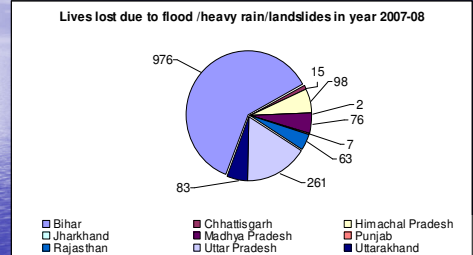
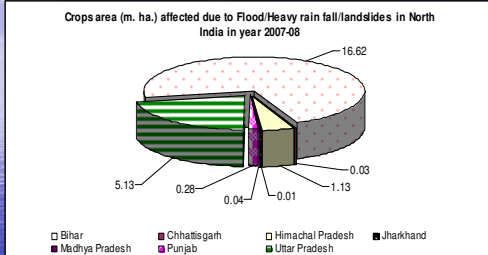
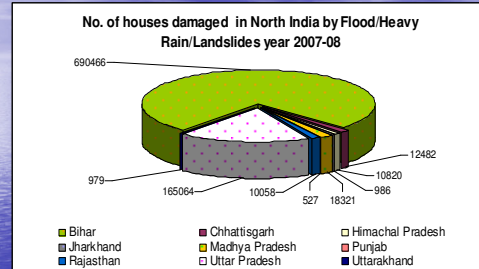


Flood Hazard, Vulnerability and Risk In North India: Assessment of Concurrent Mitigation Options

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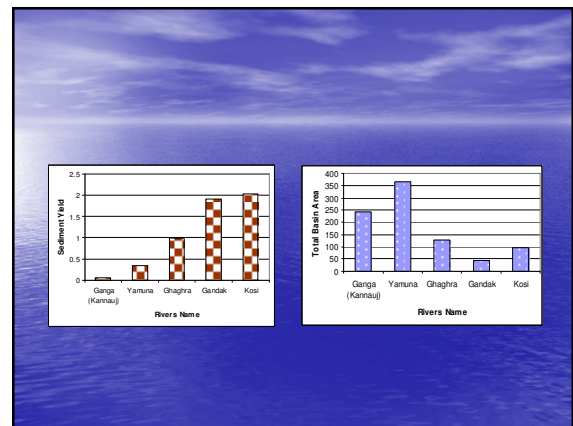
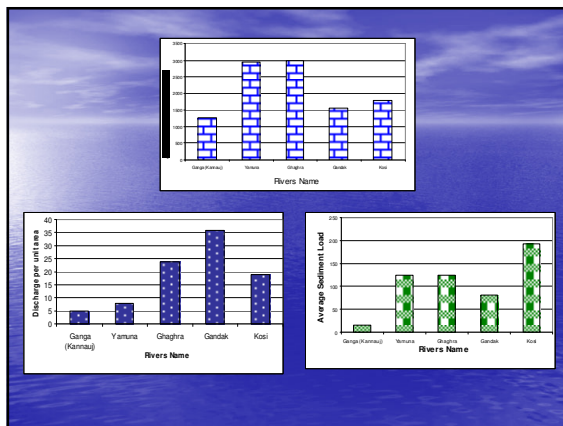
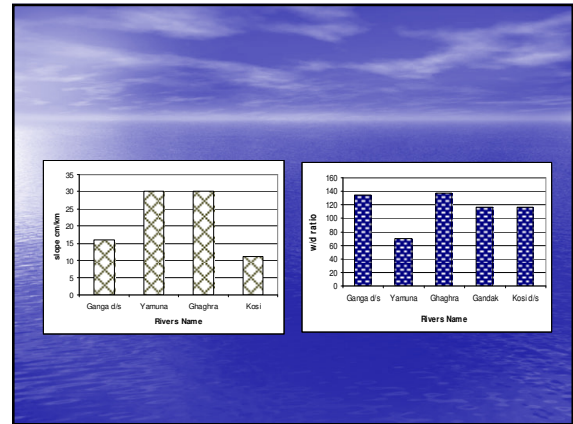
Flood in North India

- Out of total area ~121,577 m ha. of North India, 21,89 m ha. area habit to flood
- Total average damage by the flood from 1953-2002 is about 625,426 Crores Rs in North India
- Population affected is 17,112 Million (1953-2002)
- Damage of Crops in Rs is 22,802 (1953-2002)
- Human lives lost 630 (1953-2002)
- Out of total north Indian states outlay ~3234.57 Crores Rs the flood control expenditure in Gangaic plain was 2159.35 Crores Rs in 2002-07; i.e. about 66.75% of the total expenditure in North India invested in Gangaic plain
- Out of total flood control expenditure of North India, About 59.10 % spent on Bihar flood control in 2002-07
- In year 2008 ~2,50,000 acres destroyed by flood and 4.8 million people affected
- Cost of house damage is 880 Crores, damage to food grains and house hold goods is 400 and 150 crores, human lives lost ~239 and total estimated damage is 1360 Crores



River Basins of North India and Characteristics

- Major North Indian Mountain fed River Basins are Ganga, Yamuna, Ghaghra, Gandak and Kosi
- In respect to river basins and flood events the gangatic plain covers a major part in North India
- The flood in north India is synonymous to riverine flood
- A comparison of hydrological and geomorphological parameters of the rivers in North India shows the following about Kosi river : higher average annual discharge, lowest mean channel slope (l/s and d/s), lower w/d ratio, incomparable sediment yield shows that the nature of river is divergent, avulsive and high load carrying river, the lower average slope aggravate the sediment deposition



Worst flood affected districts of North Bihar



Hazard Aspects of Kosi Flood

- Source area of the river is five times more than plain area
- Extensive rain fall in upper catchments (1451.8mm/year)
- Extensive soil erosion and landslides in upper catchments
- Return period is lower
- Sediment yield 0.43 million tins/year/km²
- River bed was ~4 meter higher than surrounding flood plain level
- Average flow volume 25000m³/s
- Flow rate 1 m/s at afflux bund
- Lenient repairing coincide with heavy rainfall
- Ignorance of rare flood event
- Lack of good MOU about repairing, governance and information between both countries

Vulnerability Aspects of Kosi flood

Exposure Indications of Vulnerability

- Flood loss were experienced, aided by affected people (3 out of four)
- People flee by own mean to resources
- Water logged for 10-90 days
- Flow was 1m/s and flow volume 25,000m³/s
- Crop failure
- Loss of purchasing potential
- Occurrence of water born disease

Susceptibility Indicators of Vulnerability

- Lower educational status
- Lower flood educational status
- Water detained for long duration
- Rescue and relief was concentrated to accessible and severely affected areas and delayed in remote and inaccessible areas
- Drinking water supply was improper
- Lack of scavenging carcass and human refuse
- Lacuna in contingency and emergency measures
- Loose loose situation in maintaining the embankments

Risk arises in Kosi flood

• Risk arise at two levels

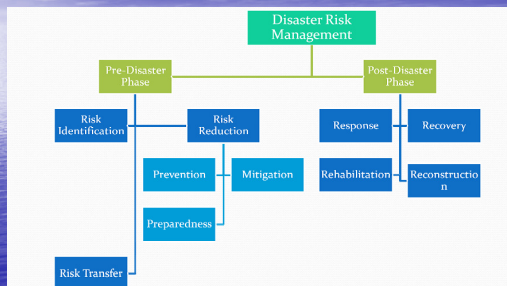
• At village level

- Loss of infrastructure
- Loss of communication

• At individual level

- Loss of crops
- House damaged
- Short of health care facilities
- Loss of domestic goods
- Lack of proper hygiene, sanitation & drinking water supply
- Long term loss in productivity and livelihood

Components of Disaster Risk Management



Flood Mitigation Measures

- It encompass all activities undertaken in anticipation of the occurrence of a potentially disastrous event including preparedness, planning, capacity building and long term risk reduction measures
- Flood mitigation measures fall in to two broad categories
 - Structural measures
 - Any physical construction to reduce or avoid possible impact of hazard like
 - Embankment (Present)
 - Dams (Possible by bi-lateral cooperation)
 - Reservoirs (Possible)
 - Natural detention basins (Possible)
 - Channel improvement (Expensive work)
 - Diversion of flood water (Possible)

Non Structural Measures

It includes policies, awareness, knowledge development, public commitment and methods and operating practices, including participatory mechanisms and the provision of information exchange

- Flood plain zoning
- Flood proofing
- Flood forecasting and warning
- Regulation of reservoirs

Concurrent Mitigation Options

- Sediment deposition study of entire river basin and the most probable flow should forecast in advance
- The flood management plan should broadcast in advance to public
- Effectiveness of the mitigation depends upon level of preparedness and correct responses
- Specific preparedness to alert, rescue and safety measures should be planned, broadcast and implement at all level
- Regular flood information, training are needed to make the community more immune to flood situation
- Flood education should be incorporated in study curriculum
- The entire long term developmental work should classify and allotted to sufferer on priority basis of their ability to do that for their livelihood options
- To create safety incentives provision

Conclusion

A flood mitigation plan should be developed based on an integrated approach covering all relevant aspect of water management including physical planning, land use, agriculture, transport and urban development, nature conservation at all level and the plan should involve the decision makers at all levels as stakeholders and civil society. The need of time is to strengthen pre disaster planning, on disaster and the post disaster responses in making the policies and preparedness and emergency arrangement to reduce such devastating conditions on the basis of rare possible flood situation also, such planning could sustain us to live with flood

Thank you