Management of Floods in Bihar

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A combination of short- and long-term measures that gives importance to both structural (traditional) means and non-structural techniques is required to solve the perennial flood problem in north Bihar.

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Bihar is the worst flood-affected state in India. Its geographical area and population are, respectively, 2.85% and about 8% of those of the country, but about 17% of the flood-prone areas and 36% of the flood-affected population of the country belong to this state. The state's share in total average annual flood damage in the country is about 23%. Of all the river basins in the state, the ratio of flood-prone to catchment area within the state is maximum in the Kosi basin (89%). Floods have been a chronic and a serious problem for the state, particularly for north Bihar. It has forever remained in discussion, but this year's breach of the eastern afflux embankment of the Kosi at Kusaha (in Nepal) has caused unprecedented damage and attracted widespread attention and concern.

Unique Case of North Bihar

The flood problem in Bihar has unique characteristics. There is severe erosion, spilling and drainage congestion. Another peculiar feature of the rivers of north Bihar is that all of them (except the Burhi Gandak) originate in hills of Nepal and their catchment areas mostly lie in Nepal. This puts a big constraint on India so far as their comprehensive and sustainable management is concerned.

After the disastrous flood experience in the country in 1954, a National Programme of Flood Management was launched. In the subsequent five decades different long-term and short-term measures for flood protection were adopted depending on the nature of the problem and local conditions. In Bihar flood management works implemented so far comprise construction of 3,455 kilometre of embankments, 365 kilometre of drainage channels and 47 town/village protection works. It is claimed that these measures have helped in affording reasonable protection to 29.49 lakh hectares out of 68.8 lakh hectares flood-prone areas in the state. It is important to mention here that the Second Bihar State Irrigation Commission (1994) analysed the flood damage data for the period 1968 to 1991 and on this basis observed,

> Although quite significant flood management works have been implemented in Bihar till March 1992, it is apparent from the reported figures of damages in all the 11 flood-prone basins that the damages have increased gradually and significantly in recent years.

However, it is said that this increase in damage in the embanked area may be due to reasons like inflation, inflated reporting, increased productivity and enhanced value of property, increase in population due to encroachment, etc.

Planning for flood management does not involve absolute control of floods but implies management of flood in the most beneficial manner in the given circumstances. All the flood management measures fall broadly into two categories, (i) structural-involving construction of embankments, reservoirs, detention basins, interbasin transfer of water, raising of village, etc, and (ii) non-structural including flood plain zoning, watershed management, flood forecasting, disaster mitigation and preparedness, etc. Both are complementary to each other and not mutually exclusive.

Embankments

The flood management works executed in Bihar so far mainly consist of embankments. They come under the category of short-term structural measures. They are very popular not because of their efficacy but due to being cheap and quicker to construct. However, they are criticised on the grounds of denial of fertilising silt to the flood plains, hampering land building by rivers, rise in bed level of rivers particularly in aggrading ones, blocking natural drainage from the countryside and damages occurring despite their construction, etc. As such the wisdom of adopting embankments as measures of flood management is highly debatable.

The Second Bihar State Irrigation Commission (1994) studied the nature of aggradation of the Kosi rivers bed. It found that during the period 1955-62 the cross sections of the river from Chatra to Supaul did not indicate any silting. Quite interestingly this reach of 102 kilometres was a degrading reach, the average rate of degradation being between 165.6 and 3.8 millimetres per year in the different reaches during this period. The Indian Institute of Technology, Delhi, conducted cubature analysis in 1974 based on data from 1955 to 1974. The period 1955-62 approximately corresponds with the commencement and completion of the embankments. During the period 1963-74 the entire reach, except Bhimnagar-Dagmara (26 kilometre) was found to be aggrading, the rise of bed level per year varying from 123.4 to 18.6 millimetres and the reach Bhimnagar to Dagmara degraded at a nominal rate of 8.3 millimetres per year. Another study conducted by University of Roorkee (now IIT Roorkee) concluded (1990) that the aggradation of the order of 2.44 metres (with respect to the levels of 1984) might occur within the existing embankments by 2005. A similar trend has been observed in case of the Gandak also. During the past three decades approximately, the rise of bed level had been of the order of 1.8 metres. This type of aggradation necessitates perpetual raising and strengthening of the embankments.

Comparison with Huang Ho

The Kosi bears similarity with the Huang Ho river of China with respect to carrying highly sediment laden water. However, most of the silt carried by the Huang Ho is fine silt and the Kosi carries mostly fine to coarse silt. Both the rivers are embanked, though the history of embankment along the Huang Ho is probably the oldest. Its construction started during 500-600 BC and it was extended, heightened and strengthened in course of time as per need. The river bed has gradually risen higher and higher. The river bed in lower reaches was found to be rising by one to 10 centimetres per year in the middle of last century and at some places the bed was found even 10 metres higher than the surrounding country level. The mean level of water between embankments is now higher than surrounding country and so the river is called "elevated river". Records show that inundations and breaches have occurred on 1,500 or more occasions in lower reaches of the Huang Ho and there were 26 important changes of course, nine of them major.

The Kosi bed has also been rising and the river has changed its course, even within the embankments, after having been embanked and its embankments breached eight times at different locations. It can now be easily visualised as to what may ultimately happen as a result of construction of embankments along rivers of north Bihar. Does it mean that the project was wrongly conceived? No, I do not think so. What were lacking were necessary safeguards in its implementation.

The important and crucial recommendation of K L Rao and Kanwar Sain that coarse silt must be eliminated from the river flow was not suitably acted on. The embankment should have been used in combination with dam on the upstream, catchment area treatment, flood plain zoning, etc.

Long-term Solutions

It is well recognised that the long-term solution for the flood problem lies in creating appropriate flood storage in reservoirs. The Damodar Valley Corporation is a very good example of reservoirs as effective measures for flood moderation. There is no dam either in Bihar or in Nepal on any of the tributaries of the Ganga which may provide flood moderation in north Bihar. The greatest difficulty in this respect is that there is no suitable site available in Bihar for dam building on any of the north Bihar rivers as they originate from Nepal. Of course, the Burhi Gandak is an exception but in this case also its main tributary, the Masan originates from Nepal. However, high dams on the Kosi, the Kamala, the Bagmati, the Gandak and the Burhi Gandak in Nepal are under consideration. They are not coming up because they require the approval of the Nepal government which is not very easy to get. There seems to be a lack of political will and a sense of urgency on both the sides on this issue, the reasons for which may be many.

The rational method of flood management in Bihar (north Bihar) should include a judicious mix of structural and non-structural measures. As regards structural measures it should have an appropriate combination of short-term measures like embankments and long-term sustainable measures like reservoirs with adequate provision of flood cushion. Natural detention basins may also be used for flood moderation and channel improvement may be tried if found technically and economically feasible. Under non-structural measures flood plains zoning and management, flood proofing, flood forecasting and warning, disaster preparedness and response planning, etc, may be tried.

Catchment area treatment is very important for soil conservation and reduction in sediment inflow to the rivers, but in this respect also the difficulty lies in the fact that about 85% of the area of the catchment lies outside Bihar and we cannot do anything there out of our own. Flood plain zoning helps in reducing the flood damage and misery afflicted by flood on the people. It is necessary not only for mitigating the flood but also for reducing the damage

caused by drainage congestion. It recognises the basic fact that the flood plains are essentially the domain of the river and as such all developmental activities there must be compatible with the flood risk involved. However, due to inability of the governments to prevent or check the encroachments of the flood plains, no beginning could be made so far in flood plain zoning. The government of India circulated a model bill on the flood plain zoning in 1974 among all the states of the country with the request to enact the same, but no state except Manipur could do so and this state also could not implement it. Flood proofing is essentially a combination of structural change and emergency action. Raising of some flood-prone villages above predetermined flood level and connecting them to nearby road or high land has been done, but the enthusiasm was lost very soon as the method did not provide any protection to surrounding agricultural areas. The flood forecasting and warning system is already working in Bihar satisfactorily.

The most common adjustment to the flood hazard in flood plains is simply to bear the loss and live with flood in areas where there is some serious constraint (as in north Bihar). Under the situation, floods become a matter of concern for all sections of society living in the affected areas and flood management needs active involvement and participation of all of the stakeholders to fulfil its objectives. The National Water Policy (2002) also advocates a participatory approach with the involvement of various governmental agencies, users and other stakeholders in an effective and decisive manner, in various aspects of planning, design, development and management of water resources schemes.

The problem of flood in Bihar is very complex and so is the task of its management. A strong political force is required for seeking and ensuring cooperation of Nepal without which sustainable long-term flood management in Bihar is not possible. Competent and capable engineers, well acquainted with the latest technology and enlightened and efficient bureaucracy should be entrusted with the job of policymaking and its implementation. Their work should not be interfered with. Last but not the least, the involvement of the stakeholders in all stages of the process is a key factor for the success of the effort and optimisation of benefits.