions, over-extraction and storage structures. Continued irrigation over the years has contributed to building up of the salt and alkali levels in cultivated soils. In areas where drainage is poor, salinity level and alkali status in the soils have risen appreciably. Even though, some argue this degradation from perennial irrigation has not been entirely captured in state-level numbers. In certain concentrated areas, the soils have been rendered infertile (*usar*) and alkali-affected (*reh*), such as pockets of Western Uttar Pradesh and Bihar.[7] From these areas there is constant subsurface seepage and the flow of wastewater here is charged with salts and alkalis, which eventually find their way to the river waters in the Ganga basin. With 1% of its major/medium irrigated command areas affected by excess salt levels, salinity represents a significant problem for the Ganga basin states. Once again, Bihar and Uttar Pradesh suffer the most salt degradation, with 2.64% and 1.21% of irrigation command areas affected, respectively; however, UP's total salt affected area exceeds that of Bihar's by a count of 2,831.4 sqkm to 1,568.8 sqkm, respectively.[8]

The Megawatt Mantra

Complementing the quest to create perennial irrigation on the Ganga system has been the equally troubled efforts to generate megawatts (MW). The hydro-electric potential of the Ganga basin has been assessed at 10,715 MW, at 60% load factor. Out of the 142 identified schemes in the basin, 22 schemes with a total installed capacity of 2437 MW are currently in operation and a further 12 schemes, with an installed capacity of about 2716 MW are in various stages of construction.[9] To achieve the ambitious program of hydro capacity addition in the 11th Plan period (2007-2012), hydro power projects with an aggregate installed capacity of 58,573 MW were identified by the CEA

(Central Electricity Authority) in the year 2006-07.[10] It remains to be seen when and whether they will be actually completed. The environmental impacts of hydroelectric power depends upon the size and type of the project.[11] World Wildlife Institute (Government of India), in one of its assessments, reported that dangerous impacts on aquatic and terrestrial ecosystems could result due to such dams.[12]

Large scale displacement of people and local ecological degradation are two other typical problems associated with hydropower projects. Displaced people invariably tend to be further marginalized and have limited capacity to withstand the trauma of eviction.[13] However, even projects under construction and many of the proposed projects have now begun to face major delays due to social protests and disapprovals from the Ministry of Environment and Forest.[14] The delays in projects are leading to huge cost overruns challenging the viability, in many instances, of hydro-power.[15] Furthermore, the categorization of large dams under 'renewable energy' is being debated heavily over its claims for being a green energy source.[16] Studies, for example, have shown that methane, emitted from reservoirs could be more potent as a greenhouse gas than carbon dioxide.[17]

Stock versus flow and the problem of the fish

In many ways, debates about irrigation or hydroelectricity are about treating the river as a form of stock rather than as flow. That is, impoundment or diversion of river volumes essentially involves radical or substantial alterations in the rivers natural flow regime. Put differently, generating megawatts or commandeering volumes as cusecs is about fundamentally transforming or impacting the natural pulse regime of the river. For fisheries, however, especially for wild fish runs, patterns and the variable flows regime rather than simply volumes are crucial.

The upland, middle reaches and estuaries of the Ganga basin have been colonized bydiverse fish populations, which thus far have provided unmeasured contributions to rural diets. According to the Central Inland Fisheries Research Institute (CIFRI), the production potential of Ganga, in its lower reaches, is estimated at 198.3 kg/ha/year, though the actual fish yield through capture and catch is 30 kg/ha/year. Thus, only 15.2% of the potential is claimed to be harvested.[18]

However, over the years, a range of developmental activities including irrigation projects, river course modifications and demographic explosion in the basin, have ecologically impaired much of the river system, so that water quality is now considered quite degraded, and unsurprisingly as well negative stress's have begun to play out on fisheries and aquatic biodiversity.[19] Amongst these, however, irrigation projects and flood control measures have been singled out as being amongst the most destructive on the flood plains, sloughs, inundation zones and oxbow lakes, all of which are the breeding and nursing grounds of the prized Indian major carp.[20] This has led to decline of the major carp population, with minor carps and small catfishes doing relatively well.[21]

A historical comparative study conducted by Inland Fisheries Society of India showed that the contribution of major carps to the fishery has declined greatly. At Allahabad between 1958 and 1966 they contributed 43.5% of the catch; between 1972 and 1976 they amounted to 29% and in 1992 to 1993, only 13%.[22] One other traditional component of the fishery is *Hilsa* (hilsa, Ilish). The migratory routes between the estuary and the river are believed to have been disrupted by the Farrakah Barrage. Some observations have been made at the barrage site. A special study was conducted on Hilsa in Bangladesh during this project, but the general survey showed that Hilsa could still be found up as far as Allahabad, although in small quantities during April and May.[23] Hilsa contributed 40-60% of river catches in Bangladesh, 1% at Patna and 0.6% at Allahabad.[24]

However, the launching of the Ganga Action Plan phase-1 by the Central Government in the mid-1980s for cleansing the river has resulted in some amelioration in water quality parameters (increased DO and decreased BOD) to the level of the 1960's in the riverine stretch (although not to the level aimed at).[25] According to De Graaf (in his study on floods, fish and fishermen), the increase in the number of prawn population may even indicate loss of biodiversity in Ganga.[26] However, some fisheries remain in decline and have become a matter of grave concern.

Towards a Conclusion

Briefly, from the above, we point out that contemporary river development in the Ganga basin is being pursued in the familiar model of trying to generate cusecs and megawatts. However, the transaction costs that result from such structural efforts shown from even a cursory look at some of the existing documentation that the trend is towards adversely impacting both the riverine ecology and, in particular, traditional fisheries. Thus far, calibrating the delicate trade-offs between irrigation and electricity demands in the region has been carried out through various kinds of cost-benefit analysis (CBA) exercises. While, undoubtedly, these CBA exercises can provide fairly convincing in puts for resolving competing demands, they nevertheless fail to address the far more complex requirements for fisheries. Put differently, while benefits derived from cusecs and megawatts can be subjected to monetized calculations because they are stock, the same is not the case with fisheries as they are deeply embedded in eco-system heath and deal with ecological relations. Furthermore, riverine communities might value their ecosystems differently than project planners and state development notions. Most CBA accounting strategies, moreover, rarely take into account the value of long-term services such as seasonal inundation and drainage complexity.

Although it is theoretically argued that monetization permits the environment to enter the decision-making process thus providing a rational method for weighing up costs and benefits, it however is burdened with several serious shortcomings. The real world applications of CBA have a bias towards an elitist approach and show a large deviation from issues of social equity, entitlements and ecological integrity. It seems that economic techniques are unable to either capture non-structural value or to translate them into structural values.[27] Therefore, it would be safe to argue that a more

nuanced, comprehensive and delicate system of assessment and evaluation needs to be undertaken when dealing with Ganga river basin.

Perhaps a model of 'co-existence' through co-benefit sharing frameworks might offer more compelling conceptual traction for understanding the Ganges system as an inter-connected series of socio-ecological webs. In turn, such an environmentally and socially informed perspective might help reconcile the range of competing and tension ridden demands for megawatts, irrigation and fisheries in the basin.

The 11th and 12th Five Year plan highlighted the need to focus on inclusive and sustainable strategies to develop the natural resources, yet the programs and policies that followed seem to pull in opposite directions. An uncomfortable disconnect between water policy, irrigation schemes, hydropower development plans and fisheries management is evident from the status of environmental degradation,[28] declining productivity of ecosystem services[29] and yet the more intensive pursuit of modern development strategies.

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