A River at Disequilibrium

By: Kanak Mani Dixit

On 18 August, there was a breach at Kusaha on the eastern embankment above the Kosi Barrage in eastern Nepal. Water flowed out firstly to impact adjacent Sunsari District of Nepal. As the breach widened into a two km stretch and the water gushed out, the inundation affected millions in seven districts of northern and central Bihar (Araria, Katihar, Khagaria, Madhepura, Purnia, Saharsa and Supaul) all the way south to the Ganga.

This ongoing crisis is a man-made humanitarian tragedy first and foremost, and additionally an issue of cross-border inundation which will have a bearing on India-Nepal bilateral relations in the days to come. Doubtless, the interventions for the future must be based on humanitarian considerations relating to the lives of the millions who live in what is known as the Kosi's 'inland delta' in Nepal and in Bihar. They must also rely on practical solutions based on a full understanding of the nature of the flow of Himalayan rivers, and the possibilities and limitations of purely engineering solutions.

The Kosi Barrage is a child of the Nehruvian dream driving the great infrastructural projects after Indian Independence, which relied on engineering advances to pull India out of poverty. Dams, declared Jawaharlal Nehru, were the temples of modern India, and the Kosi Project was one of the earlier interventions to put this dictum into practice. What Nehru could not have known was that the barrage-building knowledge of an engineering fraternity based on the non-silting rivers of Europe and North America might not be appropriate to the Kosi. India's President Dr. Rajendra Prasad, who inaugurated the project in March 1955, definitely knew the natural silt, sand and debris brought down by a river descending through the Himalayan range would be at a scale different from anything experienced elsewhere. This is what he had expressed in the Patna Flood Conference of 1937.

Despite such knowledge, the Kosi was barraged at Bhimnagar on the Nepal-India border, the task of management entrusted to the Government of Bihar. Kilometres of embankment were built on both sides upstream of the barrage (known as the 'eastern and western afflux bund') to guide the water to the barrage, there to feed two large irrigation canals. Downstream, another 125 km of levees charged southwards on the eastern side and 126 km on the west to safeguard eastern Bihar from floods.

Over the last 50 years, the silt continued to flow as a natural phenomenon (and not because of upstream deforestation, which would have no more than incremental impact on the monsoonal flow). Confined by the embankments, and having slowed down after it enters the plains at the point known as Chatara, the Kosi deposited its silt load on its bed, whereas earlier much of it would have been spread over the surrounding region. Over time, it became clear that a crisis was brewing. As the relentless and natural deposition of silt continued, the Kosi began to flow on a plateau inside the embankments, with the riverbed said at places to be up to five metres above the outlying plains of Nepal and Bihar.

Year after year, even as the 'flood mafia' in Bihar continued to reap crores from the annual ritual of supposedly strengthening the embankments, the silt continued to add to the riverbed. On its raised tableland within the levees, the Kosi had achieved a state of disequilibrium in more ways than one. This writer, interested in the phenomenon of sedimentation and possible disaster on the Kosi, has stood on the eastern embankment above and below the Kosi Barrage – the difference in height of the land surface within and outside is starkly evident even to the uneducated eye. Something had to give.

As the silt continued to add to the riverbed height above mean-sea-level, the engineers and managers of the Kosi Barrage must have known that they were riding a tiger. The Kosi was becoming more unstable by the year, and yet no one dared come up with a thought-through solution. Diverting and distributing the water

elsewhere along the old channel(s) of the Kosi would be a complex technical and social-engineering exercise, letting the silt envelope the Kosi Barrage would be the other option, and it was not at all clear that a high dam and massive reservoir upstream in the Nepali hills would provide the solution.

Bihar calamity

Over the course of history, as its riverbed accumulated sediment in the natural course of things, every few decades the free-flowing Kosi would burst its banks and find a different course at least part of the way down to the Ganga. Over the century before 1955, the Kosi had shifted about 115 km westwards from where the Teesta flows today into Bangladesh, and, because of the lay of the land, the river was said to be preparing to move back like a pendulum. This was the point in time at which the river was straitjacketed by the barrage project.

The Kosi had breached its embankments on the eastern and western sides seven times since the barrage was built, but what happened in August 2008 is the most significant one for the lives affected and sheer length of the breach. A half century since the constriction of its flow, says one river expert, the Kosi was simply following its predestined path eastwards. Meanwhile, with the river was embanked for more than a 100 km downstream there was no possibility of it to flow back to its regular channel (which, incidentally, would also have required a climb back on to its 'plateau').

In terms of the proximate cause of the breach, a part of the eastern afflux bund upstream from the barrage seems to have weakened over the past year, but maintenance was not done over the winter and spring as is the practice. In early August, the inhabitants of nearby villages had seen erosion of the bund, and alerted the authorities. The political turmoil in Nepal leading to lack of effective state apparatus and the continuous transport blockages may have been contributory. Some are pointing to the immediate cause of the breach as a deadlock between the embankment maintenance contractors and newborn local political forces within Nepal wanting a share of the spoils. For all this, the primary responsibility to see that all was well lay with the Bihar-based managers and engineers of the Kosi Barrage, who incidentally enjoy extraterritoriality within Nepal.

Whatever the mix of action and inaction which triggered the event, a weakened levee was allowed to give way at a time in mid-August when the Kosi was not even in flood. Inundation spread quickly into Sunsari District of Nepal as the water sought outlet towards the Ganga, more than a 100 km to the south. The bulk of the suffering, however, was reserved for the population in the seven districts of Bihar, by now accustomed to living protected by the embankments and accordingly having made adjustments in livelihoods.

This is a calamity whose human dimensions will only be understood in the days ahead, but the number of people displaced over the first fortnight has reached four million. The count of those who have died is sure to be far above the official figure of less than a hundred. In Bihar and in Nepal, there are thousands of families in search of their lost ones, even as there has been an upwelling of community support for the displaced in the near-absence of governmental rescue efforts. The raised roadways, which at other times stand accused of constricting drainage, seem to have been lifelines for the fleeing population even when the tarmac was underwater. Amidst all this, with the state of Bihar reeling, the unprepared and inadequate response of both New Delhi and Patna to the catastrophe is starkly evident – one which may be compared to the fecklessness exhibited by the US administration in the face of the inundation of New Orleans after Hurricane Katrina in August 2005.

The first question that remains unanswered as of this writing is whether this is a diversion of the entire mainstream of the Kosi. In which case, will the river consolidate on its new course over the remaining month of September? And still left is October, says a river scientist, which recorded the highest monsoonal flow in the Kosi in 1968. Even as we speak, the Kosi is scouring a path along one of its old channels on its way to

the Ganga in a way that might make it difficult to bring it back through a 'river training' exercise. For the fortnight after the breach, the diverted flow seems to have concentrated on creating an inland sea in Bihar, with the impact heightened because of raised roadways and the inability of the waters to flow back to the regular Kosi course because of the intervening east embankment. There are reports that the diverted waters have finally reached the Ganga around 3 September, at the southern extremity of Madhepura District.

A great humanitarian challenge will confront Bihar if indeed the river has permanently shifted course in a manner that it cannot be brought back over the coming year. The effort at rehabilitation, as things stand, would have to be massive as the population waits for the waters to recede in the months ahead. The homes and livelihoods of millions of rural India's poorest segment have already been destroyed, and upon return they will probably find their fields rendered uncultivable for a while. The needs of long-term rehabilitation would be simply unimaginable if the course-shift is permanent – in this, India's mostly densely populated region.

(In all of this, it is important to remember the nearly 10 lakh villagers who have lived within the embankments of Kosi. It is this population that has suffered the most over the years as a result of the Kosi Barrage project. It is a much-ignored category whose difficult living conditions would ironically be eased if the river were to go elsewhere.)

About the silt

The annual ritual accompanying the yearly flood season has been for politicians in Patna to move into the 'blame Nepal' mode, knowing well that with the receding waters the clamour will die down and hard decisions can be pushed back another year. Knowing this, the authorities in Nepal too have been lax in enlightening the Bihar and Uttar Pradesh public that: a) Nepal does not have any dam nor reservoir from which impounded water can be released to flood the plains, and, b) that the two barrages that do exist, on the Narayani (Gandak) and Kosi, are meant merely to divert waters into irrigation canals that exclusively serve downstream India. These barrages do not come with storage reservoirs and do not have the potential to flood, and in any case the sluice gates are controlled by Indian administrators.

The long-term solution proposed by India's water bureaucracy to resolve the problems of the Kosi flood has always been the construction of a high dam above Chatara, where the massive river, having collected water from all of its seven tributaries, debouches on the plains. As the plan goes, the reservoir would impound an immense volume of water, useful for flood prevention, irrigation and hydropower. The downside to the proposal, according to activists in Nepal and Bihar, is the reservoir's inundation of populated farmlands in the hills, the matter of earthquakes in a region racked by high-energy tremors, the loss of fertility-through-silt in Bihar, and the neglect of cheaper and more feasible options of 'living with the flood'. On the whole, the activists claim that the Kosi high dam would be ecological folly and an inability of officialdom to learn from history.

Beyond the pros and cons of the high dam concept, one matter that would have to be addressed by the planners and dam-builders relates to the silt-load of the Kosi, which after all is the underlying cause of the August 2008 breach. How would the high dam cope with the silt that would accumulate in its reservoir? The impounded lake would become a receptacle for silt, sand and debris of massive quantity annually. The advent of a single severe cloudburst (a largely unstudied phenomenon in the Himalayan context) would significantly reduce the lifetime of the reservoir. Bear in mind that the dam would impound more silt than the Kosi Barrage embankments, because in the case of the latter a large volume did flow on to Kursela, where the Kosi meets the Ganga. A reservoir would act more like a silting pond, retaining an additional proportion of the silt.

The question would have to be answered before the idea of a Kosi high dam is taken further – it might take four decades or six decades, but what would be the response when sometime in the latter half of the 21st

century the Kosi reservoir got filled with silt enough for it to be redundant? It is important to know what one would do with a high dam and reservoir that has been made inoperable due to sedimentation, and what of the downstream flooding which would increase with time, because the monsoons would continue to arrive and water (and silt) would continue to flow. How does one decommission a high dam and reservoir?

A high dam on the Kosi is what many activists consider a 'technical quick fix', and the nature of this kind of large project is such that it would be the darling of the engineers, administrators and politicians. It would also push back the need to confront the problem of floods by several decades, which is what tends to attract many authorities to the project – it would shift the search for a lasting solution to authorities two generations hence. The alternative would be much more difficult and possibly thankless, to make the modern-day inhabitants of Bihar understand that floods are a natural phenomenon in the land that their forefathers populated. Undeniably, the monsoon floods are the reason for the fertility of Bihar, and 'living with the flood' is a phenomenon that is an aggravation for but a few weeks every year. But the politicians in Delhi and Patna would find it much more difficult to sell this low-tech, socio-centric idea to a politicised, voting public than the promise of a high dam and reservoir up in Nepal.

The fact is that discussion on alternative solutions as to the future of those living along the banks of the Kosi in Nepal and India has barely begun. The Kosi Breach of August 2008 has forced all to take notice, and even as the humanitarian issues of rescue and rehabilitation continue inadequately as of this writing, it is necessary to consider alternatives for the long term. Serious discussion must begin, between scholars, activists, administrators and politicians of Nepal and Bihar. As far as the flow of the Kosi is concerned, one has evidently to wait out the September-October peak flood season to understand whether the new flow is permanent or if the breach can be plugged and the river brought back to its regular Bhimnagar course.

For the long term, there must be reasoned, non-populist and science-based discussion on the alternatives of: a) keeping the Kosi confined within the existing embankments, b) distributing the flow among several channels in the plains, c) building a high dam in Nepal, d) going back to the historical experience of living with the flood and adjusting livelihoods and infrastructure to the annual inundation. A discussion is needed to arrive at the most humanitarian, equity-driven, practical, ecologically-sound and long-lasting solution. The Kosi has reminded us that there can be no more shirking.

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