GOING WITH THE FLOW

A flood of questions

Long-term flood mitigation efforts need a paradigm shift in the way we think about them, about what is possible and what isn't.

By Kunda Dixit and Inam Ahmed

The devastating monsoon floods in 1998 in Bangladesh, Assam and northern Uttar Pradesh reminded inhabitants of these regions, yet again, about how bad things can get. The disasters were also a warning to others in the Himalayan watershed that even bigger disasters are sure to

Railway crossing over floodwaters in Bihar. HIMAL/Krishna Murari Kishan

Flash floods and alluvial fan in the Hindu Kush. ICIMOD/Li Tianchi

come. To estimate the extent of the casualties and the inadequacy of relief and rescue efforts one only need look at some of the great Himalayan events in recent geological time and imagine what would happen if they were to take place today.

- A gigantic avalanche and flood came off the Annapurna Range in Nepal about 1,000 years ago and swept down the Seti River. It deposited debris several hundred feet deep in a valley where the town of Pokhara is now located. A similar avalanche now would kill as many as 100,000 people.
- The Teesta River that flows down from the Darjeeling hills into Bangladesh to meet up with the Brahmaputra used to flow into the Mahananda and the Ganga in Bihar 200 years ago. Had that sudden river capture occurred today, it would have swept away thousands of villages in a gigantic flash flood.
- The nearby Kosi River has "migrated" some 150 km westwards in the past 200 years. In the next great flood it could easily revert to its earlier riverbed with catastrophic consequences for northern Bihar.

The hydrology of the Himalayan watersheds is scantily studied and little understood. Its potential for damage is often underestimated. This is the region of the world that combines areas with the highest rainfall in the world, the highest, youngest and most unstable mountain chain, the greatest population density and one of the most

extensive levels of poverty. But the science to study this watershed, and the engineering solutions to embank rivers, build bridges and construct dams in them, are based on inappropriate parameters, false premises and wrong priorities. Rules made for the gentle brooks and placid rivers of more temperate climes are just not applicable for the stupendous sediment loads, precipitation levels, and looming dangers like glacial lake outbursts and seismic damming of rivers.

Take the Kulekhani Dam built in the early 1980s near Kathmandu at a cost of 180 million dollars to generate 90 megawatts of power and have an economic life of 100 years. On the night of 20 July 1993, a severe cloudburst in its catchment area unleashed 540 mm of rain in a 24 hour period bringing down an estimated five million cubic metres of silt and boulders into the reservoir. The rain dumped in one night a sediment load several times larger than the estimate made by Kulekhani's designers for the entire lifespan of the dam. It blocked the intake and required another 40 million dollars to rehabilitate the intake structure and penstock to extend the dam's life by another 30 years - provided there are no more rainfall events like that in 1993.

Cloudbursts like the one that hit Kulekhani happen several times every monsoon season in different parts of the Himalaya. In 1998, 406 mm of rain fell in one day in the Butwal area of central Nepal during the same week that another cloudburst triggered landslides in Garhwal that buried several hundred pilgrims bound for Manasarovar, the holy lake in the vicinity of which originate all the great Himalayan rivers, the Indus, the Brahmaputra and the Ganga. Both cloudbursts caused severe floods in northern Uttar Pradesh.

Although those floods and the ones in Assam were bad, the mother of all floods was the one that hit Bangladesh in 1998. The Ganga-Brahmaputra delta is at the tailend of the discharge funnel for the basins of two major rivers stretching from the borders of Himachal Pradesh to southern Tibet, the whole of Nepal, Bhutan, Assam's eastern rimlands and Meghalaya. It would be surprising if there were no floods in Bangladesh. In fact, floods have been happening there ever since the Himalaya rose and became a raintrap. The reason Bangladesh exists is because of the silt that has been deposited there during annual floods over millennia.

After the near-biblical floods in Bangladesh, questions are again being asked: can Bangladesh ever be free of floods? Does it even make sense to try to control them? The 1998 floods were the worst in living memory. In 1988 the submerged area was almost as extensive, but no one remembers the water staying high for as long. For more than two months, the stagnant water remained, becoming polluted, giving off a foul smell and making hundreds of thousands of people sick. The economy was devastated, and it will take many years for the country to recoup. And this certainly won't be the end of it. In the coming decades, floods

of even greater magnitude are almost guaranteed.

Myths and truths

In trying to prevent floods, we first need to separate the myths from the truth, and pinpoint the real causes. Complete flood control in the Himalayan watershed is impossible. Even partial control is an exercise that may be geopolitically, financially and (more important) technically problematic. And so the question arises: should we be trying to prevent floods at all? Or should we be looking at what it is we do when we try to control them that makes the flooding worse. Is it better to try to live with them, and to minimise the danger and damage to infrastructure while maximising the advantages that annual floods bring to farmers? Plans for long-term flood mitigation efforts need a paradigm shift in the way we think about them, about what is possible and what isn't.

After the 1993 floods on the Bagmati river in Bihar, farmers were interviewed. They said: "Our houses are all gone, but that's all right. We have a bumper crop." Every major flood in Bangladesh has been followed by good winter and spring harvests the following year because of the silt replenishment of farmlands. People of Tangail in Bangladesh looked at the oxbow lake that used to flow by their village as the artery that fertilised the fields every year and brought fish

HIMAL/Krishna Murari Kishan

Refugees sheltering on embankment in north Bihar.

when the floodwaters receded. The villagers make a distinction between the beneficial *barsha* floods and the destructive *bona* flooding. Traditionally villagers are well prepared for the three months of high water. But ever since levees were built to "protect" Tangail from floods under Bangladesh's ambitious Flood Action Plan, the oxbow is dry and harvests have fallen. "Floods never killed us," they say in Tangail. "It is flood control that is killing us."

Although rainfall and river level data have not yet been analysed fully (data from parts of the Brahmaputra catchment is actually classified information), preliminary findings are puzzling. Precipitation rates in 1998 were only slightly above normal, but the floods in Bangladesh were as extensive as in 1988, and the water stayed high longer. The question must therefore be asked, was it rainfall that made this year's flood worse, or was it the flood control embankments, new roads, railway tracks, the rising beds of constricted rivers due to siltation, and the expansion of settlements because of population pressure over the last ten years? At least for Dhaka, there are indications that the same embankments that were supposed to protect the city from floods also prevented drainage of floodwaters.

After 1988 deluge, a call went out from Bangladesh for regional talks to control floods, but this initiative was soon ensnared in regional geopolitics. Mutual mistrust between governments, especially India's insistence on dealing bilaterally with upper and lower riparians like Nepal and Bangladesh, stood in the way of achieving any significant level of cooperation even though everyone used the same rhetoric: regional water management could turn the water into a great development force. Task forces set up in 1988 concluded the obvious in general terms: that all three countries could benefit immensely from cooperation in watershed management, flood forecasting, river navigation, drainage improvement and other technical cooperation. There is a precedent: similar mistrust between the countries of Indochina did not prevent them from coming together to cooperate in harnessing the Mekong's potential for irrigation, flood control and energy.

But there are some serious questions being asked about whether we are not putting all our hopes on regional cooperation when there is little proof that even if flood control reservoirs were built in the Himalaya they would be adequate to stop the annual submergence. There are also doubts about the presumption that deforestation in the Himalaya is making the floods worse because of increased soil erosion and siltation. Recent studies show that human activity in the upper catchment of the Himalaya did not have a major effect on floods in Bangladesh and India. In fact, there seemed to be little correlation even between high rainfall in the Himalaya and floods in Bangladesh. It was the rainfall pattern in the Meghalaya Hills directly north of Bangladesh that was the main cause of flooding in the delta.

Thomas Hofer, is a Swiss geogra-

Marooned on the Kosi river in Bihar. PANOS/Bhim Subba

pher and consultant for the Kathmandu-based International Centre for Integrated Mountain Development (ICIMOD). In the book *The Floods in Bangladesh; Processes and Impacts* Hofer writes: "The perception of the Bangladesh peasantry regarding floods displays considerably less panic than the engineers and even academics in Dhaka." He blames the media, academics and engineers who hype floods for catchy headlines and see flooding mainly "as a problem of high water volume to be resolved by technical measures." Responding to this, governments and donors have also gone for technical solutions like the Flood Action Plan in Bangladesh. Hofer says: "When it comes to perception of floods and their danger, few heed the wisdom of villagers, even though it is they who have to (mostly) live with the flood." The solutions to floods seems to be: don't block water, allow it to flow.

High dams debate

Despite this, there is no shortage of experts who advocate the engineering solution with large storage dams in the Himalaya to mitigate floods and augment lean season flow. Dr K B Sajjadur Rashid is a professor of the Geography and Environment Department of Dhaka University and a member of the Bangladesh-Nepal and Bangladesh-India Task Force on Flood Management. He says both engineering and non-engineering methods have to be applied to mitigate floods in the region.

"We need cooperation with India and Nepal to build reservoirs for storage of water in the peak flow period. There are many sites in these two countries, which have low population density, and at the same time, proper elevation for erecting dams to impound large amounts of water," says Dr Rashid.

The call to build high dams in the Himalaya is not new. Neither is the controversy surrounding it. But the tide of expert opinion is running against dams. First, is their cost. The proposed Kosi High Dam at the point where the Kosi breaks into the plains in Nepal will cost anything up to 15 billion US dollars, and if it is ever built will be the largest infrastructure project ever conceived in South Asia. Even if the money is found, the kind of negotiations needed for cost-benefit sharing between the governments of Nepal, India and Bangladesh will be extremely convoluted given the political instability and sensitivity to water issues in all three countries.

Nepali economist Prem Jung Thapa, writing in a recent issue of *Water Nepal* says that the economic benefits to the region from hydropower production and water storage on reservoir sites in Nepal would be substantial, but that Nepal itself would not gain much. Besides, given their phenomenal cost, Thapa says he has strong doubts that "these large dam projects in Nepal would be the highest priority or optimal investment choices even at the regional level in order to reduce poverty and promote economic growth in South Asia."

Besides, the Kosi has the highest silt load of any river in Nepal, and the resulting sedimentation will reduce the life of the reservoir to a point where it will not be feasible at all. And the clincher: the Kosi by itself will not be able to control floods in Bangladesh - there need to be dozens of Kosi Dams strung all along the Eastern Himalaya for enough storage to make any difference downstream. "Only by turning the Ganga and the Brahmaputra into a series of bathtubs will it work. Where is the social and political consensus needed for that kind of a project that carries over generations?" asks Nepali resource economist Dipak Gyawali of the Nepal Water Conservation Foundation.

Gyawali says the problem stems from people who see rivers only as a source of water and devise engineering solution to use and control it. "Rivers are also drainage systems. They have a right to flow out to the sea. When you deny a river that right, it will overflow because it has nowhere else to go."

Geologists and water experts argue that the theory of Himalayan degradation worsening floods has been exaggerated. They say loss of forest cover is not the only reason for flooding, and most of the siltation is caused by natural mass-wasting of the Himalaya due to its steep and geologically young formations. However, watershed conservation is crucial if flood control storage is to be feasible, say experts at ICIMOD which looks at the specific environment and development needs of the Hindu Kush-Himalayan region.

An ICIMOD study, *Forestry and Key Asian Watersheds* states: "The rainfall intensities during the monsoon season are very high. These rains exert a great deal of pressure in the context of erosion. This indicates that forests or good ground coverage are very critical, especially on the first Himalayan ridges, for protection against surface erosion and runoff." According to ICIMOD, forests in the Brahmaputra catchment are under considerable pressure with an average daily per capita fuelwood consumption of 2.5 kg, resulting in a total annual demand for fuelwood of 50 million tonnes.

Floods have their benefits, and a second school of thought advocates learning to live with floods so that the farmlands can take their benefit, while protecting houses, water supply and roads. Proper town planning, zoning and building design that take the annual flood events into account would be one way. Floods are good for the soil, replenishing nutrients.

Experts like Dr Rashid argue that if the storage dams have energy and irrigation components besides flood control, then they will make economic sense for countries in the region. "The first consideration must be to produce hydroelectricity. Nepal has enough potential to build dams that could produce electricity for the whole of Nepal, Bangladesh, northern India and part of Pakistan," he adds.

Prof Suresh Chalise of ICIMOD also believes in the potential of watershed management as a means of flood control. "Our experience has shown that management plans at the watershed and sub-watershed level is the most effective way to deal with the problems of floods as well as landslides at the sub-national, national and regional levels," he says.

Engineering panaceas

The belief in engineering panaceas - that dams in the Himalaya will control floods, provide irrigation and hydropower - is strong. And there are scientific doubts about the role that soil erosion in the mountain catchment plays in floods in the plains, whether storage dams are cost-effective, whether regional cooperation will make any difference, or even whether heavy rain in the Himalaya have an impact on floods in Bangladesh. Most conclusions tend to have a nationalistic bias, be anecdotal, or be extrapolated from extremely skimpy data. The few serious studies that have been undertaken have come to diametrically opposite conclusions to earlier theories about floods and their upstream causes. For instance, despite the glaring headlines and pitiful pictures of inundation from Bangladesh and Assam in 1998, Hofer's research and that by Anil Agarwal and Sunita Narain of the Centre for Science and the Environment in New Delhi indicate that neither the frequency nor volume of flooding has actually increased in Bangladesh over the last 120 years. A greater number of people are affected now because there are more people living in vulnerable flood plains, and infrastructure like roads, bridges and urban sprawl constrict the natural flow of water.

Nevertheless, a 1989 initiative to study the common river basins of Bangladesh, India, Nepal and Bhutan and formulate recommendations on the possible solution to flood problems resulted in three detailed reports with specific recommendations. They pinpointed cloudbursts and monsoon pulses in the catchments as the major cause of floods. Other identified reasons were: heavy local precipitation, deforestation in upper catchments, drainage congestion, outburst of glacial lakes and temporary dams created by rocks and landslides in the Himalaya, cloudbursts and snow and glacial melts.

The reports strongly underlined the need for environmental protection and management of river basins. "Creation of reservoirs at upstream reaches for optimal and multiple use of water resources of the region which, *inter-alia*, could also achieve flood peak attenuation at lower reaches," the report of the Bangladesh-Nepal Taskforce stated. The Bangladesh-Bhutan report also took the same view.

"It would be a great help for flood management if reservoirs are built in these catchments," says Prof Ainun Nishat of IUCN Bangladesh, especially citing the Kosi proposal in Nepal and the Tipaimukh and the Dihang-Subansiri projects in India. Studies have identified 26 sites where such water storage could be possible by building dams in Nepal. However, seven large sites were later identified jointly which could serve all these three purposes.

The task force report also recommended that while dredging of rivers in India and Bangladesh for improving flood drainage may not be effective, it would be useful to carry out dredging of offtakes, mouths and man-made channels to improve their conveyance capability. Both Bangladesh and India also agreed that direct point to point flow of information on water level should be transmitted for effective flood management.

Too little data, too late

In the short-term, though, everyone seems to agree that the best way to avoid casualties would be to have an effective early warning system for floods based on rainfall and river flow data so that downstream inhabitants can take precautions. The Bhutan report said exchange of data and meteorological information of the catchment areas and rivers could improve flood forecasting. The real time water levels and flows of the tributaries from Bhutan namely Mangdechu, Phochu-Mochu, Amochu and Wangchu at their terminal stations, for instance, would be useful for early warning of floods in the Brahmaputra. The data could be transmitted electronically from Bhutan and Nepal to India and Bangladesh. "Watershed management is a long term vision," says Dr Nishat. "Right now, we should focus on short-term solutions like proper flood forecasting. We should improve flood forecasting by continuously feeding data of major rivers. To do that, we must have cooperation from India and Nepal."

Despite such joint understanding on the need for effective forecasting,

there has been no progress in improving the system. Bangladesh and India have had an agreement since 1972 on flood forecasting. India is supposed to inform Bangladesh about the water levels of common rivers at five points if they reach near the danger mark: at Farakka on the Ganga, Domohoni (near Jalpaiguri), Teesta, Dhubri (near Kurigram) and Goalpara on the Brahmaputra, and Silchar on the Meghna. All these points are close to the Bangladesh border and could provide advance warnings by up to 36 hours.

In 1988, Bangladesh sought more lead-time on forecasts and also asked for data from these rivers throughout the year. Bangladesh requested India to push the measuring points further upstream so that the lead-time could be increased. For example, to provide data for the Ganga from as far back as Allahabad, and from Gauhati for Brahmaputra. But India cited logistical problems. "If we had information on the water levels of these rivers throughout the year, we could use these data in our Surface Water Modelling Centre and get very accurate long term forecasting," says Dr Rashid.

Drying grain on a straw raft during floods.

HIMAL/Krishna Murari Kishan

At present, the data on water levels and rainfall (except from areas like Arunachal Pradesh where they are classified) are first sent to the Indian Mete-

orological Department from where the data is transmitted to the Bangladesh Meteorological Office after necessary clearance has been obtained. From there the information is disseminated to other offices in Bangladesh. By the time it reaches the flood-prone districts in Bangladesh it is too late.

Not waiting for governments to get their act together, research bodies in Nepal, India and Bangladesh have joined hands to conduct their own studies and exchange information. The Bangladesh Unnayan Parishad (BUP), Institute for Integrated Development Studies (IIDS) of Nepal and Centre for Policy Research (CPR) of India have conducted different studies since 1990 on the potential for cooperation between these three countries on common water systems. "Our effort is to bring awareness among the government-level policy makers about the need for and scope of cooperation," says Kholiquzzaman of BUP. "We help the governments with studies and facts and figures. The effort of these three organisations is called Track Two."

Track Two is in the process of finding ways to augment the lean season flow of the Ganga, a water-based integrated development of the Ganga–Brahmaputra-Meghna (GBM) region, coordination between the two barrages on the Teesta, one in India and the other in Bangladesh. In addition, Track Two aims to look at the desirability and the feasibility of developing an Eastern Region (four countries including Bhutan) energy grid for the transmission of electricity and gas, as well as Indo-Nepal-Bangladesh cooperation in flood forecasting and warning and disaster management.

It also wants to do a three- or four-country study for seismic monitoring in the Himalayan region and to assess the feasibility of inland water transport network in the region. But even in Track Two, "national interest" seems to raise its head. All the three organisations have agreed on everything except the augmentation of lean season flow of the Ganga and the integrated development of the GBM region. On augmentation of lean season flow, the Indians do not agree with the idea of building dams because of the huge financial costs involved and the environmental impact. But, as the Bangladeshis point out, this does not seem to stop India holding bilateral talks with Nepal to build dams on Mahakali and Karnali rivers.

Despite the limitations of regional flood control, and its evidence that floods are more a case of drainage congestion than too much water, there is reluctance to abandon orthodox thinking and the tilt towards engineering solutions. Regional cooperation, however desirable in the long-term, has not moved beyond rhetoric. In that sense, it may be just as well that countries in the region cannot agree. This may at last force them to do their homework on their own domestic water management first.

Adapted from Economic and Political Weekly, Bombay, October 31, 1998