Water induced disasters, Flood Hazard Mapping & Koshi flood disaster of Nepal

Presentation at

East & Southeast Asia Regional Seminar on Flood Hazard Mapping

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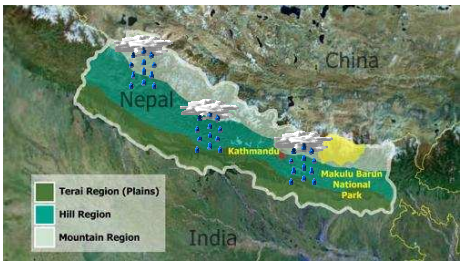


NEPAL

- Complex geographic feature
- About 75% mountains & hills, 25% plain.
- Area 147,181 sq. km
- Population 27 million. (Growth rate 2.13%,)
- 6000 rivers and rivulets.
- Average annual rainfall 1700 mm (95%; June-Sept.)
- Average annual surface flow7,125 m^3/sec
- Annual deforestation rate 1.8%.
- Sediment discharge about 353 million tones/yr
- Average rise in temp.0.5^0 C/decade (Global Warming ??)

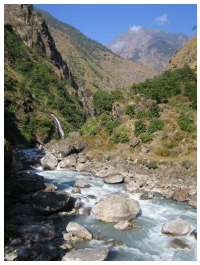
Surface Water

Perennial sources of water originating from

Mountains ➡

Water flowing through

Hills ➡



Passes through plain

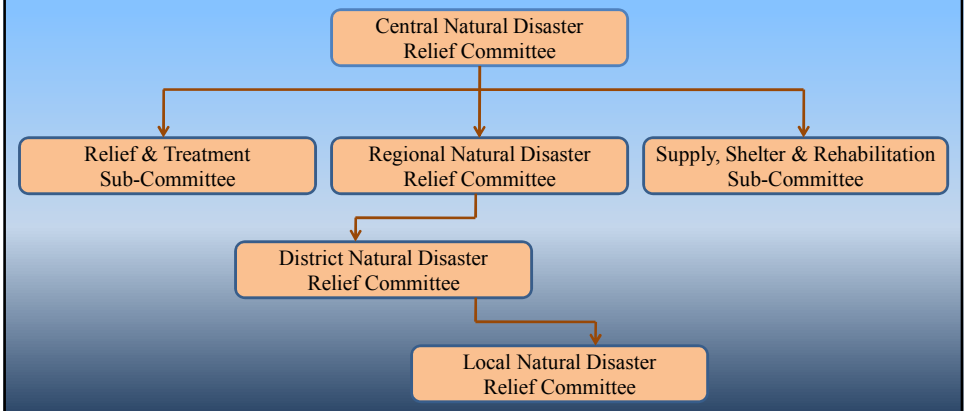
Terrains ➡

Disaster Mitigation Acts & Policies in Nepal

- Natural Calamity Relief Act 1982
- Water Resources Act 1992
- National Action Plan on Disaster Reduction 1996
- Environmental Protection Act 1996
- Local self Governance Act (LSGA, 1999)
- National Water Resource Strategy, 2002
- National Water Plan, 2005
- Three Year Interim Plan (2008-2010)

Natural Calamity Relief Act (**NCRA, 1982)**

- Amended, 1989 A.D. and 1992 A.D
- Ministry of Home Affairs: Nodal Agency
- Chief District Officers :Crisis Managers at the time of Natural Disasters.



Water Induced Disasters

- **Flood**
- **Landslide**
- **Land erosion**
- **Debris flow**
- **Glacier lake outburst**
- **Drought**
- **Epidemic**

Average annual loss of 309 lives and affects 27654 families

Concerned Organizations of FHM

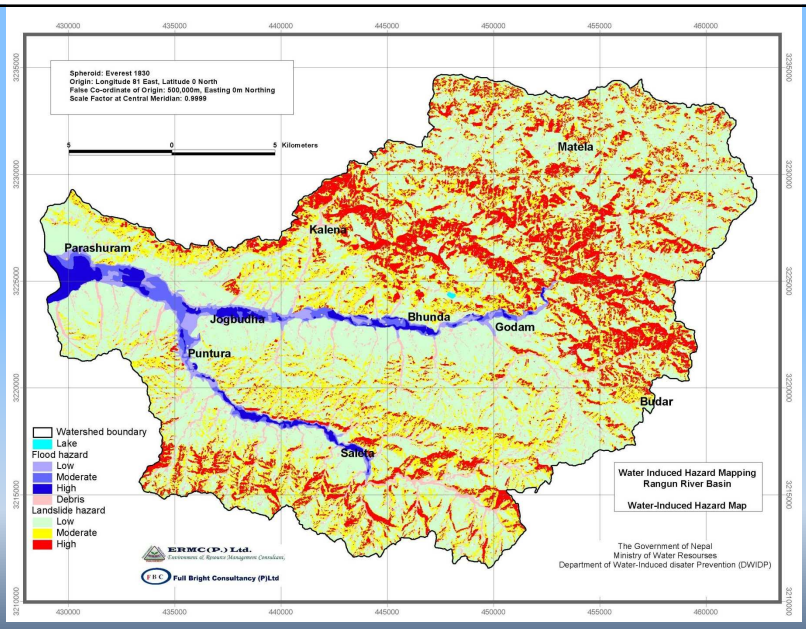
- Ministry of Home Affairs: Nodal body
- Disaster Management Section under MoHA
- Water Induced Disaster Prevention Technical Centre (DPTC): Estd. 1991; JICA
- Department of Water Induced Disaster Prevention (DWIDP) : Lead agency (Estd. 2000; JICA)
- Different INGO like Red Cross Society, JICA, ICIMOD, UNESCO etc.

Situation of FHM

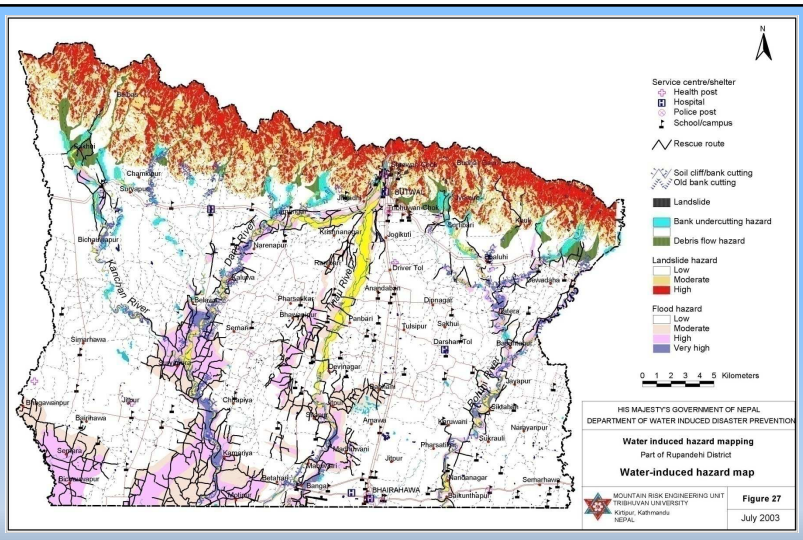
- Started in 1999 (DMSP:JICA)
- So far FHM of nine river basins.

National Water Plan

- By 2007 : Potential disasters zones are identified by type and located on map; Not completed
- By 2017 : Water induced hazard warning systems in all over the country.



Integrated water-induced map of Ranugn river basin (Area 495.8 sq km mainly the Dandeldhura District)



Flood hazard map of Rupandehi district

Others

1. Tinau River Basin
2. Bagmati River Basin
3. Kamala River Basin
4. Rapti River Basin
5. Aandhi Khola River Basin
6. Kankai River Basin.
7. Trijuga River Basin

Essential FHM data situation

Hydro meteorological data:

- Department of Hydrology and Meteorology (DHM)
- Many measuring stations throughout the country.
- Due to lack of resources, advance techniques, equipments and accountability on data collection they are not reliable and consistent.

Satellite images, Land-use and topographic maps:

- Survey Department
- Collects, preserve and revised the satellite images, land-use and topographic maps.
- High quality satellite images, precise land- use and topographic maps are not available Topographic maps are prepared in 1995

Digital elevation model (DEM):

- Survey department is also providing DEM
- Generally GIS based DEM of the study area are freely downloaded from internet.
- Not precise as available in the market.
- Do not have trend to invest for precise data.
- Problem to develop accurate flood hazard map of the study area.

Present problems of Flood Hazard Mapping

- Concept of FHM is somewhat new.
- Developed maps are not complete for dissemination.
- Not aware about the benefit of FHM
- FHM is not taken as development activity and sufficient budget is not allocated for it.
- No trend and culture to invest on observation, data collection and research activity which are essential for FHM
- Lack of availability of precise data and softwares for inundation analysis and flood hazard mapping.

Types of FHM necessary for Nepal

- Further improving the data collecting system, we can manage more precise hydro-meteorological data.
- Rainfall runoff modeling can be performed.
- If we will be able to manage precise GIS based data

We can produce Flood Hazard Maps based on inundation analysis as described by ICHARM

Type E : Past inundation area based on simulation.
Type F : Inundation area based on design flood.
Type G : Inundation forecast by real time analysis.

Other information's about FHM

- Good communication system for information dissemination
- Privatization policy in communication system.
- Many private Television and FM radio stations.
- Telecommunication and internet system are established in many districts.
- Newspapers are published even at regional and local level
- DHM provides information and forecast about weather and rainfall.
- Ministry of Home and Chief District Officer issues evacuation order.
- Red Cross Society, UNOCHA, JICA, UNICEF, Rotary, Save the Children etc are assisting in awareness raising, rescue operation, relief activity and evacuation order at the time of water induced disasters.

Koshi River & it's Disaster in Nepal

- Largest river basin of Nepal
- It originates from the Tibetan Plateau of China
- Tran boundary river (Nepal & India)

- Total length 729 km. (534 km in Nepal)
- Catchment area 60,400 Sq.Km.
- Average annual flow 1590 m^3/sec.
- River width: Up to 11km in Nepal and up to 18 km in India.
- Horizontally changed its course as much as 120 km in the last 250 years
- Average annual sediment volume: 118 million cubic meter.
- Past maximum flood : 913,000 cusec (25849 m^3/sec ;5th Oct.1968)
- Recent Flood: 168,500 cusec (4770 m^3/sec; 18th August, 2008)

Koshi Project Treaty

Signed between India and Nepal in 1954
Objective: Flood control, Irrigation and Hydropower generation
"Sorrow of Bihar" ⟶ "Pride of India" (Bihar) after completion of the project
Barrage has a discharge capacity of 950,000 cusecs (26896 m^3/sec) in a peak flood.

Koshi project

- Agreement in April, 1954.
- 1150 m long barrage with 56 gates.
- Two head regulator for canals (Eastern: 612,500ha & Western 356,610 ha).
- Power generation of 20 MW (11 km d/s of Barrage at eastern canal).
- Earthen Left embankment 144 km (32 km with 57 numbers of spurs in Nepal).
- Earthen Right embankment 125 km (25 km with 51 numbers of spurs in Nepal).
- Length of spur; 150 – 300 m.
- Nepal territory leased for 199 years.

Some clauses of Koshi Project treaty:

•The Government of India (GoI) shall be authorized to conduct necessary investigation for storage or detention for dams on the Koshi or its tributaries - soil conservation, check dams, forestation, etc. for prevention of future problems (Art. 2.2).

•Nepal shall provide necessary lands to execute the said project (Art. 3.1) and compensation of land to be provided by India to Nepal (Art. 3.2). India shall execute all necessary repair work and maintenance, and if incident occurs, compensation for every damage case shall be provided to Nepal (Art. 3.3).

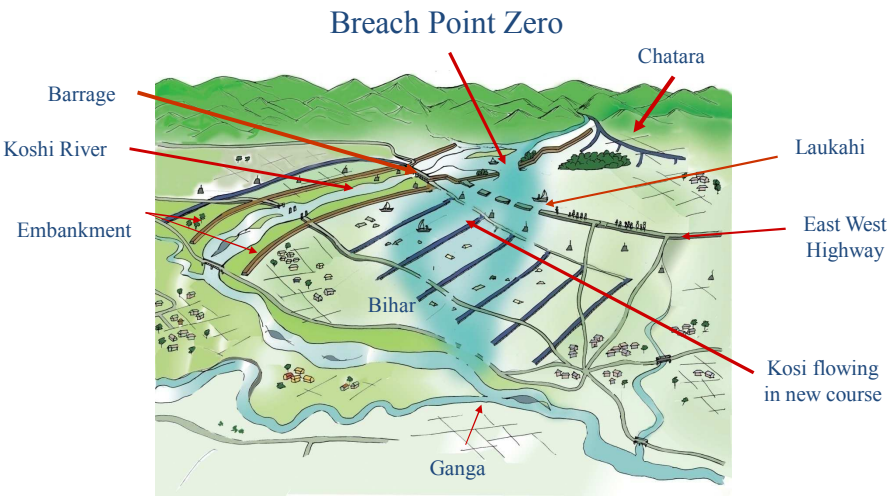
•India shall be the owner of all lands acquired from Nepal. The sovereignty rights and territorial jurisdiction of the Government in respect of such lands shall continue unimpaired by such transfer (Art.5).

•Nepal shall be responsible for ensuring security in the project areas (Art. 14).

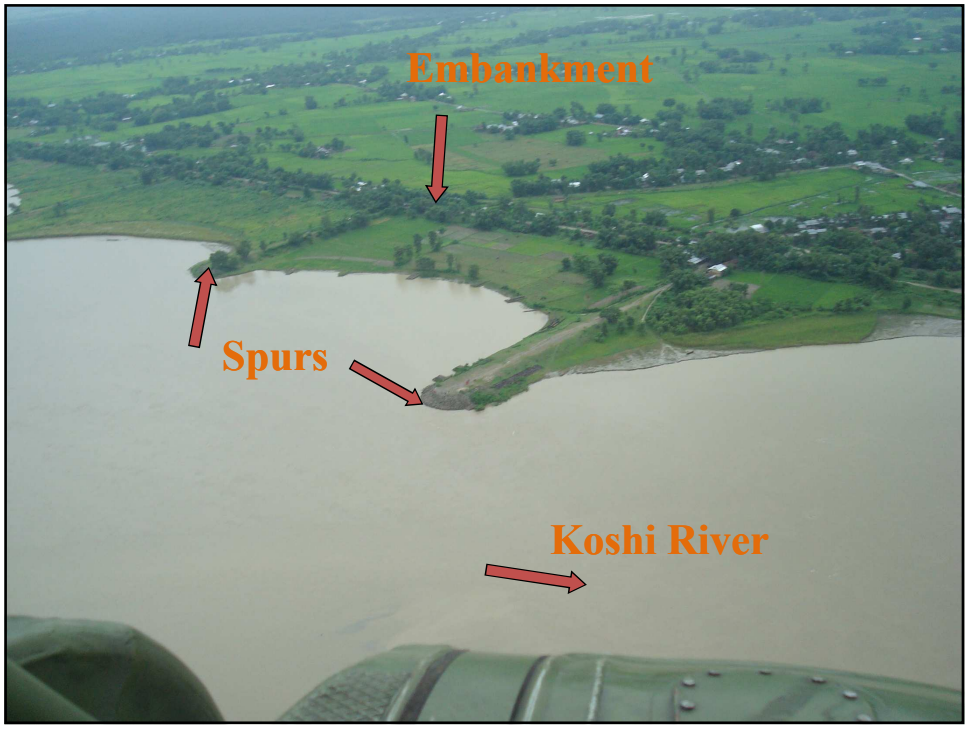
Koshi Flood Disaster of 18th August 2008

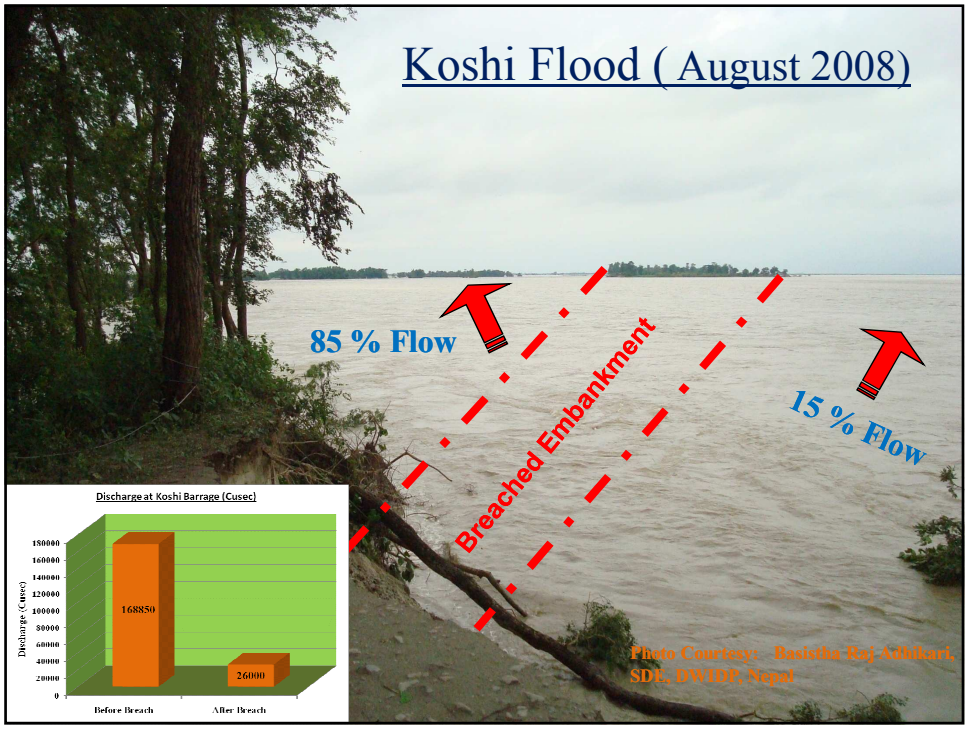
- Breaching of embankment (12.6 km U/S of barrage)
- Breached at 12:50 PM, Discharge at Barrage 168850 cusec
- 1.7 Km Embankment Breached @ 100m/ hour
- About 85% flow passed through new channel.
- No such early warning
- No FHM
- Self evacuated

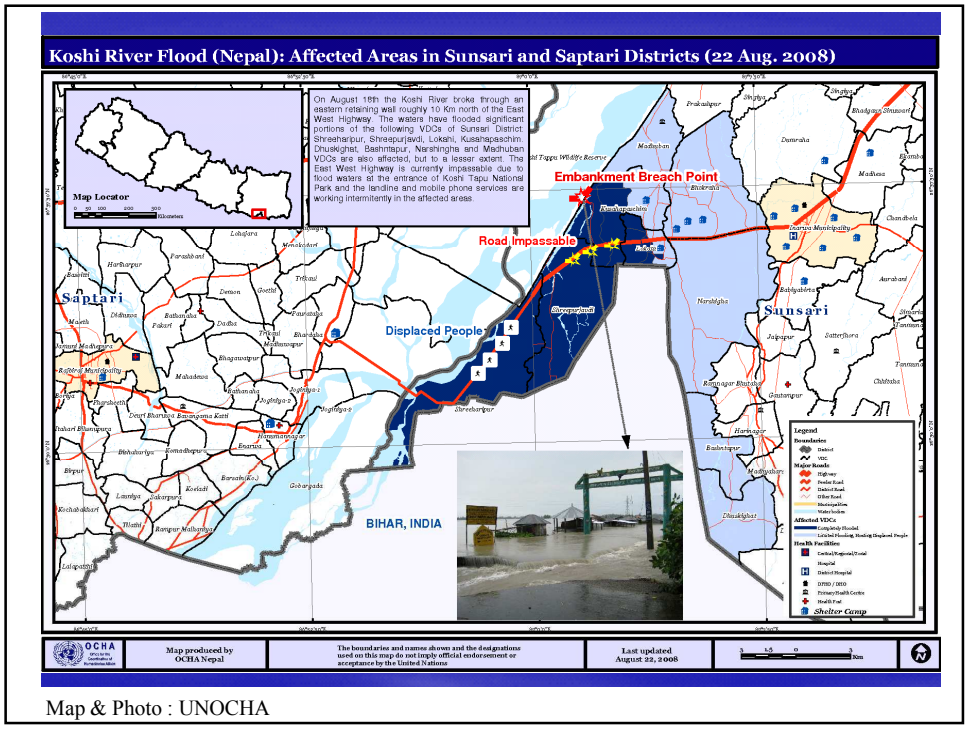
Schematic View of Koshi River & Flooded Area



Schematic View Courtesy : Ajaya Dixit


Embankment
Spurs
Koshi River

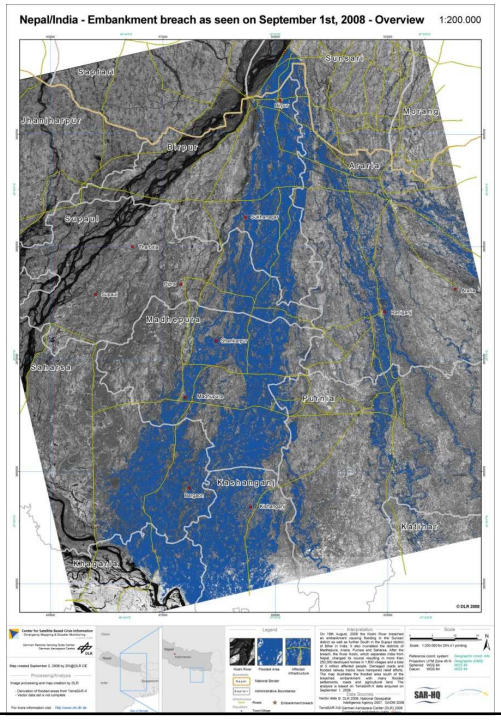

Koshi Flood (August 2008)
85 % Flow
Breached Embankment
15 % Flow
Discharge at Koshi Barrage (Cusec)
Discharge (Cusec)
180000
160000
140000
120000
100000
80000
60000
40000
20000
0
168850
26000
Before Breach
After Breach
Photo Courtesy : Basistha Raj Adhikari,
SDE, DWIDP, Nepal



Map & Photo : UNOCHA


Breached
Embankment


Dry Barrage



Map: German Aerospace Centre (DLR)

Disaster Scenario

Country	Nepal	India
Affected People	107,200	30,65,000
Affected	8 VDC of Sunsari District	1704 villages of 16 district
Displaced People/ Family	56752 / 7995	1,14,278/NA
Rescued	5500	3.78.826 evacuated
Rescued By	3 Helicopters, 10 rafting boats, 3 ordinary boats, 4 elephants etc	2036 boats (Other NA)
Human Casuality (During/ After Disaster)	1/7	7/47
Relief Camps	28	182
Human sufferings	Cholera, diarrhea, pneumonia, eye conjunctivitis, fever etc.	6 mobile health team,158 Health centre established (Other about sufferings NA)
Affected Animals	55000	NA except 96 cattle camps about 6764 animals have been treated.
Displaced Animals	20000	
Animal Casuality	14571	
Damage	Agricultural land, Infrastructures, 2/3 of Houses of the area, Road Network, Irrigation System, Telecommunications, Transmission line, Wildlife Reserved Area	2,83,797 Houses damaged (Other information NA)

Data Source: MoHA, Nepal & MoHA, India

Daily life after disaster

Reasons of Koshi flood disaster

- Unequal Koshi project treaty.
- Rise of bed level (0.05m/year) due to excess sediment load.
- Concentration of flow towards eastern embankment and striking since last 8 years
- Lack of regular monitoring mechanism and maintenance activity.
- Over confidence about the strength of structures
- Yearly havoc about breaching, but not
- Problem of security at the site.
- Lack of good coordination between Nepal & India. Trend of blaming each other
- No proper emergency response activity
- Lack of nonstructural countermeasure works like rising of awareness, development of early warning system and flood hazard mapping.
- No experience about the extent of flood damage.

Conclusions

- Flood risk reduction is possible with rainfall runoff modeling, inundation analysis & FHM
- Effects of hazards can be tremendously minimized with an application of hazard mapping and early warning system.
- Present practice of flood hazard mapping is not reliable.
- Flood Hazard Maps developed by departments are not complete for dissemination.
- We should improve our policy & practice to develop hazard maps and early warning system considering it as a development activity (rather than humanitarian) with people's participation.
- Bilateral coordination and co-operation should be set up with neighboring country to solve transboundary water induced disasters problem.

Thank you for your kind attention

Additional

Flood Damage




Daily Activity



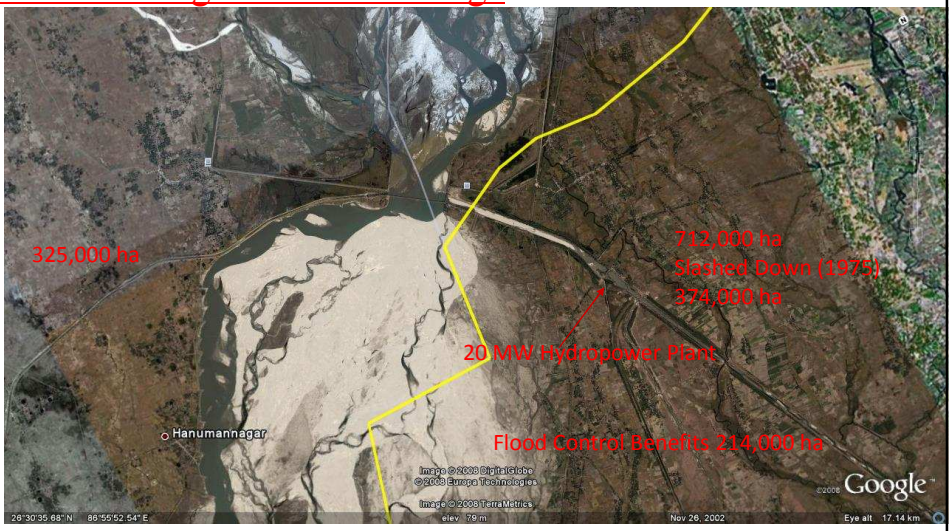

Evacuation

Damage of structures

Post Disaster Activity

Flooded Area

Satellite image of Koshi Barrage



Koshi Barrage

Koshi River Flooded Area

Embankment Breach Point