What, who, how and when of
Experiencing Floods as a Disaster

Himanshu Thakkar
South Asia Network on Dams, Rivers & People,
Delhi (cwaterp@vsnl.com)

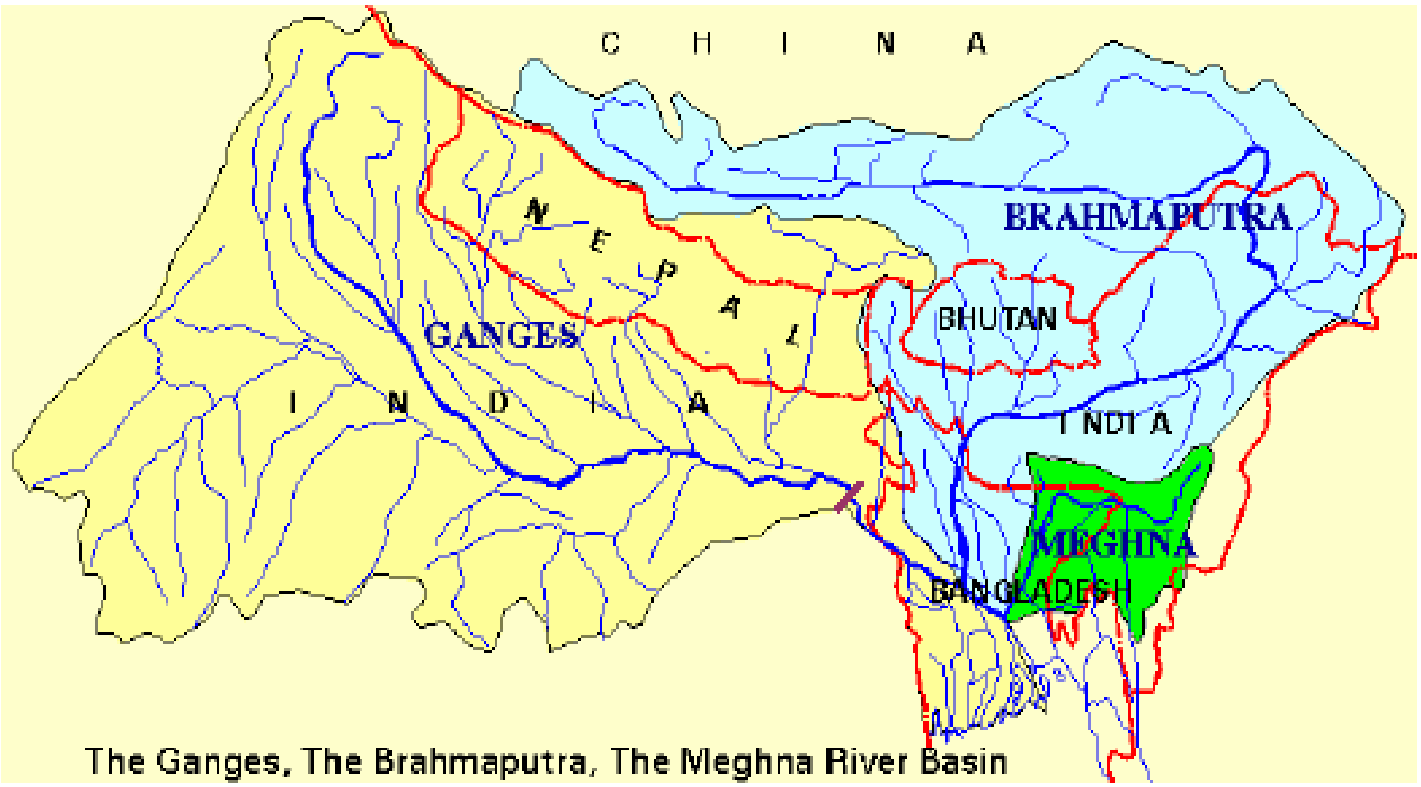
November 2006

INDEX

ACRONYMS

ADB	Asian Development Bank
BB	Brahmaputra Board
Cusecs	Cubic feet per second
Cumecs	Cubic meters per second
CWC	Central Water Commission
DVC	Damodar Valley Corporation
GBM	Ganga Brahmaputra Meghna
GFCC	Ganga Flood Control Commission
GOI	Government of India
Ha	Hectare
IMD	India Meteorological Department
LS	Lok Sabha
MCM	Million Cubic Meters
MT	Million Tonnes
NCF	National Commission on Floods
NEC	North East Council
RS	Rajya Sabha
SAARC	South Asia Association for Regional Cooperation
SANDRP	South Asia Network on Dams, Rivers & People
SARP	South Asia Regional Partnership
TOR	Terms of Reference
TVA	Tennessee Valley Authority
UP	Uttar Pradesh
WCD	World Commission on Dams

The Regional Map



Source: The World Bank, 2006

What, who, how and when of
Experiencing Floods as a Disaster [1]
1 The GBM Rive Basin[2]

South Asia consists of more than one fifth of humanity, has nearly half of the world poor as also half of the world illiterates and mal nourished live in this region. It is estimated that between 2 to 16 per cent of the GDP of different South Asian countries get wasted every year due to natural disasters [3]. These disasters erode much of our hard earned gains of development. In Bangladesh 300,000 people lost their lives due to cyclone followed by flood in 1970. Similar disaster in 1991 claimed another 138,866 lives but the floods in 1998 and 2004 claimed 10150 and 747 lives respectively. In Nepal 6982 people have died due to floods and land slides during 1983-2005. [4] In India 1529 people lose their lives due to floods every year[5].

The river basin, which is almost annually ravaged by floods from June to September, is one of the densely populated poorest areas in South Asia with largest concentration of disaster-affected people.

The GBM basin The annual run off in the Ganga-Brahmaputra-Meghna (GBM) river system is 1400 BCM, the third largest in the world. The annual sediment load in the system is 1670 Million Tonnes (MT). The annual run off, the annual rainfall, sediment load and the Himalayan Rivers' response show extreme variability. (Panos 2004 p 56-7)

Ganga Basin The total area of Ganga Basin is about 1, 093,400 sq km, the country wise break up is given below:

- ⇒ India: 861 400 sq km (79%)
- ⇒ Nepal 146 000 sq km (13%)
- ⇒ Bangladesh 46 000 sq km (4%)
- ⇒ Tibet 40 000 sq km (4%)

Of the about 453 BCM of annual flow in the river, 60% is contributed by the Himalayan rivers. The water flow at Farakka often exceeds 1.8 million cusecs. Estimates of sediment load of Ganga vary between 430 and 729 MT per year.

Ganga catchment in states in India

⇒ Uttar Pradesh (including Uttaranchal)	34.2%
⇒ Himachal Pradesh	0.5%
⇒ Punjab & Haryana	4%
⇒ Delhi	0.2%
⇒ Rajasthan	13%
⇒ Madhya Pradesh	23.1%
⇒ Bihar (including Jharkhand)	16.7%
⇒ W Bengal	8.3%

Tributaries The major tributaries of the Ganga from the Himalayan North (Yamuna, Ramganga, Gomati, Sarada (Mahakali in Nepal), Ghagara (Karnali), Gandak (Narayani), Kosi (Saptakosi) and Mahananda) bring in the perennial waters from the glaciers. Tributaries from the south (Chambal, Betwa, Ken, Son, Damodar, etc) are not snow fed and contribute significantly only during the monsoon.

Besides Mahakali, Karnali, Narayani and Saptakosi, five medium tributaries of Ganga from Nepal are: Babai, West Rapti, Bagmati, Kamala and Kankai. These nine rivers contribute 47% of the total annual Ganga flow at Farakka, however, their proportionate contribution in monsoon would be lower than this figure as these glacial rivers contribute 71% during lean season.

Ganga at Farakka Following data of water flow in Ganga at Farakka is based on 24 year observations (1949-1973), that is till just the time when Farakka was commissioned. The average flow across the year is 12105.4 cumecs, and annual discharge is 382 BCM. By the time Ganga reaches Farakka, water has already been stored and extracted by the Ganga basin population in India and Nepal. The flow data of Ganga continues to remain state secret and the data given below was available thanks to KL Rao.

Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Flow, cumecs	2827	2418.3	2014.4	1751	1984.5	4314.4	20793	43030	36899	17593	6836.7	3984.5
BCM flow per month	7.6	5.9	5.4	4.5	5.3	11.2	55.7	115.3	95.6	47.1	17.7	10.7

(Source: Panos, 2004, quoting KL Rao, 1974)

The Shifting, Eroding, Displacing River Just upstream of the Farakka barrage, the river has been eroding away the bank to the east at the rate of 0.7 km per year. Till Sept '03, the river has eaten away over 200 sq km area of Malda district and 356 sq km of Murshidabad district. The erosion is experienced along 72 km stretch of the river in Malda and 102 km stretch in Murshidabad. This has lead to displacement of large number of people.

The course of the Ganga River has been shifting eastwards and the river has shifted 4-9 km over the period between 1925 and 2003. Such shifting has also created problems between W Bengal and Jharkhand and also between India and Bangladesh, particularly over the ownership of *char* lands created by deposition of sediments by the river.

Once the high floods recede and river water level goes below the groundwater table at the banks, second wave of erosion starts with the backflow of groundwater into the river, with it washing in the sand below the ground. This second wave of erosion is often of greater magnitude than the first one. Moreover, the water back up upstream of the barrage that extends about 190 km and submerges upto 8000 ha of land has increased the intensity and severity of the floods in Malda district. (Panos 2004 p 57-9) At least 80 000 people are estimated to have been displaced due to the erosion caused by the Farakka barrage in Malda district (Panos 2004 p 80).

The Kosi River, one of the northern tributaries of the Ganga flowing from Nepal to Bihar, is well known for its tendency to change course generally in west word direction. During the course of the last 200 years, the river has shifted westwards for a distance of 112 km and laid waste large tracts of agricultural land in the Darbhanga and the Purnea districts by depositing coarse silt. (GOI-I 1980, p 21)

Brahmaputra The Brahmaputra is a braided river and occupies a width of 6-10 km in a valley of 80-90 km width.

According to the National Commission on Floods (GOI-I 1980 p 31), "The excessive sediment load of the Brahmaputra and its tendency for a lateral shift towards south in many stretches appear to be the main reason of its instability. Studies show that erosion has taken place for a length of 355 km on the south bank and 230 km on the north bank during the period between 1923 and 1954". The NCF also notes that the Brahmaputra basin lies in an area of acute seismic activity. The earthquakes of 1897 and 1950 rated as some of the severest, have greatly disturbed the drainage set up of the valley. An analysis of the earthquakes during the period 1920 to 1969 shows that 416 shocks of magnitude 5 and above on Ritcher scale occurred in the north-eastern India. After the earthquake of 1950, there was rise of 3 m due to silt build up in the low water levels of Brahmaputra and the Dibang silted up by 6 m near Sadiya.

The major tributaries of the Brahmaputra, which contribute significantly to its flow, are Siang (37.45 per cent), Subansiri (10.66 per cent), Lohit (9.50 per cent), Dibang (7.65 per cent) and Kameng (5.84 per cent).

The Brahmaputra Master Plan As per the Master Plan prepared by the Brahmaputra Board, the permanent solution[6] to the perpetual problems of Assam from the annual floods in Brahmaputra lies in creating storage reservoirs of adequate capacity with the requisite allocated flood storage capacity on the tributaries of Brahmaputra. Major tributaries of Brahmaputra and the storage schemes on them were identified as under:

1. Siang River: Siang basin projects in Arunachal Pradesh with proposed reservoirs of 20,000 million cubic meters gross capacity (approx). This includes three projects, namely Siang Upper, Siang Middle and Siang Lower which came up as alternative to single dam project.

2. Subansiri River: Subansiri basin Projects in Arunachal Pradesh with proposed reservoirs of 4800 million cubic metre gross capacity (approx). This includes three projects namely Subansiri Upper, Subansiri Middle and Subansiri Lower[7] which came up as alternative to single dam project.

3. Dibang River: Dibang Dam Project in Arunachal Pradesh with a proposed reservoir of 3600 million cubic metre gross capacity (approx).

4. Lohit River: Lohit Dam project in Arunachal Pradesh with a proposed reservoir of 5100 million cubic metre gross capacity (approx).

In addition, there are many other schemes on other tributaries of the Brahmaputra, details of which are given in table below:

Tributary	Main River	Gross Storage (mcm)
Noa-Dehing	Brahmaputra	57
Jiadhal	Brahmaputra	1344
Dikrong	Brahmaputra	-
Kameng	Jiabharali	6500*
Dhansiri(S)	Brahmaputra	1500 *
Pagladiya	Brahmaputra	313
Manas	Brahmaputra	920 *
Aie	Brahmaputra	-
Killing	Brahmaputra	56
Kulsi	Brahmaputra	795
Dikhu	Brahmaputra	1000*
Dhansiri (N)	Brahmaputra	
Janji	Brahmaputra	300*
Kopilli-Kollong	Brahmaputra	1620*

*Storage potential as indicated in the Master Plan. (Union Water Resources Minister in LS 080805)

Barak Basin As NCF notes (p 234), the Barak basin lies to the south of the Brahmaputra valley and the width of the valley between the foothills is almost 40-50 km. The level of the river is higher than that of the surrounding valley which is dotted with depressions called *haors*, the hills bordering the valley is subject to heavy precipitation. A flood in the Barak River overspills its banks, and heads up into the tributaries and drainage channels thus filling up the *haors* almost upto the foothills.

Box 1. Frequently flooded districts in GBM basin in India

As per the information received from the State Governments, the districts which were flooded in at least 5 years during the last 10 years (upto 2005) are listed below:

Assam Dhubri, Barpeta, Nalbari, Kamrup/ Prayagjyothispur, Darrang, Lakhimpur/Dhemaji, Jorhat, Morigaon (7out of 10 years),
Goalpara, Tinsukhia, Golaghat, Nagaon (6 out of 10 years),
Kokrajhar, Sonitpur, Dibrugarh, Sibsagar (5 out of 10 years).

Bihar Muzaffarpur, Khagaria, Saharsa, Samastipur, Gopalganj, Supaul, Madhepura, Katihar, Begusarai, Purnia, Bhagalpur (10 out of 10 years),
Patna, E Champaran, Darbhanga, W Champaran, Sitamarhi, Madhubani, Seohar (9 out of 10 years), Saran, Araria (8 out of 10 years),
Munger, Lakhisarai, Kishanganj (7 out of 10 years),
Vaishali (6 out of 10 years),
Bhojpur, Siwan (5 out of 10 years).

West Bengal Murshidabad (7 out of 10 years),
Jalpaiguri, Uttar & Daskhin Dinajpur & 24 Parganas (N) (6 out of 10 years),
Nadia, Malda, Purba & Paschim Midnapur (5 out of 10 years).

Uttar Pradesh Basti, Barabanki, Khiri, Baharaich (9 out of 10 years),
Gazipur, Gorakhpur, Maharajganj, Sidharthnagar, Gonda, Binour, Ballia (8 out of 10 years),
Deoria, Shahjahanpur (7 out of 10 years),
Varanasi, Faizabad, Muzaffarnagar, Farukhabad, Pilibhit, Unnao (6 out of 10 years),
Allahabad, Badaun, Hardoi, Mirzapur, Bareily, Aligarh (5 out of 10 years).
(Union Water Resources Minister in RS 260705)

Flood Control Plan for W Bengal Rivers Ganga Flood Control Commission has prepared comprehensive plan for flood control for the following river basins of West Bengal for evolving a long term strategy to solve the flood problem in the State: Main Ganga, Damodar, Ajoy, Rupnarayan, Mahananda & Mayurakshi. The comprehensive plans have been sent to the Government of W Bengal for implementation. (Union Water Resources Minister in LS 120301)

The Sept 2000 Floods in W Bengal West Bengal faced a very grim flood situation in the districts of Birbhum, Murshidabad, Nadia and 24 Parganas (North) in September, 2000. This was due to very heavy rainfall both in quantity and intensity never recorded before. Between 18th to 23rd September, 2000, the total rainfall in Ajoy Basin was 1040 mm, in Mayurakshi Catchment was 1224 mm and in the Damodar Basin 529 mm. The Bhagirathi basin was overflooded as it received discharges from its tributaries many times more than its carrying capacity. The embankment of all rivers breached by over-topping. The details of devastation are as follows:-

i) Total area affected	23971 sq.km.
ii) Crop area affected	19200 sq.km.
iii) Population affected	218 lakhs
iv) Loss of human lives	1320 nos.
v) No. of missing persons	154 nos.
vi) No. of houses damaged	21.94 lakhs.
vii) No. of blocks affected	117 nos.
viii) No. of Municipality affected	68

(Water Resources Minister in LS 22112000)

Drainage congestion in E Mdinapore As informed by the Government of West Bengal, the State Government is aware of drainage congestion encountered in the district of East Midnapore particularly in the Dubda Basin area in P. S. Ramnagar and Egra, caused by Kudi- Negua Channel System. There were heavy floods in the district due to heavy downpour during the period from 05.10.2003 to 09.10.2003 caused by formation of a deep depression, in the Bay of Bengal. (Union Water Resources Minister in LS 081203)

Bihar: The Embankment state Bihar can boost of having taken up embankments on a massive scale. It started with a bang in 1955 with the nationally advertised programme of embankment of Kosi River. From 162 km of embankments in 1952, Bihar had 3430 km of embankments by 2003, 2952 km in the North and 478 km in the south. The state claimed in 1991 that 2.9 m ha have been protected from floods with these embankments, out of which 2.7 m ha in North Bihar. That claim has not changed since than. Embankments lead to a series of problems, as is well known, not allowing water from outside to come in, creating water logging outside, seepage from underneath the embankments adding to the problems, provision of sluices to overcome this problem is not helpful as the raised riverbed quickly makes the sluices useless and in fact opening them could lead to release of water outside, embanking the tributaries creates similar problems with respect to areas outside the tributaries and so on. Moreover, no embankment is break proof, and when they break they variously bring deluge, prolonged water logging and sand casting. While not an inch has been added to length of embankments in Bihar over the 13 years from 1991 to 2004, over Rs 700 crores were spent in the name of maintenance of the embankments, keeping the contractors, engineers and the politicians happy.

A situation of conflict arises between those who are within the embankments, who would like to break the embankment to reduce the water level within the embankment and those who are outside, who would like the embankment to remain in tact.

The embankments have to constructed sufficiently wide so that the embanked river is able to carry the flood peaks, keeping in view the fact that the earthen embankments cannot stand velocities adjacent to banks exceeding about 1.2 to 1.5 meters per second, as noted by KL Rao in *India's Water Wealth* (p 151).

Nearly a million people in 387 villages in Supaul, Saharsa, Madhubani and Darbhanga districts are trapped between the Kosi embankments. These people have never been properly resettled. The Bagmati embankments trapped 96 villages and the Mahananda 66. There are about two million people trapped within embankments in Bihar. There are almost equal number of people outside who either face water logging or threat of breaches in embankments leading to flooding, erosion and sand casting.

In spite of building all these embankments, the flood prone area in the state has gone up from 2.5 m ha in 1952 to 6.9 m ha in 1993 as per the report o the Second Irrigation Commission of Bihar. Now that embankments are clearly failing to provide the flood protection, the govt is promising to construct dams for flood control. But people have no role in any of these decisions.

The breach of embankments is now an annual story, started in 1968. First rats and foxes were blamed for the breaches. Then anti social elements were held responsible. Sometimes global warming and *release* of water from Nepal (even when Nepal has no way of storing or "releasing" stored water) is held responsible. However, the negligence of engineers of failure of the embankment technology is never or is only rarely held responsible for breach

of embankment. For some time the govt also tried to evict the people living on the embankments, holding them responsible for the breaches, forgetting that these people have been evicted by the embankments and its consequences and have no where to go as the govt has neither resettled them, nor compensated them.

Now the govt wants to make stronger and higher embankments, but there has been no consultation with the people before taking this decision. (Panos 2004, p 102-10)

Pipara-Piparasi Embankment The embankment on Gandak along the Bihar UP border and also along the Nepal India border created flood havoc in 1993 in West Champaran district. Area that had no history of floods for 250 years was affected. The Gandak here is shifting and more areas are going towards Nepal. A petition, raising the issue of transfer of land and villages to Nepal due to shifting of Gandak and consequences thereof has been filed on this issue in Delhi High Court in 2006[8].

Water Logging in Bihar About nine lakh hectare of land is suffering from the problem of waterlogging in Bihar, out of which about eight lakh hectares of land lies in N Bihar and one lakh hectare of land in the Mokama Tal area in the Central Bihar. It has been found, after study by various expert committees that out of nine lakh hectare, it would not be economical to free 2.5 lakh ha of land from waterlogging due to excessive depression. Pisiculture and other aqua-crops such as Makhana etc. have been suggested in these areas. Till now about 1.5 lakh ha of waterlogged area has been freed from waterlogging as reported by Government of Bihar. Thus remaining 5.0 lakh ha remains to be freed from the waterlogging. (Union Water Resources Minister in LS 220402) The Minister does not say so, but this waterlogging is entirely due to the embankments and creation of canal network without proper drainage system in place. The construction of railway lines, roads, canals and urban settlements without proper drainage system in place has further deteriorated the waterlogging condition. About 8360 sq km (16%) out of total area of 52312 sq km in North Bihar is waterlogged. With the population density of 880 per sq km in Bihar, this means that about 7.5 million people stay in the waterlogged area (Panos 2004, p 94, 104).

June 2000 floods in Arunachal Pradesh Arunachal Pradesh experienced flash floods during 11–12 June, 2000 in Siang (Brahmaputra) river. Nearly 10,000 people are reported to be affected due to the floods. 26 persons died and three bridges namely Sagarm Bridge, Dite Dime bridge and Nubo bridge have been washed away. Four districts namely E Siang, Upper Siang, W Siang and Dibang Valley have been affected by the floods. As per information available this unprecedented flash flood was not due to rainfall in the Indian position i.e. Arunachal Pradesh catchment of Brahmaputra river but due to failure or breach of blockade in the upstream portion of Brahmaputra river in Tibet.

Following these floods the matter was raised by External Affairs Minister with the Chinese Foreign Minister, Mr. Tang Jiaxuan, during his visit to India on July 21-22, 2000. External Affairs Minister proposed to the Chinese Foreign Minister that India and China could engage in a dialogue to examine ways in which human suffering could be reduced on the Indian side in event of such natural disasters.

An Indian delegation from the Ministry of Water Resources visited Beijing on June 8, 2001. The Indian side stressed the need for sharing the hydrological data on both the Brahmaputra and the Sutlej on a year round basis to reduce the human suffering on our side in the event of natural disasters. The Chinese side proposed provision of rainfall, water level and discharge data on the Brahmaputra during the flood season. (Union Water Resources Minister in LS 09082000, 300701)

NEPAL

The terai region of Nepal faces flood problem, while the upstream hilly regions faces the problems of land slides and also erosion and earthquakes. Construction of embankments have been the chief means of protection. Discussion of construction of dams continue with India and some projects are under survey now, as we shall note in latter parts of this report.

Contribution of Nepal Rivers In the table below we have given the flow (cumecs) in the nine main tributaries of Ganga flowing from Nepal for the five monsoon months of June to Oct.

River	Years of Observation	June	July	Aug	Sept	Oct
Mahakali	NA	560	1579	1332	1489	577
Karnali	62-86	1520	3290	4370	3020	1320
Babai	67-85	56	222	241	232	95
W Rapti	64-85	93	298	388	355	147
Narayani	63-85	1610	4210	4970	3420	1600
Bagmati	65-79	214	539	513	338	137
Kamla	57-69	46	130	160	102	45
Saptakosi	77-85	1660	4110	4340	3460	1460
Kankai	72-84	72	198	145	106	51
TOTAL		**5271**	**12997**	**15127**	**11033**	**4855**

(Panos 2004)

Bangladesh Bangladesh owes its existence to the rivers like Ganga, Brahmaputra and Meghna. The fertile soil has attracted millions from far away and the country has the highest population density among all the countries in the world, with the possible exception of Singapore. The country drains water from a catchment of over 2 m sq km, it has annual rainfall of 2000 mm (the range is from 1350 mm in northwest to 3468 mm in the northeast) and the low land with low gradient and incidents of cyclones all add up to a flood prone area. During normal monsoon, a third of the country can be flooded and in unusually high rainfall years like 1988 and 1998, upto two thirds of the country can be flooded. Upto 230 rivers have been identified, 53 of which come from India and one from Myanmar.

In Bangladesh, Ganga basin constitutes 36% of the country's total land area in the southwestern region of the country. Of the total fresh water flow in Bangladesh, Ganga (called Padma in Bangaldesh) contributes 18%, Brahmaputra (Jamuna) contributes 67% and Meghna contributes 15%. (*Disputes over the Ganga: A look at potential water related conflicts in South Asia* Panos, Oct 2004)

Of the cultivable area of just above 9 m ha, 3.14 m ha lie in Ganga basin, 3.75 m ha in Brahmaputra basin and 2.61 m ha in Meghna basin. (WASSA Project Report June 2003, Vol 3, p 63)

Floods in Ichhamati Basin in Sept 2000 As a follow up of the unprecedented floods of September, 2000 which had affected Southwest Bengal & adjoining areas of Bangladesh, a Joint India-Bangladesh Task Force has been constituted for flood management in Ichhamati Basin for formulation of an Action Plan for tackling flood calamities jointly in future & to submit it for consideration of Joint Rivers Commission. The Committee has already held two meetings and visited the study areas both in Bangladesh & India and an action plan for completion of the studies has been drawn. (Union Water Resources Minister 110803)

However, unprecedented water release from Farakka barrage was to a significant extent responsible for this flooding. In another instance, when in 2003, discharge in the river reached 2 million cusecs, all the 109 gates of the Farakka barrage had to be opened, causing floods in the downstream. This is because while the barrage had a designed discharge capacity of 2.7 million cusecs, its capacity has now substantially reduced due to build up of silt in the upstream particularly in the western portion. This has increased the flooding risk both in the upstream and also in the downstream portion (Panos 2004, p 71).

Bhutan A "Comprehensive Scheme for Establishment of Hydro-meteorological and Flood Forecasting Network on rivers common to India and Bhutan" having 35 hydro meteorological stations located in Bhutan is in operation since 1979. The data received from these stations is utilised for formulating the flood forecasts in India. (Union Water Resources Minister 161202, 110803) However, this data does not seem to be in public domain.

2. The Policy History of Tackling with floods

It should be noted at the outset that natural variability and uncertainty characterizes the rainfall in the Himalayan region. Events of rainfall being in excess of 500 mm in a day are not uncommon, such events are also called cloudbursts. This is a complex and poorly understood dimension of Himalayan hydrology. High intensity rainfall can trigger mass movement and debris flows in the hills and cause flash flooding in the plains, which can also greatly increase sedimentation rates. This is not accounted for in the project planning and costs could be heavy as is evident from the experience at the Nathpa Jhakri Hydropower project[9] in Himachal Pradesh and Kulekheni Project in Nepal.

Kulekheni, the only reservoir built in Central Nepal, experienced massive sedimentation triggered by a cloudburst, reducing the useful life of the reservoir from 100 years to 30 years. Hydrologic uncertainty is compounded by the geologic and seismic uncertainties. (Panos 2004 p 180-1) The Global climate change is likely to only add to these uncertainties.

1954 National Flood Policy and National Flood Management Programme In the Policy statement made in the Parliament on Sept 3, 1954 by the then Union Minister for Planning and Irrigation & Power, the objective set before the nation was to rid the country from *the menace of floods* by containing and managing floods. In fact the minister's statement was categorical, "I may in the conclusion express the *conviction* that floods in the country *can be contained and managed*". This objective was afterwards modified to say that reasonable protection that was technically and economically justifiable is to be provided, with greater stress on flood forecasting, flood warning and flood management. Less than two years after announcing the National Flood Policy in the Parliament, the Union Minister said in the Parliament on July 27, 1956 that absolute immunity from flood damage was not physically possible even in the distant future, because of the unpredictability of several natural forces which might cause unprecedented situation and, "We shall have to learn to live with floods to an extent". (National Commission on Floods (NCF) p 98)

Central Flood Control Board In order to implement the country-wide programme of flood control a Central Flood Control Board was constituted in 1954 under the Chairmanship of the then Union Minister of Irrigation and Power with representation of the concerned flood prone States and Union Ministries such as Railways, Transport etc., as its members. The Central Flood Control Board, in its 16th meeting held in November, 1977, decided that since the irrigation, flood control and drainage aspects could not be dealt with in isolation and since in almost all the States, the Ministers in charge of Irrigation were also in charge of Flood Control, the subject of flood control could be discussed in the State Irrigation Ministers' Conference, wherein the flood control aspects are also being deliberated. (Union Water Resources Minister in LS 110803) It is not know what happened to CFCB thereafter, but there is no mention of the CFCB in the reports after 1980.

Other Flood Control Boards Following the constitution of the CFCB, four other flood control commissions were set up, including the Ganga Flood Control Commission, the Brahmaputra Flood Control Commission, and a Flood commission for Central and North West India and one for Deccan areas, with the objective of preparation of integrated flood management plans of the river basins. In addition, some of the flood prone states also set up flood commissions. The National Commission on Floods had chairman of the Ganga and Brahmaputra Flood Commission as members.

The Brahmaputra Flood Control Commission seems to have been dissolved around 1980 and in 1981, the Brahmaputra Board was constituted through an act of Parliament.

1957: High Level Committee on Floods In Feb 1957, the Govt of India set up a High Level Committee mostly related to the policy on the strategy to provide flood control, mainly in view of divided opinion on flood protection through embankments. The Committee submitted its report in Dec 1957. The committee made a number of recommendations, including emphasizing that priority should be given to soil conservation and watershed development works and that comprehensive appraisal of the embankment schemes should be taken up before their inclusion in the plans. (NCF p 102)

1964: Ministers Committee on Flood Control The committee was formed to review the flood control measures taken up after the adoption of the National Flood Policy in 1954. Among the recommendations, the committee said that non physical measures like flood warning, forecasting to be made integral part of the flood control departments, flood plain zoning and flood insurance should be taken up. (NCF p 103)

1972: Ministers' committee on floods and flood relief In Oct 1970, a Ministers' Committee on floods and flood relief was constituted, which submitted its report in March 1972. The committee emphasized, among other

recommendations, that each flood affected state should frame programmes of soil conservation after detailed investigations. (NCF p 103)

1978: Report of the Working Group on Flood Control The report brought out in Nov 1978 by the Union Ministry of Agriculture and Irrigation made a number of important recommendations, including the need for the state govts to "critically examine all major existing works and put up proposals for stabilizing existing benefits" and that the "long term effects (of embankments) on river regimes are yet to be evaluated". (NCF p 104)

1980: the Report of the National Commission on Flood The Commission was set up in July 1976 under the Chairmanship of Shri Jaysukhlal Hathi, the main TOR of the Commission was to review the flood protection measures undertaken since 1954 with special reference to construction of embankments and to evolve a comprehensive approach to the problem of floods. This is the only really comprehensive review of flood management policies and practices in post independent India, so let us look in some detail the findings of the commission.

The commission noted about progress of embankments in UP, Bihar, W Bengal and Assam, by 1978, was as follows:

State	Length of Embankment, km	Area protected, Lakh ha
UP	19174	9.16
Bihar	2355	15.66
W Bengal	515	10.01
Assam	4145	13.05
Total	**8189**	**47.88**
Nation	**10821**	**99.85**

Box 2: No credible assessment of performance of Embankments

The Central Water Commission assessment in 1978 about the performance of the embankments made it clear that "unless a scientific evaluation of their performance is made on the basis of large number of case studies, it is not possible to form definite conclusion." Chairman of Brahmaputra Flood Control Commission pointed out that there were large scale breaches in the embankments on Brahmaputra during the floods of 1962, 1966, 1969, 1972, 1977. He also observed that drainage congestion has developed in a number of tributaries.

The W Bengal govt's assessment is even more candid, "It is at best a temporary measure, where river water carries a heavy silt charge, the embankment by shutting off the spill areas on either side hastens raising of river bed with consequent rise in flood levels. This phenomenon creates potential danger of breach of embankments. A vicious race starts at that stage between the rise of the river bed and raising of the embankments in which the latter has not even a remote chance to win." (NCF, p 108)

According to NCF (p 96), at the time of independence in 1947 there were about 5280 km of embankments giving protection to 3 m ha. By 1954, when the national flood policy was declared, we can assume, based on available information, that there were 6 000 km of embankments.

The report of the NCF (p 109) is quite categorical that no credible assessment of performance of the embankments over any river has been done by any state. Among the set of questions that the commission sent to the states regarding the performance of embankments, following questions drew no response:

⇒ Post embankment drainage congestion with average depth, duration and extent of water accumulation over the protected area

⇒ Quantitative evaluation of the economic conditions before and after construction of embankment

⇒ Creation of additional flood problem on upstream, downstream and opposite bank, after embankment construction

The commission notes, "Any assessment of the partial negation of these benefits, due to accumulated drainage water over the protected area from year to year, were also not done. The annual benefits from embankments were, therefore, by and large, a matter of overall opinion of some individual, with no supporting data. We were, therefore, reluctant to draw any conclusion from the trend of such opinions."

R Rangachari, former additional Secretary, govt of India has noted[10] "There are, however, many problems associated with embankments. Unfortunately there are few scientific evaluations of their actual performance under different types of rivers in representative regions.

Sand casting The breakup of the area where the damage has been caused to cultivable land by excessive infertile sandy deposition by flood instead of fertile silt in the flood prone areas of the country is not available… The problem of damage caused to cultivable land by excessive silt generally occurs in the rivers originating in the Himalayas and flowing down to the plains. Broadly, the problem can be tackled by construction of storage dams in the upstream. (Union Water Resources Minister in LS 061204)

Average Annual Damage due to Floods in Bihar

Period	Total Area affected, Lakh Ha	Crop Area affected, Lakh ha	Total damage at constant prices, Rs Lakh
1950-65	8.81	4.43	861.92
1966-70	10.82	5.85	1184.08
1971-78	21.30	8.85	4588.57

Source: NCF, p 167

Average Annual Damage due to Floods in Uttar Pradesh

Period	Total Area affected, Lakh Ha	Crop Area affected, Lakh ha	Total damage at constant prices, Rs Lakh
1950-65	16.80	7.84	1229.48
1966-70	20.12	10.42	1730.16
1971-78	30.00	16.64	4550.81

Source: NCF, p 174

Flood Damage Trend in Brahmaputra Basin

Period	Average Annual Area flooded (m ha)		Flooded crop area as % of total inundated area	Average Annual no of people affected, m	Average annual damage Rs M
	Total	Cropped			
1953-59	1.013	0.1	8.85	0.86	58.6
1960-69	0.75	0.16	21.33	1.52	75.7
1970-79	0.87	0.18	20.69	2.00	151.8
1980-88	1.43	0.40	28.05	4.55	1445.2
1999-2005	1.07	0.38	35.65	4.586	7171.7

Source: World Bank, 2006

It is clear from the above tables that the embankments in Bihar and UP had failed to reduce the damages due to floods in Bihar, on the contrary, the average annual damage has been increasing over the years, till 1978, as per the information from NCF. The situation after 1978 is not likely to be any different, though we do not have organised information for this period. Similar is the situation in Brahmaputra basin.

On raising of villages for flood protection, the NCF notes (p 112-3) that in UP, where 96% of the villages so raised are, the govt says, “the raising of village has not been considered very useful”.

About operation of dams for flood protection, the NCF notes (p 112), “Most of the reservoirs completed in the country do not have any specific operation schedules for moderation of floods”. In the Ganga basin, while Kangsabati reservoir has an earmarked flood storage of about 28% of live storage, the report says, “As seen from W Bengal’s reply the Kangsabati reservoir has no operation rules drawn up so far, not have the moderation benefits been evaluated.” In case of Damodar dams, the report concludes, “the cumulative result of all these factors has been that despite the outflow, after the flood moderation having been reduced to 25% or even less than the inflow, even this causes flood in the lower basin. The problem becomes more acute when the release from the reservoirs synchronise with the runoff from the uncontrolled catchment.”

On anti erosion works (spurs, revetments, etc), the NCF notes (p 113), “The CWC has stated that the assessment of anti erosion work so far carried out indicates that they are extremely costly both in capital outlay as well as in maintenance. The CWC also opines that traditional works like spurs do cause adverse effects in the vicinity.”

On flood forecasting, the NCF notes (P 113) that this programme started in 1959 at modest level, in Yamuna basin, but has now covered all the interstate river basins prone to heavy damages. The Central Flood Forecasting Organisation of the Central Water Commission is discharging the function of flood forecasting and in some states there are state flood forecasting cells.

About the impact of lack of proper drainage incorporated by the development works like the railways, roads, urban development, industrial estates, embankments and canals, the NIC notes (p130), "these works have, sometimes, affected the flood problem… Also, the infiltration index or the amount of rainwater seeping into the ground has decreased due to occupation of the land by structural works and large-scale urbanization… This has also resulted in higher flood peaks." After examining the responses of the various agencies involved in these developments, the NCF concludes (p 134), "it is apparent that there is considerable lack of coordination amongst the various departments undertaking the structural works. Even among the different departments of the same State itself, there is scope for more coordination."

Fate of NCF Recommendations The NCF in its report in 1980 made 204 recommendations; none of them have been implemented till date. As noted by the National Commission for Integrated Water Resources Development (Sept 1999, p 121), "Follow up on 25 important recommendations by Working Group for the Ninth Five Year Plan revealed that no concrete measures were taken to provide tangible physical achievements." The NCIWRD mentions 25 recommendations that were accepted by the Govt of India.

R Rangachari, former additional secretary, govt of India says[11] "A review of the implementation, made by the Central Water Commission in 1987, indicated that hardly any of the recommendations were followed up. The position remains almost the same even today."

1987 Committees for Flood Management in Ganga and Brahmaputra basins The recommendations of the two Committees on flood management, headed by Secretary, Water Resources, one for the States of Uttar Pradesh, Bihar, West Bengal and Orissa and the other for North eastern States constituted in 1987 were sent to the concerned States along with the conclusions of the Empowered Committee. (Union Water Resources Minister in LS 10052000) It is not known what the recommendations of the two committees were.

1996 Five Task Forces In September, 1996 Central Government have constituted five Task Forces on flood related issues and the reports of these Task Forces have been sent to the respective State Governments for taking up necessary follow up action. (Union Water Resources Minister in LS 10052000)

1998 Expert Group on Flood Management in UP and Bihar In the wake of unprecedented floods of 1998, the Government of India set up an Expert Group in Nov 1998, headed by Chairman, GFCC and members representing the states of UP & Bihar for suggesting effective flood control measures for Uttar Pradesh and Bihar. The reports of the Expert Group and their recommendations have been sent to the State Governments for their consideration and implementation. (Union Water Resources Minister in LS 190400, 230701) It is not known what the recommendations of the Expert Group were.

1999 National Commission for Integrated Water Resources Development Some of the noteworthy recommendations of the Report (Sept 1999) of the Govt of India's National Commission for Integrated Water Resources Development on the issue of "Flood Control and Flood Management" (p 353) are:

⇒ "… there are no universal solutions which can provide complete protection against floods. The country has, therefore, to shift its strategy towards efficient management of flood plains, flood proofing including disaster preparedness and response planning and flood forecasting and warning and other non structural measures such as disaster relief, flood fighting including public health measures and flood insurance."

⇒ "However, it is recommended that performance review of selected embankments may be carried out and based on the findings, planning, designs and management of embankments may be reviewed for obtaining better results. It is essential to associate the beneficiaries in the upkeep and surveillance of embankments during the monsoon season for prevention of possible breaching."

⇒ "The network of flood forecasting and warning at the Central level needs to be extended to remaining flood prone areas."

The recommendations of NCIWRD remain unimplemented.

A Model Draft bill on Flood Plain Zoning A model draft bill for Flood Plain Zoning was also prepared and sent to the State Governments. (Union Water Resources Minister in LS 021202) As noted in the Mid Term Review of the 10th Plan, the govt had circulated this bill in 1975, but Manipur is the only state that has enacted a legislation on the suggested lines.

Flood Forecasting in 2000 Central Water Commission under this Ministry is maintaining 157 flood forecasting stations (161 by 0803, 166 by 1203) on 62 major rivers comprising of 8 river basins spread over 13 States. During the year 2000, 6,510 forecasts were issued to the concerned State Governments/ Organisations with an accuracy of 97%. (Union Water Resources Minister in LS 120301, 221203)

The claim about accuracy of CWC forecasts needs to be taken with riders. Firstly, there has been no independent assessment about the accuracy or effectiveness of the forecasts. Secondly, it needs to be assessed how specific the forecasts are and if they are reaching in time to the concerned that are going to benefit from it, that is communities in the flood prone areas. Thirdly, it needs to be assessed how well the forecasts reflect ground realities. Fourthly, it needs to be checked how many of the floods were not forecast by the CWC, though they could have forecast the same.

To give an instance of how divorced the CWC forecasts are from the ground realities, on Sept 15, 2006, CWC website made a forecast that Kamala Balan river near Jhanjharput in North Bihar is flowing at 49.33 m, above warning level of 49 m, hence as per CWC definition, a flood was forecast. Some newspapers uncritically published the forecast as facts, saying Kamala Balan is in floods. When a journalist in Delhi called up his brother in Jhanjharpur, he was told that the river had very little water there. It latter came to light that the warning level mark on the river at Jhanjharpur is submerged in sand. One hopes that not all forecasts of CWC are so divorced from realities.

To give an instance of how CWC has not been able to forecast some of the recent floods, the floods in Narmada, Tapi, Mahi, Sabarmati basins in Gujarat in July-August 2006 were not forecast, though CWC should have, as it had all the information about the dams, river flows and river levels in these rivers.

Box 3: *Troubled Waters*: Independent Commission on Floods in East UP in 1998

Eastern UP, like many other areas of the GBM basin, faced unprecedented flood disaster in 1998. Oxfam India Trust (Lucknow office) along with its partners in East UP, set up *Independent People's Commission on Floods in East UP* to study the floods and make recommendations. The report of the Commission *Troubled Waters*, published in February 1999, said the following among other things:

"Control over floods can only be partial, not total. Thus, the emphasis should be on flood management rather than on flood "control". An efficient flood management is a special case of water management and requires a most holistic approach as it involves the management of thousands of micro-watersheds in both the catchment and the flood prone areas. Maps showing the natural gradient of these micro watersheds should be prepared for an effective flood management. The misconception that watershed management is relevant only to water scarce regions should be dispelled. It is equally relevant for a high or erratic rainfall region. The distinction lies in the emphasis on the objectives. The objective of water management in a deficit rainfall province is to ensure an optimal use of scarce water through conservation while the optimization of excess water is sought by designing an efficient drainage system and a compatible cropping pattern, in a flood prone area."

"We have been relying too much on dams and embankments for protection in flood prone zones. Now the emphasis should be on exploration of alternatives to these measures that have largely failed the test of time. Thousands of tanks, lakes, reservoirs, *jhils* and *tals* have been derelicted through neglect for decades. These reservoirs, if rejuvenated, would serve as a cushion for the vast quantity of excess rainwater that can attenuate the ferocity of floods. Village/ field channels have also been silted over the years. These channels could form a good drainage system, if renovated regularly. An over emphasis on canal water, available on easy terms, is responsible for the dereliction of the traditional water management system comprising of the tanks and field channels. Public policies should focus on these issues and encourage innovation and creation of more of the local water harvesting systems."

The report of the commission that included members from Engineering, Agriculture, Health, Sociology, Environment fields and an NGO made comprehensive recommendations.

2002 Multi Disciplinary Committee on Silting of Rivers To study the problem of silting in rivers, the Government of India has set up a multi disciplinary committee, which has members from various organisations like Central Water

Commission, Ganga Flood Control Commission, Brahmaputra Board, Dredging Corporation of India, Central Water & Power Research Station, National Remote Sensing Agency, Inland Waterways Authority of India, Geological Survey of India, Jawahar Lal Nehru University and various State Governments… there is no proposal at present to set up another Commission. (Union Water Resources Minister in LS 251102)

Box 4: River Basin friends: People driven flood forecasting

The River Basin Friends is a people's network in which more than 300 organizations located along the GBM basin and more than 1000 people of different disciplines and locations of the basin areas are associated with. The network also circulates flood forecasting messages from its upstream location to the downstream locations. Though the CWC and Indian Meteorological Department give the flood forecasting messages to different agencies, departments and in their websites (http://www.india-water.com/ffs/index.htm), but the messages have regional context and the information are not sufficient for local level forecasting and the information can not reach to the people at the vulnerable locations. So River Basin Friends with its own initiative and support from the organizations and people in the network initiated a flood early warning mechanism which reaches to the people at downstream at Bangladesh. The central hub at Village Akajan in Dhemaji District of Assam collects information from different sources and peoples' network in the up stream locations of river Brahmaputra and its major tributaries over phone and email. This information is then processed based on correlation of different background information, statistical and operational analyses. The final flood early warning messages are then formulated for different vulnerable locations in the areas and disseminated to these locations through different Medias.

This has been going on quite effectively at least for the last three years. More in-depth study of this remarkable initiative needs to be done as it has the potential to provide lessons for many other communities. (*Flood forecasting and experience of River Basin Friends network* by RVC, 2006)

Groundwater Recharging to Manage Floods The Central Ground Water Board constituted an internal group to undertake a study to prepare a conceptual framework for estimating the additional ground water resources that could be available by arresting the surplus monsoon run-off and storing in the sub-surface aquifer. Accordingly a conceptual framework of a National Perspective Plan for recharge to ground water by utilizing surplus monsoon run-off has been prepared. The salient features of the plan are:

⇒ In the 20 river basins in the country surplus monsoon run-off available has been estimated as 86.47 million hectare metres; Keeping in view the present depth to water and the void space available, it would be possible to create surplus potential of 59.06 million hectares by saturating the aquifer. Out of this storage, it would be possible to retrieve 43.64 million hectare metres;

⇒ However, on the basis of the available surplus monsoon run-off, which is not uniform in time and space, the ground water storage that could be feasible has been estimated as 21.42 million hectare metres of which about 16 million hectare metres is considered retrievable; and

⇒ The above resource could be harnessed to create an irrigation potential of 32.00 million hectares.

(Union Water Resources Minister in LS 101201) However, there has been no attempt to realise this potential that would also have a very significant impact on floods.

2002 Proposal for Integrated Flood Management Commission rejected The Working Group on Flood Control Programme for the 10th Plan (2002-07) in its report submitted to the Planning Commission had recommended that "It would be desirable to consider setting up an Integrated Flood Management Commission to go into all the details and make review of the flood management programme in the country". (Union Water Resources Minister in LS 100303) The Mid Term Appraisal of the 10th Plan said that in view of the report of the Task Force in 2004 (see below), this suggestion "could be deferred for consideration in the 11th Plan".

PM's Task Force in 2004 After the severe floods in Assam, Bihar and Orissa during 2004, the Prime Minister announced constitution of a Task Force for Flood Management / Erosion Control, headed by the Chairman, Central Water Commission with representatives of State Governments, various Central Ministries and experts as members to examine the problem of flood and erosion in Assam and neighbouring States, West Bengal, Bihar and Eastern Uttar Pradesh. The TF submitted its report on 31.12.04. The TF mainly made business as usual recommendations with emphasis on storage projects on intra state, interstate and international rivers, some notable ones being:

⇒ The flood control schemes should be funded through the Centrally Sponsored Scheme in the ratio of 90% Central and 10% State from the present 75:25.

⇒ Schemes worth Rs. 316.14 crore should be taken up as immediate measures to be taken before the 2005 flood season. The Schemes worth Rs 2030.15 crore have been recommended during the remaining two years of the 10th Five Year Plan i.e. during the 2005-06 and 2006-07 under short term measures and Rs. 2635.81 crore have been estimated as requirement during the 11th Plan.

⇒ The total investment for plan/ Flood Management may be increased from the existing half per cent of the total outlay to at least 1%.

⇒ Community Participation in maintenance of embankments should be encouraged. Earmark funds in the State sector as Additional Central assistance for maintenance of embankments.

⇒ To mobilize resources for this revolving fund, a flood cess of say 1% to 2% could be levied on new infrastructures like roads, buildings, power plants etc. in the flood prone states.

⇒ The establishment of Sikkim and North Bengal River Management Board as well as strengthening of the Ganga Flood Control Commission by addition of a Member (Works) and appropriate field formations for investigation and execution of critical flood management works. (Union Water Resources Minister in RS 190405, Mid Term Appraisal of 10th Five Year Plan)

The Proposed North East Water Resources Authority

One of the recommendations of the PM appointed TF was a proposal for setting up North East Water Resources Authority (NEWRA), which is also under consideration of the Government. The Principal Secretary to Prime Minister reviewed the status of constitution of NEWRA in a meeting held on 23.01.06. Apart from other issues and decisions it was decided that it would be necessary to empower NEWRA to accord statutory clearances under various regulations/ statutes. As decided during the meeting a Small Working Group has been constituted with a representative from Planning Commission, Ministry of Power, PMO and Ministry of Water Resources by Prime Minister Office, vide PMO ID No. 450/50/C/2/05/ ES-I dated 28.02.2006 on North East Water Resources Authority. (Union Water Resources Minister in LS 220506)

The constitution of the NEWRA is being pushed by the World Bank and was possibly first loudly proposed by the Prime Minister at a speech in Guwahati in 2004. The Union Ministry on North East Development is actively working with the World Bank to push this proposal.

It may be added that, as the NCF notes (p 234), in 1964, on invitation of the govt of India, Mr HE Weller of the US Army Crops of Engineers was invited and he visited the state a number of times in view of the erosion problem in the Brahmaputra Valley. In his report, he said that eve through it may be desirable to have a comprehensive scheme including reservoirs, he said, the NCF notes, "it might not be feasible to implement the scheme on account of technical and other considerations."

The Five Year Plans

State wise figures of flood prone and protected areas

(million Ha)

S No	State	Geographical Area	Area Liable to floods	Max area affected in any one year during 1953-2004 (year)	Area benefited upto March 1993
1	UP	29.441	7.34	7.34 (1978)	1.532
2	Bihar	17.388	4.26	4.986 (2004)	1.889
3	W Bengal	8.875	2.65	3.08 (1978)	2.077
4	Sikkim	0.71	-	1.17 (2000)	0.0002
5	Assam	7.844	3.15	3.82 (1988)	1.7269
6	Arunachal Pradesh	8.374	-	0.207 (2003)	-
7	Manipur	2.233	0.08	0.8 (1989)	0.09
8	Meghalaya	2.243	0.02	0.095 (1987)	0.0896
9	Mizoram	2.108	-	0.541 (1993)	-
10	Nagaland	1.658	-	0.009 (1993)	-
11	Tripura	1.049	0.33	0.33 (1963)	0.0308
TOTAL		**81.923**	**17.83**	-	**7.4355**

Source: National Commission (Sept 1999), p 427

Physical Works under Flood Management Programme upto 1993

S No	State	Length of Embankment (km)	Length of Drainage Channels (km)	Towns/ villages protection works (Nos)	Villages raised/ protected (Nos)
1	UP	1811	3593	64	4511
2	Bihar	2788	365	47	-
3	W Bengal	1184	1648	48	-
4	Sikkim	-	-	6	-
5	Assam	4566	957	89	16
6	Arunachal Pradesh	2	-	-	-
7	Manipur	300	76	1	1
8	Meghalaya	112	-	8	2
9	Mizoram	1	1	-	-
10	Nagaland	-	-	-	-
11	Tripura	128	94	11	-
TOTAL		**10892**	**6734**	**274**	**4530**

Source: National Commission (Sept 1999), p 428

The Flood Prone area goes up

Sr No	State	Area prone to floods (m ha) as assessed by	
		NCF (1980)	10th Plan working Group
	Main Ganga Basin states		
1	Bihar	4.26	6.88
2	UP	7.34	7.34
3	W Bengal (partly in Brahmaputra basin)	2.65	3.77
	Brahmaputra basin/ NE states		
4	Arunachal Pradesh	-	0.12
5	Assam	3.15	3.82
6	Manipur	0.08	0.08
7	Meghalaya	0.02	0.10
8	Mizoram	-	0.05
9	Nagaland	-	0.01
10	Sikkim	-	0.02
11	Tripura	0.33	0.33

As can be seen from the above table, as per the assessment of the 10th Plan working group on water resources, the flood prone area in most of the GBM states in India has gone up since the report of the NCF (1980).

Interlinking of Rivers As per preliminary studies done by National Water Development Agency, the flood peaks are estimated to be reduced by about 20-30% in Brahmaputra basin. (Union Water Resources Minister in RS, 231203) It is instructive to look at what has been the stand of some of the GBM states we are looking at.

Current Flood Control Schemes in Ganga Basin To give a glimpse of the kind of flood control schemes that are under implementation in the Ganga basin, we have given details of the current flood control schemes.

(Rs. In crore)

Sr No	Scheme	State	9th Plan: Amount released towards Central Share	10th Plan: Central Share	
				Amount earmarked	Amount released by 301104
1	Flood proofing programme in N Bihar	Bihar	2.37	3.5	1.25
2	Maintenance of Flood Protection works of Kosi and Gandak Projects	Bihar (Kosi)	15.60	27.00	11.72
		UP (Gandak)	2.70	8.00	2.06
3	Critical anti erosion works in Ganga basin states	Bihar	22.08	57.42	26.14
		UP	10.89	38.61	16.69
		Uttaranchal	1.00	4.95	0.95
		W Bengal	17.88	63.12	10.78
4	Raising, strengthening and extension of embankments on Lalbakeya, Kamla, Bagmati and Khando rivers	Bihar	4.80	46.00	1.50

(Source: Union Water Resources Minister in LS Dec 6, 2004)

Interstate issues

⇒ **Bihar-W Bengal** The construction of 58 km of embankment along the Mahananda by W Bengal led to increased flooding in Bihar and forced Bihar to embank its side of the bank too.

⇒ **Bihar-UP** There are differences over cost sharing for the maintenance of the Pipara-Piparasi embankment on the Gandak.

The trend in damages The NCF notes (p 231) that the proportion of damage to property and public utilities has been rising, from 24% to about 40% of the average annual flood damage since 1954. This is in spite of having spent about Rs 650 crores on flood control till 1978.

Paradigm Shift in Disaster Management? India's Home Minister, Shivraj Pail recently[12] said, "We have a very firm conviction that disaster risk reduction is no longer an issue of relief and rehabilitation but of development. Therefore we have decided that it should be mainstreamed into the process of development in every sector at all levels. We had announced this in our Tenth Five Year Plan in 2002 and we are going to follow this in a much more vigorous and effective manner in our Eleventh Plan that is currently under formulation".

That conviction does not seem to be reflected in reality. To give a recent instance, if risk reduction were to be part of dam operation, many of the floods in India in 2006 could have been avoided. On the contrary, the improper operation of dams were responsible for some of the most disastrous floods of 2006.

NEPAL: Some important recent developments[13]

Some important recent developments in water resources in Nepal include:

⇒ 2000: The first draft of Napal's water resources Strategy: River basin planning framework was prepared by consultants, for the Govt of Nepal.

⇒ 2002: Water Resources Strategy finalised by the Water and Energy Commission Secretariat, Govt of Nepal

⇒ Tenth Plan (2003-8) has major focus on Disasters: Natural and Human induced, including a policy on disaster risk reduction

⇒ 2005: National Water Plan with specific focus on water induced disasters. The plan included measures to enhance institutional capabilities for managing water induced disasters, effective measures for better management of water induced disasters and mitigation of their adverse effects, making water-induced disaster management system fully and functional, effective and responsive to people's needs

⇒ 2006: Water Induced Disaster Management Policy includes strategy of preservation of rivers, river-basins and environment for sustainable use. This policy includes following measures.

- Mitigating the loss of lives and property arising from water-induced disasters like flood and landslides
- Reservation of rivers, river basins, and water related environment for the sustainable use of natural resources and facilities like water supply, irrigation, water navigation, road transport, etc.
- Reclamation of riverbanks and flood affected areas for the rehabilitation of landless people and conduct of socio-economic activities
- Institutional development for the control of water induced disasters and management of flood affected areas
- Defining the role of local and central government institutions, NGOs, community-based organizations and private institutions.

BANGLADESH: Some Important recent developments[14]

⇒ Water Resources Planning Organisation rejected the National Water Management Plan (NWMP) prepared for the govt of Bangladesh by a team of consultants in 1980s and 1990s, saying that many of the analysis were based on unrealistic assumptions. However, the govt have recently adopted the NWMP for implementation.

⇒ Master Plan Organisation formulated a National Water Plan in 1986, which was updated in 1991.

⇒ 1993-4: Agitation on Flood Action Plan, pushed by the World Bank

⇒ 1995: Flood and Water Management Strategy Report

⇒ 1998: National Water Policy

⇒ 2000: National Water Resources Database created at WARPO- Water Resources Planning Organisation

⇒ 2004: National Water Management Plan final by WARPO, Ministry of Water Resources (Netherlands involvement)

⇒ 2003-2008: Integrated Planning for Sustainable Water Management, implemented by Bangladesh Water Development Board.

Adnan (July 1991) would help understand recent historical context of flood management issues in Bangladesh, particularly the institutional issues.

3. The Issues

What Affects Floods The flood can be affected by many factors, besides the rainfall, the rivers, the dams and the embankment in a given area. The drainage congestion caused by railways, the roads, the canals, the urban and industrial areas and the embankments themselves can create floods in a given area. Forests, local water systems, wetlands in the river basins, Landslides, erosion, soil and conservation works (or lack thereof), creation and destruction of natural dams, glaciers, earthquakes, tides in the sea, and global climate change are some of the less known factors that can have impact on floods in a given area.

Even flood protection measures in one area can increase the problem in another area. The NCF notes (p 232), "local or narrow functional approaches often conflict with the interests of the basin or the region or the nation as a whole. For example, in the case of embankments we have mentioned that construction of embankments in certain areas can lead to increase in flood levels upstream and downstream". This is also true in case of removal drainage congestion. The NCF hence recommends that it is necessary that flood control measures are dealt with on a basin wide basis.

In fact, some of the so called flood control measures in a given area can lead to increased floods elsewhere. Thus, while dams may or may not moderate floods in the downstream areas, they certainly lead to submergence in the immediate upstream areas. The embankments are basically flood transfer mechanisms, they quickly transfer the floods from a given area to the downstream areas, and the downstream area in fact are likely to get greater flood than would be the case in absence of embankments in the upstream. Attempts to remove drainage congestion can have similar impact in the downstream areas.

Different Nature of Floods Firstly, it should be noted that floods are not synonymous with disaster, as the official govt agencies would have us believe. The floods brought by the rivers like the Ganga, Brahmaputra and Meghna are in fact responsible for the creation of fertile flood plains that now sustain millions of people. Moreover, there are many kinds of floods and the nature would change with the inventions we make in the given area.

Thus the existence of embankments changes the character of floods in the area. The floods that visit an area when embankment is breached is very different that the floods that would come in absence of the embankment: the floods now would be sudden, would have greater destructive power, could bring a huge quantity of sand with it and could remain for longer periods than would be the case without the embankments. Similarly, the floods that would visit the area downstream from the dam when dams open the spillway gates is very different in character than the floods that would come without the dam.

Dealing with floods There are many ways of dealing with floods (NCF, p 83):

⇒ Attempts to modify the flood (dams, embankments, river dredging)

⇒ Attempts to modify the susceptibility to flood damage (e.g. watershed development and catchment management)

⇒ Attempts to modify the loss burden (evacuation, flood relief)

⇒ Living with the floods

Flood forecasting and flood warning As NCF notes (p 93), "The system of flood forecasting consist of observation and collection of hydro-meteorological data at base stations and transmitting them to forecasting centers, assimilation of data from various sources, formulation of forecasts and their dissemination." Flood forecasts can go a very long way in alerting and preparing the people in the flood risk area, giving time to the disaster management agencies to prepare for the impending disasters and thus reducing greatly the damages due to the floods. This should be the first step of defense against flood disasters. With all the latest satellite and communication systems, flood forecasting and preparedness can greatly reduce the damages, but we have been unable to use this to advantage because of the failure of the govt machinery to make forecasts and disseminate such forecasts.

The wetlands The wetlands in India, excluding rivers, artificial impoundments and the area under paddy, occupy 14.3 m ha. These wetlands perform vital flood control function as they act as water sponges and are nature's initiative at flood moderation, besides other benefits they have. A detailed survey shows that these wetlands are dying as a result of human neglect and overexploitation. Lakes, ponds, marshes and watercourses in the vast low lying area between the Ghaghra and Ganga form the wetlands of eastern UP comprising more than 500 freshwater bodies of over 100 ha. A third of the area under wetlands may have already been lost. The condition of wetlands in Bihar, Bengal and Assam is similarly bad. (CSE 1991, p 122)

The wetlands in the river basin can absorb a lot of precipitation and thus reduce the flood peaks. However, neglect and destruction of wetlands over the years have reduced their numbers and areas very significantly, reducing their capacity to impact flood peaks.

The local water systems The NCF notes (p 179-180) that existence of small storages in the upstream can significantly reduce the flood peaks and delay the flow of water into the main rivers downstream. This has been shown from the actual experience in Mississippi basin and in Washita river basin in Oklahoma, USA. The NCF goes on to say (p 181), "From flood mitigation point of view, provision of small and large reservoirs along the course of rivers and their tributaries has been universally accepted as an important measure for a long term solution."

Similarly, the NCF (p 179), with experience from Machkund, Panchet, Maithon, Ramganga, Bhakra and Kundah reservoirs, have shown that watershed development in the catchment area can significantly reduce the silt inflow into the rivers.

The NCF notes (p 196-197) that numerous saucer shaped depressions occur in the chronically flood prone plains in eastern UP, North Bihar, W Bengal and Assam. They are locally known as Jheels in UP, Chaurs in Bihar, beels in W Bengal and Assam. An area of about 0.49 lakh ha in Assam valley is under such inland water bodies, the NCF noted. In Gangetic W Bengal, *beels* occupy about 0.8 lakh ha. NCF noted that due to the implementation of the Estate Acquisition Act, about 0.4 lakh ha were then vested with the state govt.

However, most these systems are in poor shape due to neglect of maintenance, due to silting up of the link with the rivers, due to proliferation of weeds and also some attempts at draining of these depressions permanently for agriculture crops. In Bihar, construction embankments have cut off many of such *mans* from the rivers. The NCF observed that these water bodies can be a rich source of fisheries and these should be preserved as such as they also have flood moderation potential.

The remarkable system of canals off taking from rivers throughout Gangetic plains in general, but particularly in Bengal has been described in detail in *Dying Wisdom: Rise, fall and potential of India's traditional water harvesting systems* (see for example p 93-103). Those systems made Burdwan district in W Bengal "India's most prosperous agricultural district in the early part of the 19th Century". The neglect of that system over the years lead to the area being impoverished by the late 19th Century. The Royal Commission of Agriculture (1926) blamed the problem in Bengal agriculture to lack of adequate drainage. That diagnosis may be only partly accurate, for the real reason was the system "that the people of Bengal previously had been able to cope successfully with the problem of "too much water" because they had devised a method for redistributing excess water over vast areas and utilizing it to their advantage".

Watershed Development While expressing some doubts about usefulness of watershed development in flood moderation in Himalayan basins, NCF agrees (p 90) that "Watershed management is thus likely to give some benefit to flood mitigation works by reducing the silt load". Moreover, it agrees that flood moderation through watershed development may be useful for small floods and small catchments.

Groundwater Recharge As NCF notes (p 89), groundwater storage of flood waters occur naturally when flood plains are inundated, when the initial groundwater level is low. Groundwater storage can be induced artificially through the use of water spreading in shallow basins and by injection wells. The NCF notes (p 229) that measures for increasing ground water recharge are conducive to reduction of flood runoff. The NCF thus recommends, "Research and development be carried out and such measures considered, while drawing up flood management plans." However, this technique is yet to be implemented in any big way in India.

The Large Dams and Flood Control The first five year plan prepared in 1952 made a rather bold statement, "The construction of large dams to store these flood waters is the most effective way of preventing flood damage" (NCF, p 97).

The NCF (p 86) notes about usefulness of reservoirs for flood control, "The flood problem being more acute in the basins of rivers originating from the Himalayas, the reservoirs for flood moderation have to be sited in the Himalayan region, where there are complex problems to be dealt with in putting up large dams due to geological, seismic and topographical constraints. Because of narrow valleys, capacities of reservoirs on Himalayan Rivers are not very large. Also, the rivers carry very large silt charge. These factors limit the economic life of the reservoirs, which, in turn, affects the economic feasibility of the project".

The NCF also notes about flood moderation in the downstream areas through dams, “The continuous moderation of floods deprives the lower reaches of flushing dose of high floods which is reported to be the cause of deterioration of the channel in the lower basin”. Moreover, the trapping of the silt in the reservoir may, NCF notes, “increase erosion of the bed and sides of the channel as has been reported in the case of Maithon Dam.”

The Kurichu and Karbi Longi Dams The water releases and land slides connected with the Kurichu project in Bhutan and the Karbi Longpi project in Assam lead to floods in Assam in 2004 that hit many areas including severely affecting Morigaon and overall impacting some 15 m people.

Box 5: Pagladiya Dam approved to control *mad river* would worsen the situation

The Government of India had also approved implementation of Pagladiya Multipurpose Project in Assam in 2001 at a cost of Rs. 542.90 crore (Revised tentative cost Rs. 1069.40 crore) which has flood control as a major benefit. It is estimated to provide protection against floods to an area of 40,000 ha. (Union Water Resources Minister in RS on 170804, 291105)

The dam is being built on the Pagladiya River, a tributary of the Brahmaputra. This is a "multipurpose" affair, meant to establish "flood control" over 40 000 ha, irrigate 54 000 ha and have a token 3 MW power generation installed capacity. In 2001, the project was meant to cost Rs 543 crores. Its estimated cost had more than doubled to Rs 11.36 B – by 2004 when it was not even half-complete. The cost meter is running -- and fast. The Pagladiya project came in for sharp criticism last year in the Parliamentary Standing Committee on Agriculture.

Praful Bidwai says, “I was on an Environment Ministry "Expert Committee" on river valley projects in 1996-98. The Pagladiya dam was referred to us. "Pagladiya" literally means "mad river" because it changes its course wildly, drastically and suddenly. This is the result largely of seismic factors that cause mountainous masses of earth to shift position, creating landslides, huge silt flows and floods. The effect is compounded by deforestation and other man-made factors. A minority within the committee, including me, opposed the project because no dam could possibly address the root-cause of the floods or the river's "migration" (shifting of its bed) by kilometers at a time. A three km-long dam would be useless, for instance, on a river that changes course by 30 km in 4 years! The project, we argued, is doubly irrational because in the name of "irrigation", it would create waterlogging in places. Half the power it might generate in a good year would be used to pump out the accumulated water from "irrigation" -- to prevent floods!”

The project was approved under pressure from the Centre and irrigation lobbies. Today, the same "mad river" is creating havoc through floods and by depositing coarse silt on fertile paddy fields -- causing local shortages of food. The Pagladiya, reports *The Hindu*, has turned Namati village (population 8 000) in Assam's Nalbari district "into an island. Three villagers, including two women, [have] died of diarrhea due to lack of safe drinking water. The district administration has now installed four tube-wells". The irony of drilling tube-wells amidst floods should be self-evident!

At any rate, continues the report, the large amount of sand the river carries "gets deposited on the bed, raising its level. As a result, it easily breaches the banks, causing catastrophic damage. In 2004 too, [the] Pagladiya changed its course and converged with another river, Buradiya", no less! According to the Pagladiya Baandh Prakalpar Khatigrasta Alekar Sangram Samiti, the project will result in the loss of ancestral homes of 33 villages, in order to benefit 37 villages in the southern part of National Highway 31. The Samiti has recommended that three check dams be built instead of this single dam. Several groups like the All Bodo Students' Union, Bodoland Demand Legislative Party, All Rabha Students' Union and the All Bodo Employees Federation have held demonstrations seeking a halt to the dam as it may create a serious flood problem in the tribal dominated Tamulpur Revenue Circles.

According to the All Bodo Students Union, 27 villages of Tamulpur and Mushalpur Revenue Circle would be submerged by the project. They say that the survey for the dam was done in 1968 and since then the environmental scenario in the area had undergone drastic changes making the construction of the dam irrelevant in the present context. The ABSU stressed that instead of going in for a big dam, the Central Govt should explore the possibility of setting up small dams in the tributaries in Nalbari district which would also help the irrigation.

The apprehensions are that the implementation of the dam in the present form would completely submerge 70,000 bighas of agricultural land. (*Large dams for hydropower in NorthEast India* (SANDRP-Kalpavriksha, 2005) *Dams, Rivers & People*, Aug-Sept 2004, p 21)

Box 6: The ILR proposals' claims of Flood Control on shaky foundations

Govt of India now proposes that the interlinking of rivers would solve the flood problems in the Ganga and Brahmaputra basins. President of India in his address to the nation on Aug 14, 2005 said, "I feel that it has the promise of freeing the country from the endless cycle of floods and droughts." It is claimed that ILR would save 40 m ha area and 260 m people from floods and lead to avoiding damages of Rs 2400 crore/ year. It may be noted that total flood prone area of India 40 m ha.

The Himalayan Component of the ILR proposal contains following links that affect GBM basins: Kosi – Mechi, Kosi – Ghagra, Gandak – Ganga, Ghagra – Yamuna, Sarda – Yamuna, Yamuna – Rajasthan, Chunar – Sone Barrage, Sone Dam – Southern Tributaries of Ganga, Brahmputra – Ganga (MSTG), Brahmputra – Ganga (JTF) (ALT), Farakka – Sunderbans, Ganga – Damodar – Subernrekha.

In addition, Ken Betwa and Parbati-Kalisindh-Chambal links in the peninsular component are also in the Ganga basin.

There are serious doubts about these claims. For example, ILR proposals imply that at the most, the link canals from Brahmaputra basin can have capacity of 1500 cumecs and that from Ganga basin can have capacity of 1000 cumecs. However, at its peak, Brahmaputra basin can have floods of 60 000 cumecs and Ganga basin 50 000 cumecs. Thus the ILR can reduce the flood peak by just around 2.5 %. Moreover, it needs to be noted that when Brahmaputra is in floods, Ganga basin is also in floods or have high water flows, so it is questionable why should the Ganga basin states accept more water from outside the basin when Ganga basin itself is in floods. Ganga basin states like Bihar and W Bengal and many of the significant organisations in Assam in Brahmaputra basin have also expressed their opposition to the project. Bangladesh and Nepal have also expressed serious apprehensions about the project. Union of India as of now has said that they would focus on the peninsular component, implying that the Himalayan proposals won't be taken up in near future. However, many of the peninsular links are not viable without some of the Himalayan links.

Dr. Bharat Singh, Professor Emeritus at the Water Resources Development Training Centre at the IIT, Rourkee, and Member of the National Commission for Integrated Water Resources Development Plan (1996-99), has said, "Any water resources engineer will immediately discard the idea of the inter-linking of rivers as a flood control measure".

John Briscoe, Senior Water Resources Expert of the World Bank has said, "River linking per se will do little to reduce flood damage since the size of the link canals would usually be miniscule compared to flood flows."

The Report of the Govt of India's National Commission for Integrated Water Resources Development (Sept 1999) concludes, "The Himalayan Component data are not freely available but on basis of published information it appears that this component may not be feasible for the period of review up to the year 2050… the costs of construction and environmental problems would be enormous. These links should only be taken up if and when they are considered unavoidable in national interest."

About Inter basin transfer (that is what ILR proposals essentially are about), the NCF says (p 89), "This method is not economically feasible except in cases of small streams and where the watersheds are separated by flat ridges". The ILR proposals are not about small streams, nor are the concerned watersheds separated by flat ridges.

From all accounts it is clear that the flood control claims of the ILR proposals are on shaky foundations.

Dumbur Dam The Dumbur dam also called Gumti because it is on Gumti River in Tripura is an example of how wrong the decisions to build large dams can get. That dam has submerged vast tracks of land, submerging thousands of tribal families without any rehabilitation. The displaced population than became a catchment area for the separatist militant movement. To top it all the dam is has produced miniscule benefits and is already substantially silted.

The World Bank's Strategy paper of June 2006, titled *Natural Resources, Water and the Environment Nexus for Development and Growth in Northeast India* says (in spite of it being of questionable intent and wisdom otherwise) about this dam, 'Projects may also lose their utility, such as the project on the Gumti in Tripura (upgraded installed capacity of 15 megawatts, but outputs diminishing over the last 30 years). This project also submerged about 45,000 hectares and displaced about 9,000 tribal families. There have been suggestions to analyze if it would now make economic and political sense to decommission the dam, and resettle about 30,000 landless tribal families in the state on the rich silt-laden reservoir bed. This could make Tripura self-sufficient in grain, help ethnic reconciliation and

ecological restoration, and would send a message across the region that water resource development will not take place at the cost of legitimate human and tribal interests."

The eminently justifiable demand for decommissioning of Dumbur dam has been rising for some years now and during the 2004 general elections, practically all political parties (except the one party that came to be elected) said that the dam should be decommissioned. But there is little further movement for decommissioning of the dam as yet.

The Damodar Dams The Damodar Valley Corporation that was constituted through an act of Parliament in 1948, has largely failed to achieve most of the stated objectives. The NCF has concluded that the floods in the basin in 1978 were worsened by dams in two ways: Firstly the dams were already full as the high rainfall arrived late in the monsoon. Secondly, the existence of the dams lead to steady deterioration of the downstream drainage system because, due to the dams, the system did not get the flushing required to clear up the silt. The NCF found that between 1958 and 1978, the river got more than 4248 flows only in seven years and no studies were done to assess the impact of such low maximum flows in the downstream drainage. According to Subrata Singh, former deputy director general of Geological Survey of India, "Dams have proved to be more a curse than a source of prosperity, defeating their purpose." Kapil Bhattacharyya, an engineer with the Bengal govt had warned about the problems that DVC dams would cause and many of the predictions of Bhattacharya have proved to be correct (CSE 1991, p 118-9).

There have been a number of attempts at history and performance of the Damodar Dams. Danieal Klingensmith did one from the political economy perspective in his PhD dissertation to the University of Chicago in 1998, titled *One Valley and a Thousand: Remaking America, India and the World in the image of the Tennessee Valley Authority, 1945-1970*. One of the conclusions Klingensmith reached was, "It (DVC) has not established integrated, balanced development of resources, but indeed the reverse. Nor, probably, has such development as it has achieved been cost effective". Sudhir Sen, the first CEO of the DVC latter went on to call his work as DVC as bed of poison ivy.

The Tipaimukh Detailed Project Report of Tipaimukh Multipurpose Project on river Barak has also been prepared which will inter alia have flood control benefits in the Barak Valley. (Union Water Resources Minister in LS, 020505) However, this statement of the Union Water Resources Minister does not answer many questions about the Tipaimukh. Firstly, the flood control benefits of the project are doubtful, considering the hydrology of the Barak basin, the uncontrolled catchment below the proposed dam site, the fact that the Barak river bed level in Assam is already higher than the surrounding land, among other factors. Moreover, a strong opposition to the dam exists in upstream Manipur and Bangladesh, due to different reasons. While Manipur is facing the worst submergence, Bangladesh fears that Meghna will dry up in the lean months. Indian govt does not seem to have taken the Bangladesh govt or people into confidence about the project, nor has the govt followed the basic norms of preparing full Environment Impact Assessment and holding public hearing in the affected areas. Moreover, the project's economic viability is in doubt and in an attempt to make the project look viable, Home ministry has been asked to bear the costs related to security of the project and flood control costs are being pushed on to other departments, so that NEEPCO (North East Electric Power Corporation), an organisation under Union Power Ministry, can take up the project.

When Dams bring flood disasters This sounds strange, but is true. Dams that are expected to provide flood moderation are actually the cause of many of the floods that visited India in July-August 2006, particularly those in Mahi, Sabarmati, Narmada Tapi, Chambal, Krishna and Godavari basins. The unjustifiably high water storage in reservoirs before the monsoon and sudden and high quantity water release only when the dams were near full were the two main reasons behind this man made disasters. SANDRP's analysis of floods in July-Aug 2006 (see www.sandrp.in/news) revealed that many of the flood disasters in these basins could have been avoided if the dams had been operated properly.

Earlier the 3rd Report on State of India's Environment (CSE 1991) had concluded, "Dams have become an important cause of floods."

The Natural Dams The natural dams get created due to landslides blocking the path of the river. At a later stage when such earthen dams break, they can bring sudden and devastating floods in the downstream areas. Such possibility exists all along Himalayas. Two of the most recent examples are the floods in Arunachal Pradesh in June 2000 and in Himachal Pradesh in July-August 2000. In September 2003, landslides caused a formation of an artificial lake on Tsatichhu river in Bhutan. Such hazards will continue to prevail in Bhutan's rivers placing hydropower plants, farmlands and human settlements at risk.

As the 3rd Report on State of India's Environment (CSE 1991) noted, "In 1893, a landslide blocked the Birahiganga in the Uttar Pradesh Himalaya to form a 350 m high dam creating the vast Gohana Tal. When a part of the dam toppled 10 months later, the level of the Alaknanda rose by 50 m and washed away the town of Srinagar".

Glacial lakes Glacier inventory carried out by Indian Space Research Organisation using satellite data has shown formation of 22 lakes (moraine-dammed) in the Satluj basin. These lakes are fed by melting of glaciers. Lakes formed in proglacial area are far away and they will cause least damage to plains. The formation of lakes over the glaciers and in the adjacent areas is a natural process. The National Remote Sensing Agency under the Disaster Management Support Programme has been constantly monitoring various major glacier lakes in the Himalayas for any possible breach. (Union Water Resources Minister in LS on 220805) However, as our experience with the Sutlej floods of July-Aug 2000 and the Arunachal floods of June 2000 show, Indian water resources establishment still has no idea about the cause of these floods.

The 15 000 odd Himalayan Glaciers cover about 17% of the mountain area (CSE 1991), which is very high compared to other mountain systems around the world.

Box 7: Independent Assessment of Flood Management Experience

There have been many attempts at Independent Assessment of flood management experience in India and elsewhere. Some such attempts like that by CSE, by Independent People's Commission in the context of Eastern UP floods of 1998 have been mentioned elsewhere. Let us take stock of some other such attempts.

Oxfam's India Disaster Report in 2000 As part of mapping India disaster picture in 2000, Oxfam's India Disaster Report also included a number of chapters on Flood management experience. Some important findings of these chapters include the following.

⇒ Gradually, in the first half of 20th Century, floods changed in character from relatively harmless inundations to highly damaging disasters.

⇒ The structures that are supposed to protect the people from flood, namely dams and embankments, are also those that have aggravated the damage potential of floods. In spite of repeated signals to that effect, governments continue to have faith in the old structural techniques of building dams and embankments.

⇒ Unless the issue of post flood sustenance is allowed to go beyond salt, candles, match boxes, a few kilograms of wheat and *secret* inquiry committee reports, no effort will succeed.

⇒ The tribulations of people affected by rivers in spate have always bowed to the technological and political exigencies of profits and power.

One of the chapters also said, "since rum ours create rifts between the citizens of India and Nepal, it was strongly suggested by the People's Commission that joint international commission be urgently set up to sort out these issues, inviting active participation from the various stakeholders, especially the affected people."

Barh Mukti Abhiyan As can be seen from the partial list of books and booklets from Dinesh Kumar Mishra of Barh Mukti Abhiyan in the References section at the end, BMA has done extensive and intensive work on the research, documentation, analysis, dissemination and mobilization on the issue of floods in Bihar also some other areas. In the process, it has produced a remarkable knowledge base on flood management issues in Bihar in particular and in India in general. Some notable conclusions of the literature include the following.

⇒ The most unfortunate part of this continuing relief work is that nobody ever questions why one should spend so much money every year and whether there is any end to it.

⇒ The concept of *Living with the floods* is yet to develop. Unless the craze for structural solutions to the problems of floods is shelved, no serious inputs are likely to be made either.

⇒ Living with floods surely means minimum interference with the workings of nature.

The World Commission on Dams During the work of the WCD, a remarkable knowledge base has been created that included an assessment of flood management experience. Some important conclusions of this exercise included the following.

⇒ The Dublin and Rio conference set out guiding principles for sustainable development, which means maximizing public involvement at all levels of decision making and adopting a catchment management approach.

⇒ In the long term, restoration of rivers and their associated wetlands to a more natural form is a widely held objective. The wetlands in the flood plain are the most valuable ecological resources on the planet.

⇒ A significant proportion of the failures of the past fifty years in water management have been institutional, and the physical solutions adopted have frequently required institutional systems to support them and that have not been sustainable.

⇒ Decisions about the most appropriate flood management strategy to adopt must both take account of the effects of climate change and the contribution of the flood management strategy to slowing climate change and then stabilizing the climate.

Glacial Lake Outburst Flood (GLOF) The GLOFs are among the most serious natural hazards potentials in Bhutan GLOF threatens the lives and livelihood of people living in the valleys and low lying river plains. There are 2,674 glacial lakes in Bhutan, of which 562 are associated with glaciers History of GLOF occurrences in the past in 1957 and 1960 The 1994 GLOF caused 17 lives and damaged more than 1700 acres of agricultural land. 12 houses were damaged and 5 watermills were washed away. Hazards due to GLOF flash floods and land slides are likely to increase in intensity as a result of impacts of climate change. The GLOF monitoring system has been enhanced as part of the early warning systems in Bhutan.[15]

The Hydropower projects A large number of hydropower projects are being built all along the Himalayan region, from Kashmir in the west to Arunachal Pradesh in the east. Most of these projects do not have large capacity to moderate the floods, but they all have significant impacts on the nature and intensity of floods in the region due to among other reasons: landslides due to the project construction and blasting, dumping of muck in the river, sudden release of water from the storage (e.g. from Baspa HEP in HP in July 2005).

River Training works These include spurs, bank revetments and boulder pitching. These are all proving to be temporary measures and they also induce large scale erosion and devastation (Panos 2004, p 79). NCF rightly notes (p 89), these works try to shift the erosion problem upstream or downstream, which may affect other areas. These aspects need careful consideration before such works are undertaken.

The forests The National Flood Policy statements in the Parliament (NCF, p 100) indicated the aggravation of flood problem of the Himalayan rivers by deforestation in the upper catchment area and consequent soil erosion and silting of beds of rivers, resulting in shifting of their courses and recommended that this particular aspect must receive much more attention than before. As the NCF notes (P 51), deforestation and denudation of soil cover that have been taking place on an ever increasing scale are known to facilitate quicker and increasing runoff of rain water. This in turn may add to the peak flood discharge in minor and medium floods.

Even the 3rd report of State of India's Environment (CSE 1991) concludes that afforestation helps local economy and can inhibit shallow landslides, though it controversially concluded that afforestation won't be able to stop the larger process of soil erosion and landslides as Himalaya is still under construction young mountain range.

The Infrastructure (Roads, Towns, Tourism) The NCF notes (p 51) that activities like expansion of rail and road network, irrigation systems, embankments, industrial and residential complexes etc have also adversely affected drainage, thereby aggravating the drainage problem.

Climate Change The report entitled "An Overview of Glaciers, Glacier Retreat, and Subsequent Impacts in Nepal, India and China" of WWF Nepal Programme reveals that the Himalayan glaciers including Gangotri glaciers have been found to be in a state of general retreat. The report has posited that the accelerated melting of glaciers would cause an increase in river levels over the next few decades, initially leading to higher incidence of flooding and land-slides but in the longer term, as the volume of ice available for melting diminishes, a reduction in glacial runoff and river flows can be expected.

The issues related to glaciers are studied by various organisations in India including Geological Survey of India. The studies carried out by Geological Survey of India also reveal that the glaciers are receding. The causative factors are stated to be subnormal snowfall, higher temperature during summer, less severe winter or a combination of all them. The Geological Survey of India has further stated that if the recession is only due to higher melting of the Glacier, then there may be some increase in the river discharge. However, this process is a very slow one and if the past is any key to the future, then heavy floods may be an apprehension only. The Ministry of Water Resources has already identified "likely effect due to climate change on water resources" as a thrust area for studies. (Union Water Resources Minister in LS on 180405) However, SANDRP (South Asia Network on Dams, Rivers & People)'s recent questions under the Right to Information Act to the Central Water Commission and the Central Electricity Authority revealed that neither of these premier organisations have done studies of impact of climate change in performance of water resources projects.

Moench and Dixit (June 2004) looks into the factors that help adaptive capacity of the communities in times of extreme weather changes in India & Nepal and helps look at issues that will need to be addressed to help the communities adapt to such situations in future.

As noted by the World Bank (June 2005), climate change would mean that many of the flood prone areas will be affected due to changes in glacial behaviour and precipitation in the Himalayas, that while overall precipitation in South Asia may increase, it is likely to come more in the form of high rainfall events. The report recommended that we need a water resource management system that is flexible and is driven much more by knowledge (including hydrologic) than is the case currently. Structural solutions like big storages and embankments are not likely to be the best options if adaptation and flexibility driven by knowledge is the criteria.

INDO-NEPAL ISSUES Broadly, Nepal govt has resentment that it has not got fair deal in the Sarada (1920), Kosi (1954) or Gandak (1959) agreements and that Nepal should have got better deal. The implementation of the accords has only increased the resentments in spite of the amendments in the Kosi and Gandak agreements. That resentment over the years has turned into suspicion about any proposal from India and has also percolated down to people. The Mahakali agreement of 1996 remains unimplemented.

Nepal feels that India takes up projects that have impact in Nepal, without consulting Nepal and only after the project is a fait accomplice, India consults Nepal. Such incidents continue, the perception persist. A very recent example is the construction of an embankment at the Laxmanpur barrage (on Rapti River) by India on its own land close to the India-Nepal border. This embankment has adversely impacted Nepal in terms of inundation affecting more than 10 000 farmers. Nepal protested against India's action, but had no option but to work with India to find a solution and negotiations continue. (WASSA Project Report June 2003, Vol 3, p 95)

Although some 16 (at last count) Indo Nepal Joint committees exist, the overall institutional mechanism to deal with the India Nepal issues is found to be weak. Some of the committees have not met for many years now. (WASSA project report June 2003, Vol 3, p 36)

Standing Committee on Inundation Problems The Problems of inundation in the vicinity of India – Nepal border are discussed in a Standing Committee on Inundation Problems (SCIP) between India and Nepal, which has been functioning since 1986. The Objectives of SCIP are: identify the problem areas and suggest solutions. Its approach has been conventional: it has repeatedly recommended that embankments be constructed. As Panos report notes, not once has the SCIP undertaken a joint analysis to understand why the flood related problems regularly resurface or how the problems could be tackled differently.

Flood Forecasting A scheme namely, "Flood Forecasting and Warning System on rivers common to India and Nepal" has also been in operation since 1989 to provide forecasts in the State of Bihar on the rivers flowing from Nepal. This scheme was reviewed in May 2002 and a Flood Forecasting Master Plan (FFMP) prepared jointly, which inter alia provides for 47 stations in Nepal, has been approved in the 2nd meeting of the Joint Committee on Water Resources held in October, 2004. For implementation of the scheme a Standing Committee on Flood Forecasting (possibly the fifteenth Indo Nepal Committee) has been constituted. In addition Nepal has also agreed to transmit real time data in respect of 5 key hydrometric stations located on Gandak, Kosi, Rapti, Bagmati and Mahananda rivers which in turn would help in making flood forecasts with increased warning times.

As per the decision taken by Joint Committee for Water Resources during its 2nd meeting held on 7 – 8 Oct, 2004 in New Delhi, an India Nepal Joint Committee for short term strategy for flood management and control (16^{th} Committee) was formed with mandate to work out jointly, a short term strategy for identifying the vulnerable areas along various rivers – common to India & Nepal. The Committee has since held two meetings and site visits and prepared a report for the areas lying between Gandak and Kosi rivers, which have been sent to the State Government. (Union Water Resources Minister in RS in 021202, 250203, 260405, Panos 2004, p 175))

The one problem with this plethora of committees is that neither has anyone outside the govt any place in these committees, nor is the functioning and reports of the committees in public domain. Even the flood forecasting information claimed by the minister above is not in public domain.

Embankments on Indo Nepal Rivers along Border in Bihar An understanding has been reached between India & Nepal to extend the existing embankments on Lalbakeya, Bagmati, Kamla & Khando rivers into Nepalese territory upto the non-spilling zone and tie them up with high ground with corresponding strengthening of embankments on the Indian side. The works on Nepalese side are funded by Ministry of External Affairs whereas the full cost of the works on the Indian side being executed by Government of Bihar is met by the Ministry of Water Resources. (Union Water Resources Minister in RS on 060704)

Pancheswar Dam This dam is proposed on the Kali river along the India-Nepal border in the west, under the Mahakali Agreement signed between the two countries in 1996. However, ten years after signing of the agreement, it remains unimplemented and there are doubts if the agreements are any longer valid. In July 2001, in answer to a question in Lok Sabha, India's Union Water Resources Minister said that as regards the Pancheshwar Multipurpose Project the preparation of Joint Detailed Project Report is in progress. (Union Water Resources Minister in LS on 230701)

Dams on Kosi Agreement has been reached with Nepal and a scheme at the cost of Rs. 29.34 crore has been approved to take up field investigations and preparation of Detailed Project Report on Sapta Kosi High Dam Multipurpose Project and Sun Kosi Storage Cum Diversion Scheme which interalia will have substantial flood control benefits for North Bihar. The process of Letter of Exchange which was pre requisite for opening of Joint Project Office and other field offices in Nepal has also been completed in June 2004 paving the way for taking up the above work. Joint office opened in Nepal in August 2004. (Union Water Resources Minister in Rajyasabha 060704, 291105)

As Kanwar Sain (former Chairman of Central Water and Power Commission, Govt of India) notes in his autobiography (*Reminiscences of an Engineer*, 1978), there have been numerous proposals for dams on Kosi, including the Belka Dam proposal made by the 1952 advisory committee, the Kothar Dam project proposed by the Central Water and Power Commission in 1953. The proposal for Barakhetra dam was revived by the 1974 Board of Consultants.

The report of the Bihar's Second Irrigation Commission (1994) suggests that catchment area of Kosi upto the site where the Kosi High dam is proposed is 59 550 sq km and there is an additional 13 676 sq km of catchment below the proposed dam site. The size of this catchment below the proposed dam site is of almost the same size as the catchment of Bagmati and double that of Kamla river, which are equally flood prone rivers. So Kosi is likely to remain flood prone for the people inside the embankments and waterlogging would continue for those outside the embankments even with the proposed high dam, as long as embankments along Kosi exist, says well known expert on Bihar floods, Dinesh Kumar Mishra (Panos 2004, p 112). Moreover, since the high dam is not expected to store all the water in the river, there will be additional water downstream of the dam.

Dams on Kamla Kamla Multipurpose Project on river Kamla is under discussion with Nepal, though the Nepalese side feels that this project may not be feasible because of social and environmental implications. This matter was discussed during the 5th meeting of Joint Team of Experts in June 2003 and is being followed up further. (Union Water Resources Minister in RS on 060704)

Dams on Gandak During discussions between India and Nepal in October 2003, agreement has been reached to take up field investigations and preparation of Detailed Project Report of 600 MW Burhi Gandaki Hydroelectric Project by an Indian agency on river Burhi Gandak which is a tributary of river Gandak. (Union Water Resources Minister in Rajya Sabha on 060704)

Dams on Bagmati Nepal has agreed for undertaking preliminary study of Bagmati Multipurpose Project to ascertain likely constraints in implementation of these projects so that the same could be appropriately addressed. (Union Water Resources Minister in Rajya Sabha on 291105)

INDO-BANGLADESH ISSUES

After the independence of Bangladesh in 1971, in 1972 the two countries signed a declaration, under which a Joint Rivers Commission was created for among other objectives, jointly prepare and implement flood control plans. A second joint declaration was issues two years later.

1996 treaty The agreement provides a formula for allocating water during the critical period between January-May. Problems remain as the flow goes down upto 43 935 cusecs, as it happened in 1997. There is no well defined mechanism as to what would happen when the flow goes down below 50 000 cusecs. Bangladesh also feels aggrieved as the flow now it gets is below that was available under the 1977 agreement, especially in March-April. Moreover, the 1977 agreement guaranteed certain minimum flow for Bangladesh, but the 1996 agreement does not guarantees any minimum flow.

Bihar govt was also unhappy that it was kept out of discussion and the commitments in the treaty may force limitations on its use of water. (WASSA Project Report, June 2003, p 82)

Sharing Flood information There is very limited exchange of data. India provides real-time flow data to Bangladesh only when the levels in the Ganges and the Brahmaputra and the Barak rise to within a meter of the danger levels. Level data only from some points near the borders and not from entire lengths of river are shared. (Panos 2004, p 51) However, now that the CWC flood forecasting data is updated daily, including level data of Ganga, Brahmaputra and Barak, that should be accessible to Bangladesh.

Box 8: The Farakka Experience: the Disaster foretold?

India started building the dam in 1963 and completed the construction of the bypass feeder canal in 1975. The first interim agreement was signed between India and Bangaldesh in 1975 for 41 day trial operation of the Farakka barrage from 21 April to 31 May to flush the Bhagirathi and Hugli rivers.

The project diverts 40 000 cusecs to augment the Bhagirathi flow and thus flush the silt out to keep the Kolkata port navigable. The project has adverse impacts for both India and Bangladesh. Bangladesh took the issue to UN in 1976.

The dams on Damodar and Rupnarayan rivers built in 1950s are also considered cause for the deterioration of the Kolkata port's navigability and it is questionable if Farakka has helped (Panos 2004 p 68). This is because the high intensity floods in Damodar and Rupnarayan every year in the monsoon helped flush away the silt accumulated in the Hugli River, which stopped once the dams were built. Subsequent to the building of Farakka, the erosion of the Bhagirathi-Hugli in the downstream reach has also significantly increased and now the river erodes about 220 ha every year.

According to Kolkata Port Trust Authorities, the port continues to depend on dredging for its survival as much as it was before the Farakka was commissioned. The dredging of 7 million cubic meters in 1974-75 has gone up to 14 million cubic meters I 1995-6 and even 22 million cubic meters reported more recently (Panos 2004, p 74). Farakka has increased flooding, waterlogging, bank erosion in the upstream area. Malda district has lost 200 sq km and Murshidabad has lost 356 sq km due to river erosion. More seriously, Farakka could be rendered useless as the river may bypass it, which could bring greater disaster to the whole region.

In 1977, the two countries signed the first water sharing agreement for five years. This was followed by the Memorandum of Understanding of 1982 and 1985 (this expired in 1988) and the 1996 treaty.

In spite of the overwhelming evidence that Farakka has failed, the proposal of building similar barrage over Ganga in Bangaldesh is a perennial topic of discussion. It seems the race to the bottom applies here too.

A report published by the Centre for Development and Environment at the Indian Institute of Management in Calcutta and authored by well known expert Kalyan Rudra said that the Farakka barrage across the Ganga has worsened land erosion, failed to clear mounting sediment downstream, and is now driving the Ganga off course. The report says the Farakka barrage appears to have been constructed without regard to the natural behaviour of river water in the Gangetic delta and that the state and the central governments have been investing in expensive but superficial and ineffective engineering measures to prevent erosion along the banks of the river. The report also warns that the Ganga annually carries more than 700 million tonnes of sediment at Farakka, of which about 300 million tonnes gets trapped in a barrage pond. This is driving the river to change course. "The river may outflank the barrage and open a new channel for its water through the distributary called the Pagla which joins the Mahananda," says Rudra. This will make the Farakka redundant as the river would bypass the structure. (Telegraph 020906)

INDO-BHUTAN ISSUES The technical delegations of India & Bhutan met in Delhi on 2nd August 2004 and agreed to set up a Joint Group of Experts to discuss and assess the probable causes and effects of recurring floods and erosion in the southern foothills of Bhutan and adjoining plains in India. Further, as a part of non-structural measures for flood management, cooperation exists between India and Nepal as well as Bhutan under which the hydrological data received from these countries is utilised for flood forecasts on the Indian side. (Union Water Resources Minister in RS on 170804)

Joint Group of Experts During the first meeting on Nov 1-5 '04, the Indo Bhutan Joint Group of Experts felt that a more detailed technical examination is required and it was recommended to form Joint Technical Team consisting of four members each from India and Bhutan and with provision that any expert or special invitee could be co-opted as and when required. The first meeting of JTT was held on April 18-21, '05. The Joint Technical Team made visits to some of the identified areas and submitted its report on various aspects. The Joint Technical Team studied some sources of sediment load, nature of slides and suggested further studies and preparation of maps to be taken up for deciding remedial measures to be recommended by the JTT. The report findings of the Joint Technical Team are for consideration of the JGE. (Union Water Resources Minister in RS on 061205, 010806)

Bursting of Natural Lake However, during July 2004, the bursting of a natural lake which was formed in September 2003 near village Ladong in Bhutan resulted in rise of water level in river Beki by 20 cm. in lower Assam. (Union Water Resources Minister in RS on 170804)

INDIA-CHINA ISSUES The floods in Arunachal Pradesh in June 2000 and in Himachal Pradesh in July-Aug 2000, both originating from China remain an issue between the two countries. The issue of creation of Parichoo lake in Sutlej basin and its impact on India in 2005 and construction of a hydropower project on Sutlej in Tibet by China, which came to light in 2006 are also important to note, though they are not in GBM basin. The Chinese objection to the design of one of the proposed hydropower project in Arunachal Pradesh in 2006 is relevant to GBM basin. India promptly agreed to change the design of the project. The border issue and China's plans to divert the Tsangpo (as the river is known in Tibet) to the North are other relevant concerns.

GOI statement Major rivers that originate in China and flow into India are Brahmaputra, Sutlej, Lohit, Subansiri and Indus. At present no agreement has been signed with China on sharing of river waters.

However, cooperation exists relating to flood control measures. In this regard a Memorandum of Understanding (MoU) had been signed between India and China in January, 2002 for provision of hydrological information namely rainfall, water level, discharge and other relevant information on Brahmaputra (Yaluzangbo) river in respect of three stations namely Nugesha, Yangcun and Nuxia in flood season by China to India from 1st June, to 15th October, every year. The Chinese side have started transmitting data to India for the above mentioned three stations since June. 2002. An Agreement regarding the provision of hydrological data on Sutlej (Langqen Zangbo) was also concluded during the visit of Hon'ble Premier of China in April, 2005 for which an MoU has been signed. As per MOUs, the Chinese side has also agreed to provide information on any abnormal rise/fall in the water level/discharge and other information, which may lead to sudden floods on the basis of existing monitoring and data collection facilities on real time basis. The two sides have also agreed to continue bilateral discussions to finalize at an early date similar arrangements for the Parlung Zangbo and Lohit (Zayu Qu) rivers (which are Tributaries of Brahmaputra).

Further, regarding the artificial lake created in 2004 on Parechu river in China due to a land slide dam, the discussions were held during the visit of Secretary level delegation to Beijing in March, 2005 and during the current visit of Hon'ble Premier of China to India in April, 2005. The Chinese side has agreed to take measures for controlled release of accumulated water of the land slide dam as soon as the conditions permit. (Union Water Resources Minister in LS 020505)

Attempts at trilateral or multilateral platforms A number of agencies like the World Bank, the Asian Development Bank and the USAID have been trying to bring the south Asian countries for sharing natural resources and infrastructure. Some non governmental channels are also known to work. There have also been attempts at SAARC level to raise some of these issues.

A SAARC framework on Disaster Management has been created, which includes managing floods among other disasters, as per the presentation made at the Aug 21-22 South Asia Dialogue on Disaster Management in Delhi. Some of the Priority areas area for this framework including the following:

- ⇒ Develop and implement risk reduction strategies
- ⇒ Establish Regional and National Response Mechanisms
- ⇒ Establish a Regional Information Sharing Mechanism and Develop Network of Institutions and Organizations
- ⇒ Develop and implement Disaster Management training, education, research and awareness programmes
- ⇒ Apply the ICT for disaster management.
- ⇒ Establish an effective monitoring and evaluation mechanism.

Bangladesh and Nepal have been trying to persuade India to take up the construction of dams in Nepal through a trilateral agreement, but India has been insisting on treating these issues at bilateral level.

On Sept 4, 2006, the ADB's Bangladesh country director in his speech said, "On a broader level, we note with pleasure the preliminary progress of establishing a multilateral river commission, with representation of the governments of Bangladesh, Bhutan, Nepal, India and the PRC to improve trans-boundary river management, including regular exchange of key data and information on flood and water levels." (http://www.adb.org/Documents/Speeches/2006/sp2006038.asp)

4. The Players

Preface It should be noted at the outset that this paper does not go into deep on the flood management in the context of Disaster Management framework. One major reason is that according to the author, to view flood management solely in the context of the DM framework as most DM frameworks and governments tend to do, would be inviting another policy disaster. To tackle flood management effectively, it is important that the root cause and mechanisms of the floods have to be understood, which is missed if one tries to look at the floods management solely in the DM framework.

To give an instance of such fallacy, the cause of floods, as given by the website (http://www.nidm.net/flood1.asp) Indian Government's premier institute, namely the National Institute of Disaster Management, are:

- Inadequate capacity within the banks of the rivers to contain high flows.
- River bank erosion and silting of riverbeds.
- Landslides leading to obstruction of flow and change in the river course.
- Synchronization of flood in the main tributary rivers.
- Flow retardation due to tidal and backwater effects.
- Poor natural drainage.
- Cyclone and heavy rainfall.

While at one level this may be true, this description of causes of floods does not include some of the most frequent causes, like the failure of embankments or sudden high quantum release of water from the upstream dams.

Similarly, the situation reports on floods by the UNDP disaster management website (http://www.undp.org.in/VRSE/SitRep/) in India would almost always say that the floods are due to heavy rains, even when the floods are due to release of sudden release of high quantum water from dams or due to failure of embankments.

Communities The Communities in the basin, experiencing the flood disaster are the first and foremost players. Community is the first to suffer and first real time respondent in any disaster and the last interest group to stay behind after a disaster. However, beyond being at the receiving end in terms of the floods and sometimes relief, they have little role in flood management planning, decision making or implementation and upkeep. A number of models for Community Based Disaster Programmes exist, but we are not going into them here.

Government players

Inter-Governmental: SAARC: Floods of Bihar and Assam as well that of Bangladesh and Bhutan have their origin in Nepal and Tibet. Regional co-operation within South Asia therefore are extremely important. Shortly after the Indian Ocean tsunami the Environment Ministers of SAARC met at Male and decided that a Comprehensive Framework of Regional Cooperation for Disaster Risk Reduction and Management in South Asia be developed. The Framework is based on the Hyogo Framework of Action that was adopted at the World Convention of Disaster Reduction held at Kobe Japan in January 2005, which all the South Asian countries have endorsed. This Framework prepared by an expert committee will be reviewed in the next SAARC Summit in Delhi in April 2007. Earlier in the Dhaka Summit of 2005, the approval was sanctioned for setting up a SAARC Centre for Disaster Management in Delhi which will begin operations in October 2006.

India: Union Government: Ministry of Water Resources

Central Water Commission The Central Water Commission is the main technical arm of the Union Water Resources Ministry in India. Among other roles, CWC is in charge of flood forecasting in India, as described by the Union Water Resources Minister in Rajya Sabha in Nov 2005:

Flood Forecasting In order to mitigate the damages from floods, a nationwide flood forecasting and warning system, as a non — structural measure, has been established by the Central Water Commission which issues flood forecasts at 173 stations in the country of which 145 stations are for river stage forecast and 28 for inflow forecast. The Flood Forecasting Network is being upgraded in the 10th plan by way of installation of modern data collection & data communication system to enable collection and transmission of real time data to forecast formulation centers and dissemination of the forecasts to user agencies for which a scheme estimated to cost Rs. 51 crore has already been approved by the Government of India. (Union Water Resource Minister in RS on 291105) However there has been no

independent assessment of the performance of the CWC in this regard. SANDRP's monitoring of 2006 floods in India showed that CWC's performance in this regard leaves a lot to be desired.

Flood Forecasting in Bihar According to the information given by the Union Water Resources Minister in Rajya Sabha o 060704, "As a part of Non-structural measures for flood management, a nation wide flood forecasting and warning system has been established by CWC all over India out of which 32 flood forecasting stations are located on rivers in Bihar. During flood season, the forecasts are issued by CWC and given to the local authorities for advance warning for flood mitigation. In order to have the quality flood forecast, cooperation also exists between India and Nepal under which we are receiving the hydrological data from Nepal."

To illustrate, how, the CWC flood forecasting is far removed from ground situation, on Sept 15 2006, CWC website (http://cwc.nic.in/) list of moderate flood sites included Jhanjharpur on Kamala Balan River in Bihar. The website said that the river was flowing at 49.33 m, and since the warning level was 49 m, a flood forecast was issued. However, when a journalist from Delhi contacted his brother in Jhanjharpur, he was told that there is very little water in Kamala. The journalist than said that this is possible as the warning level mark of 49 m on the Kamala Balan river at Jhanjharpur is submerged in sand!

The Ganga Flood Control Commission Set up by GOI in 1972, it has prepared comprehensive plans for flood management for all the 23 river systems of Ganga, all the Ganga basin States, the recommendations of which have been sent to the State Government for their implementation. (The Union Water Resources Minister in Rajya Sabha on 060704, 291105)

The Brahmaputra Board The Government of India constituted the Brahmaputra Board in December, 1981 under the Brahmaputra Board Act, 1980 for planning and implementation of measures for the management of floods and bank erosion in Brahmaputra valley. Brahmaputra Board which started functioning at Guwahati in 1982 prepared Master Plans for Flood Management for Brahmaputra, Barak and its major tributaries. These plans were forwarded to concerned State Governments for implementation. (The Union Water Resources Minister in Rajya Sabha on 020500, 291105) The Brahmaputra Board possibly replaced the Brahmaputra Flood Control Commission that was in existence before 1980.

The Brahmaputra Board prepared Master Plan Part-I for main stem of river Brahmaputra and Part-II for Barak river and its tributaries, which were approved by Government of India in 1997. Under Master Plan Part-III, out of the identified 49 sub- basin Master Plans, Government of India has so far approved 34 Nos. and the balance sub-basin Master Plans are under various stages of preparation. The Master Plan suggests various measures for flood management. (The Union Water Resources Minister in Rajya Sabha on 250705)

Other Government of India organisations Many of the govt of India organisations play a role that affects the floods in the GBM basin. A partial list of such organisations include: Planning Commission, Ministry of Power (along with organisations under it like the Damodar Valley Corporation, the National Hydroelectric Power Corp, the North East Electric Power Corp, the National Thermal Power Corp, all whom are involved and are likely to remain involved in constructing hydropower projects), Ministry of Environment and Forests, Ministry of Development of North East Region, North East Council, India Meteorology Dept, etc).

In India legislation on Disaster management has been enacted which intends to empower institutional structures from the central to the provincial levels, vesting them with powers, functions and resources to manage the disasters, both natural and man made, in a holistic manner [16]. Indian Disaster management Network is an online inventory of equipment and skilled human resources for emergency response available at a district level (http://idrn.gov.in).

State Governments in India The state govts of Uttaranchal, Himachal Pradesh, Madhya Pradesh, Rajasthan, Uttar Pradesh, Bihar, Jharkhand, W Bengal have some part in the Ganga basin and hence they play a significant role in how flood affects these states. Similarly, state govts of W Bengal, Assam, Arunachal Pradesh, Manipur, Meghalaya, Mizoram, Nagaland, Tripura and Sikkim have some parts in Brahmaputra – Barak River basin and hence they play important role with respect to floods in the basin.

Other Nations The nations other than India that have some area in GBM basin include China (Tibet), Bhutan, Bangladesh and Nepal.

⇒ **Bangladesh** Some of the relevant govt organisations in Bangladesh include: the Institute of Water Modeling, Centre for Geographical Information System and Bangladesh Disaster Preparedness Centre.

The World Bank The World Bank plays significant role that has impact on the floods in the GBM basin and is active at various levels. Within India, the Bank funds a number of projects that are related to floods in Uttaranchal, Uttar Pradesh, Madhya Pradesh, Rajasthan and the North East India. The Bank's interventions in India's water sector date back to the early days after independence, when the Bank supported many projects, including the Damodar dams. However, in early 1990s the Bank faced strong public movements in all the three GBM countries, namely India, Bangladesh and Nepal for the Bank's agenda of pushing structural solutions like big dams, in spite of bad performance of such projects on all counts in the past. In India the movement was called Narmada Bachao Andolan with focus on Sardar Sarovar Project. In Nepal the opposition was centered around the Bank's proposal to fund a huge Arun 3 hydropower project, in spite of availability of better options and in Bangladesh the opposition was to the Flood Action Programme, a massive project for structural treatment of Bangladesh's flood problem. In face of strong and well informed movements in all three countries, the Bank had to withdraw from all three projects. That was a huge set back that also had impact on Bank's funding in rest of the World.

However, in the early years of new millennium, a group within the Bank management came together to push large dams again. Under the World Bank's Water Resources Sector Strategy proposed in 2002, these projects were called high risk high reward projects and in spite of all the evidence against such proposals, including the evidence presented in the report and process of the World Commission on Dams, this group succeeded in getting the WRSS 2002 sanctioned by the Bank management.

We are beginning to see the impact of that change, first in the form of Bank pushing the interventions in the North East River Valley along the line of the Tennessee Valley Authority, in spite of the known failure of the Damodar Valley Corporation, which was also an attempt at intervention on the lines of TVA.

The ADB The Asian Development Bank is also involved in all the GBM basin nations and many of the Indian states, funding projects that affects floods in the region.

⇒ **Technical Assistance on Bangladesh Early Warning System** The Asian Development Bank has been supporting the water resources management sector of Bangladesh, in river bank erosion mitigation and command area development, both for small and medium-scale water sector projects. After the devastating floods in 2004, ADB supported rehabilitation of flood damaged infrastructure through the Emergency Flood Damage Rehabilitation Project, at a total cost of $180 Million including co-financing from both the Government of the Netherlands and the Swedish International Development Agency. The water resources management component accounted for about $ 43 million, of which $ 13 million was provided by the Government of the Netherlands as co-financing.

Furthermore, flood preparedness and disaster mitigation measures are being mainstreamed into all ADB projects, it is claimed by ADB. Under the Second Primary Education Development Program (PEDP-II) for example, all new construction being provided is supposed to incorporate flood resistant designs. The school buildings in flood-prone areas are to be designed to withstand floods and serve as flood shelters in such emergencies.

A Technical Assistance for "Early Warning Systems Studies" was proposed to chalk out a comprehensive Flood Forecasting Strategy of Bangladesh, with financial support from the Government of the Netherlands. This TA is also to provide analytical input and prepare project portfolios and pre-feasibility studies to enhance the existing early warning system, including improved flood forecasting and dissemination.

UNDP The UNDP regularly prepares floods update, but they not always reflect the ground realities accurately. For example even when the floods occur as a result of sudden release of high quantum of water from dams, the UNDP report will say that the floods are due to high rainfall. This was noticed throughout the 2006 monsoon.

⇒ A USD 20 m Disaster Risk Management Programme in India is supposed to be active in 125 vulnerable districts in the country. Launched in Aug 2002, the programme is to end in Dec 2007. (The Tribune 170906)

Bilateral Agencies

The Danish International Development Agency (DANIDA) and the Netherlands Government have been supporting in Bangladesh the capacity strengthening of the Flood Forecasting and Warning Centre since 1990 through the 10th Component of the Flood Action Plan (FAP). According to the Bangladesh country Director of ADB, "I understand this has significantly improved the accuracy of flood forecasting and the lead time has increased to 3 days. It is encouraging to learn that state-of-the-art technology and a mathematical model of the river system of Bangladesh have been developed for this purpose. We need to put the best efforts to increase the lead time to 5 to 7 days, by

making the best use of new state-of-the-art technologies which may require further investment. Institutional capacities must also be strengthened both with human and financial resources for more effective flood forecasting and dissemination." (Speech on Sept 4, 2006, www.adb.org)

Similarly SIDA and Govt of Netherlands have been involved with ADB in flood related projects as mentioned in the section on ADB above. USAID, DFID and JBIC are also known to be involved in related issues in the region.

Advocacy Organisations This is only a partial list of groups that are known to be active on issues around floods and water issues in the region.

⇒ **Ganga Bhangan Pratirodh Action Committee** Active in the Malda district upstream from the Farakka barrage, to mobilize public opinion against narrow, short term engineering means and also to fight for the rights of the flood affected communities (Panos 2004, p 80).

⇒ **Paschimbanga Khara-Bhangon Pratirodh Committee** (West Bengal Drought and Erosion Prevention Committee) (Panos 2004, p 63) for rights of the people affected due to erosion.

⇒ **Barh Mukti Abhiyaan** One of the most knowledgeable and oldest organisation active on flood related issues in Bihar and also in UP, W Bengal and Assam. They are involved in research, documentation, publication, dissemination, mobilization and advocacy related issues.

⇒ **Mohane Nonai Sangharsh Samiti** In Gaya District in Bihar, fighting for opening up the mouth of the Mohane river where it meets the Falgu River, as per the orders of the court orders in 1997. In Nov 2002 people started hunger strike in Kudawa village. A committee headed by the chairman of the Ganga Flood Control Commission was set up to submit report by Jan 31, '03, but no report was submitted even over an year after the deadline. This also reflects on the GFCC.

⇒ **Megh Pine Abhiyaan** For Rainwater harvesting for drinking water needs of the people affected by floods, during the monsoon. The initiative started with focus on one panchayat each in Kagaria, Saharsa, Supaul and Madhubai districts in N Bihar. Contact person: Eklavya Prasad (graminunatti@gmail.com).

⇒ **Kalyan Rudra and team** Research, writing, publication, dissemination on issues around embankments and floods in W Bengal.

⇒ **Rural Volunteer Centre, Assam** They have been involved in many flood related issues in Assam and Dams related issues of North East India and the region for a long time.

⇒ **Plavan Manch, Assam** Active on flood and water related issues.

⇒ **NESPON** This Siliguri based group has been involved in issues of natural resources management, including dams and floods.

⇒ **Dams related groups** CCDD, CORE, Naga Women's Union, Hmar Student Association, Intercultural Resources (Delhi based), Kalpavriksh (Delhi based) are some of the groups that active on issues around large dams in North East.

⇒ **MATU** This group is mainly active on issues around dams and hydropower projects in Uttaranchal.

⇒ **Action Aid** They have been active, for example in flood related issues in Bihar and other parts of the region. In 2005 they launched a special report on floods in Bihar.

⇒ **SANDRP** South Asia Network on Dams, Rivers & People have been involved in research, publication, dissemination and networking on water related issues in the region but with major focus on dams in India, for the last eight years. See their website www.sandrp.in for more details.

⇒ **SaciWaters (South Asian Consortium for Interdisciplinary Water Resources Studies)** The website (http://www.saciwaters.org/) of SaciWATERs says it is an Consortium comprising of senior scholars based in academic institutions and NGOs in the different South Asian countries (Bangladesh, Bhutan, India, Nepal, Pakistan, Sri Lanka). The organisation was involved in India Water Partnership programmes, which was not participatory in many senses.

⇒ **South Asian Network for Development and Environmental Economics** The website (http://www.sandeeonline.org/) of the organisation says, SANDEE is a regional network that seeks to bring together analysts from the different countries in South Asia to address environment-development problems with a mission to strengthen the capacity of individuals and institutions in South Asia to undertake research on the inter-linkages among economic development, poverty and environmental change and to disseminate practical information that can be applied to development policies. The only flood related item that surfaces on search for flood on the website is a study on impact of 1998 flood on the biodiversity of Dhaka done in 2001, which too is not accessible.

⇒ **NEPAL WAFED** They have been involved in many floods, dams and water related issues in Nepal and also at South Asia level (through SARP: South Asia Regional Partnership). Also active on issues related with WCD.

⇒ **Nepal Water Conservation Foundation** Active on research and publications on water, dams, and floods related issues in Nepal and South Asia.

⇒ **BANGLADESH** Unnayan, Bangla Praxis, Bangla Poribesh Andolan, Lokoj are some of the groups known to be active in Bangladesh on water and floods issues.

Student bodies and Indigenous groups A number of student bodies and indigenous groups are involved on issues around water resources and floods in the North East.

Research Organisations

⇒ **Integrated Centre for Integrated Mountain Development** ICIMOD has been involved in research on flood related issues in the Himalayan region for many years now. It has a website http://southasianfloods.org/ for this issue (with subtitle of *Regional Cooperation for flood information exchange in Hindu Kush Himalayan Region*) gives a misleading impression as the year mentioned in the front page visited on Sept 29, 2006, gave the year of all the updates as 2005, when it should have been 2006.

⇒ **IIM Kolkata (Prof Jayanto Bandopadhyay and team)** They are involved in research and publication on many water related issues including floods in India and South Asia.

⇒ **Centre for Policy Research** They have been involved in research on water policy and project planning issues and are also part of the track two diplomacy initiatives in the south Asian countries.

⇒ **Centre for Science and Environment** CSE is involved in regular monitoring and research on all environmental issues in the region, including the flood related issues. The State of India's Environment series from CSE has had major focus on water related issues. In 1991 CSE came out with the 3rd report focusing on Floods in the Himalayan region, which became controversial for wrong reasons, because it made an important contribution in understanding the issues.

⇒ **WWF for Nature, India** Though largely involved in conservation issues, WWF has a special programme on freshwater issues and another on dams related issues, both are relevant for this issue. WWF did a contributing paper on Biodiversity issues in the North East Indian region for the World Bank strategic study in North East India in 2006.

REFERENCES

Adnan Shapan *et al*, *Floods, People and the Environment: Institutional Aspects of Flood Protection Programmes in Bangladesh, 1990*, Research & Advisory Services (Dhaka), July 1991

Asian Development Bank (Manila), Speech of the Bangladesh Country Director on September 4, 2006, downloaded from www.adb.org

Centre for Science and Environment (New Delhi), 3rd Report on State of India's Environment: *Floods, Flood Plains and Environmental Myths*, 1991

Centre for Science and Environment (New Delhi), 4th Report on State of India's Environment: *Dying Wisdom: Rise, Fall and Potential of India's traditional Water Harvesting Systems*, 1997

Global Environment and Energy in the 21st Century (Honolulu, Hawaii), Water and Security in South Asia Project Report Vol 1-3, June 2003

Govt of India, Ministry of Water Resources (New Delhi), Report of the National Commission on Floods, 1980

Govt of India, Ministry of Water Resources (New Delhi), Report of the National Commission on Integrated Water Resources Development, Sept 1999

Govt of India, Planning Commission (New Delhi), Midterm Appraisal of 10th Five Year Plan, Academic Foundation (New Delhi), June 2005

Govt of India, Planning Commission (New Delhi), Approach Paper to the 11th Five Year Plan, June 2006

Green CH, et al, (Flood Hazard Research Centre, Middlesex University) *Assessment of Flood Control and Management Options*, WCD thematic Review paper, Nov 2000

Klingensmith Daniel, *One Valley and a Thousand: Remaking America, India and the World in the image of the Tennessee Valley Authoriy, 1945-1970*, Ph D Dissertation submitted to University of Chicago, USA, August 1998

Mishra Dinesh Kumar, *Stagnating pools and the Gandak Command*, Jal Jamav Virodhi Sangharsh Samiti (Bihar), January 2001

Mishra Dinesh Kumar, *Living with Floods: People's Perspective*, Economic and Political Weekly, 21 July 2001

Mishra Dinesh Kumar, *Living with the Politics of Floods: The Mystery of Flood Control*, People Science Institute (Dehra Dun), 2002

Mishra Dinesh Kumar, *Thus Come the Floods*, Barh Mukti Abhiyan (Bihar), June 2003

Mishra Dinesh Kumar, *Floods Despite Dams*, Barh Mukti Abhiyan (Bihar), June 2003

Mishra Dinesh Kumar, *Noose Around the Mahananda*, Mahananda Tatbandh Virodhee Sangharsha Samiti, (Bihar), June 2003

Mishra Dinesh Kumar, *Story of a Ghost River and Engineering Witchcraft*, Barh Mukti Abhiyan (Bihar), June 2004

Mishra Dinesh Kumar, *Barah Ksehtra Bandh ki Vastu Sthiti*, Barh Mukti Abhiyan (Bihar), Oct 2004

Moench Marcus and Dixit Ajay, *Adaptive Capacity and Livelihood Resilience: Adaptive Strategies for responding to floods and droughts in South Asia*, Institute for Social and Environmental Transition, Nepal, June 2004

Panos Institute South Asia (Katmandu), *Disputes over the Ganga*, 2004

Parasuraman S & Unnikrishnan PV (editors), *India Disasters Report: Towards a policy initiative*, Oxford University Press, New Delhi, 2000

Poorvanchal Gramin Vikas Sanstha (Gorakhpur, UP), *The Troubled Waters: A Report on the 1998 Floods in Eastern Uttar Pradesh*, Feb 1999

Rao KL, *India's Water Wealth: Its Assessment, Uses and Projections*, Orient Longman (New Delhi), 1975

Rural Volunteer Centre (Assam), *Flood forecasting and experience of River Basin Friends network* 2006 (Received over email from RVC)

Sain Kanwar, *Reminiscences of an Engineer*, Young Asia Publications (New Delhi), 1978

Seminar (New Delhi), Special Issue on Floods, June 1999

South Asia Network on Dams, Rivers & People (New Delhi) & Kalpavriksh (Pune), *Large Dams for Hydropower Development in North East India*, June 2005

South Asia Network on Dams, Rivers & People (New Delhi), *Dams, Rivers & People*, various issues

World Bank, *Natural Resources, Water, and the Environment Nexus for Development and Growth in Northeast India*, June 2006 (and contributing papers thereof)

World Bank, *India's Water Economy: Bracing for a Turbulent Future*, June 2005

World Commission on Dams, *Dams and Development: A New Framework for Decision Making*, Earthscan Publications, London, Nov 2000

[1] Edited from a report done for Oxfam (India) Trust.

[2] It should be noted at the outset that the govt of India rema ins paranoid about releasing any information about river basins like Ganga, Brahmaputra and Meghna that is shared by more than one country. This paranoia seems to have passed on to Bangladesh govt, which too has stopped sharing flow in Ganga after the 1996 treaty between the two countries.

[3] P.G.Dhar Chakrabarti (2006), Welcome address presented at the South Asia Policy Dialogue on Regional Risk reduction Vigyan Bhavan, New Delhi 21-22 August

[4] Presentation by Bishnu Kharel at Oxfam RBP workshop in Delhi in January 2006.

[5] Report of the National Commission for Integrated Water Resources Development, Govt of India, Sept 1999, p 430.

[6] This information is given here only to give a picture of what the official agencies are planning. The report does not support what the Brahmaputra Board proposes.

[7] Even as the Union Minister gave this information in the Indian Parliament in August 2005, these plans had already been significantly changed. The Subansiri Lower is no longer being taken up as a storage dam as was earlier proposed by the BB, but it is being take up as so called Run of the River Hydropower Project. Moreover, one of the conditions imposed by the Supreme Court and latter including the clearance given by the Union Ministry of Environment and Forests for the NHPC's 2000 MW Subansiri Lower HEP, there would be no further dam in the Subansiri upstream from the Subansiri Lower Dam. A petition has now been filed for modification in that order of the Supreme Court.

[8] E.g. http://www.tribuneindia.com/2000/20001215/nation.htm#3

[9] The consequences of ignoring the silt potential of the Sutlej basin for the 1500 MW installed capacity, World Bank funded Nathpa Jhakri HEP in Himachal Pradesh in North India has been serious with frequent shutdowns, and short fall in generation being around 40%.

[10] In an article in Seminar, special Issue on Floods, June 1999.

[11] In an article in Seminar, special Issue on Floods, June 1999.

[12] Inaugural Speech at South Asia Policy Dialogue on Regional Risk reduction, Vigyan Bhavan, New Delhi, on 21-22 August, '06

[13] Presentation by Pratap Kumar Pathak, Joint Secretary, Ministry of Home Affairs, Govt of Nepal, at New Delhi, 21-22 Aug '06

[14] Presentation by Dr Aslarn Alam at New Delhi, 21-22 August '06

[15] Presentation by Kunzang Dorji, Head, Disaster Management Division, Department of Local Governance, Ministry of Home & Cultural Affairs, Bhutan at New Delhi, 21-22 August '06

[16] Shivraj Patil (2006), Welcome address presented at the South Asia Policy Dialogue on Regional Risk reduction Vigyan Bhavan, New Delhi 21-22 August