Information Sheet 14
Flood hazards in the Koshi River Basin

Introduction

Floods are a serious problem in the Koshi River basin and are often described as the **"**Sorrow of Bihar**"**. Water flowing from the seven tributaries in the upstream reaches of the Koshi river join together at a major confluence at Tribeni (above Chatara) before entering the Indo Gangetic plain and crossing into Bihar. Every year when stream flow increases during the monsoon season, floods wreak havoc in the downstream areas causing loss of life and damage to property.

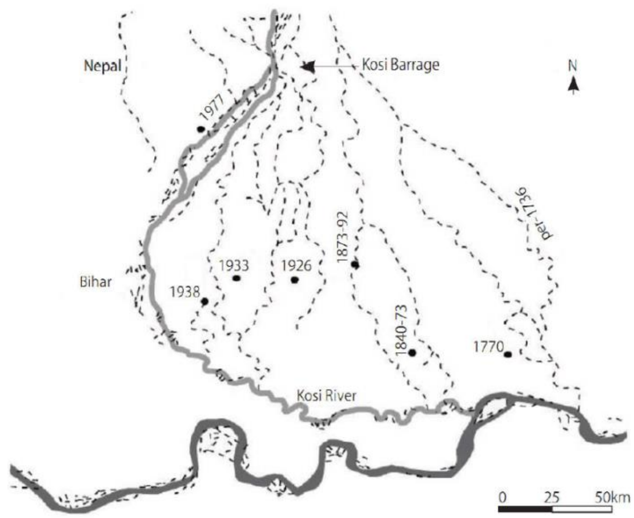


Figure 1: The historical movement of Koshi River stream channel

Source: Gole & Chitale, 1966

The Koshi river basin is also known for its exceptionally high sediment carrying capacity. The young and fragile geological conditions of the Himalayan region together with the high intensity rainfall during the monsoon lead to a high erosion rate in the mountains and subsequent high sediment load in streamflow. The high flow and sediment load also lead to extensive river cutting and bank erosion causing the river to shift and meander. Sediment eroded from the mountains upstream is transported downstream and deposited in the plains and valleys, much of it across the river profile near Chatara. Over time the river's main channel has aggraded as sediment is deposited causing the river to shift its course. The alluvial fan of the Koshi River illustrates the dynamic nature of the river's channel over the past 220 years (Figure 1), during which the river has shifted westward by about 115 km across northern Bihar in India. (Gole and Chitale, 1966; Thakur and Tamrakar, 2001).

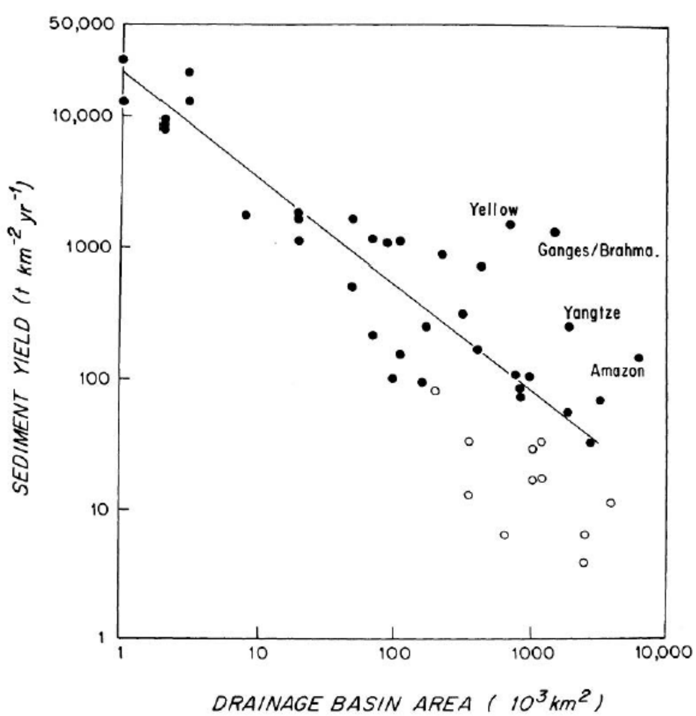
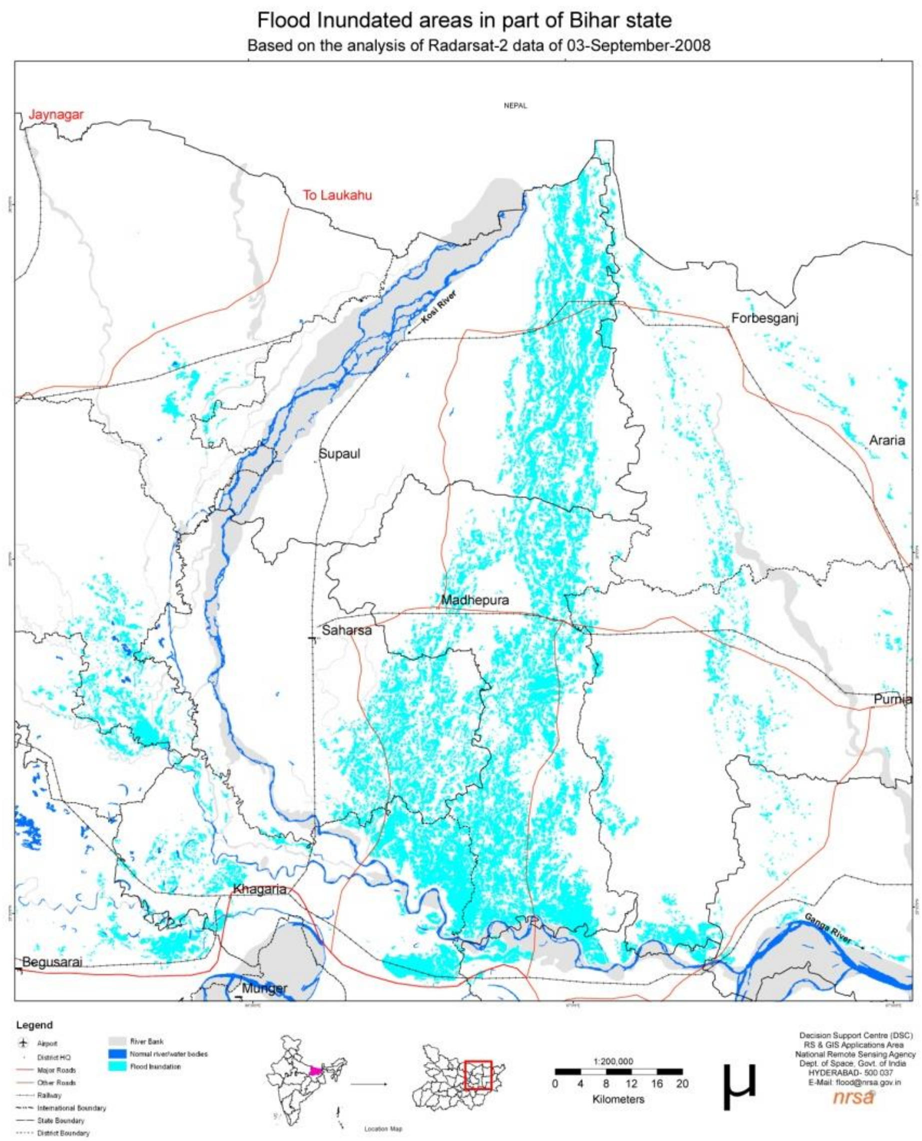


Figure 2: Comparison of sediment yield of major river basins. Koshi represents 8.5% of the Ganges basin area.

Nearly 135 million tonnes of sediment are transported from the Koshi river basin each year (Sharma, 1997). The specific sediment yield is reported to be around 2,500 tonnes/km$_2$/year (equivalent to 25 t/ha), which is very high compared to other river systems: the Ganges transports 491 tonnes/km$_2$/year, the Brahmaputra 578 tonnes/km$_2$/year, the Amazon 207 tonnes/km$_2$/year, and the Nile 40 tonnes/km$_2$/year (Alford, 1992; Mool, Bajracharya, and Joshi 2001; Sharma, 1997). Figure 2 shows the sediment yield and drainage basin area of major sediment discharge rivers (greater than 10 million t/year). The natural process of sediment transport can create problems in conjunction with anthropogenic activities when rivers erode lands and wash away crops, with serious implications for local livelihoods (Nepal, 2012).



Koshi embankment breach in 2008

On 18 August 2008, the eastern embankment of the Koshi river breached at Kushaha, 12 km upstream of the barrage. After the breach, most of the monsoon discharge and sediment load started flowing along a new path believed to be the same path the river had followed 80 years earlier. This area in Sunsari district in Nepal and Sahrsa, Supaul, Araria, Madhepura, Khagaria, and Purnia districts in India, was dominated by agricultural land, settlements, and infrastructure. The river flowed through the older abandoned channel for nearly five months, inundating the East-West Highway in Nepal and many settlements and areas of agricultural land in Nepal and India. The breach and subsequent floods caused unexpected devastation and heavy damage, including the deaths of 235 people and 787 livestock. A population of 4.8 million was affected, 322,169 houses were destroyed and more than 338,000 ha of agricultural land was damaged (Mishra, 2008; Sinha, 2009).

The river was diverted back to its normal course on 26 January 2009 after the embankment was restored (Shinha, 2009). A huge amount of sand and sediment was deposited on fields and in irrigation channels and drainage ditches. In Nepal, the area immediately below the breach is still filled with sand and sediment and agricultural production has not yet resumed (Figure 2)

According to data from the DHM in Nepal, the river discharge at Chatara at the time of the embankment breach was 4270 m3/sec (Figure 3), which is slightly higher than the long-term average for August (1985–2010). The maximum discharge recorded at the Chatara gauging station between 1985 and 2010 was 9610 m3/sec on 11 August 1987.

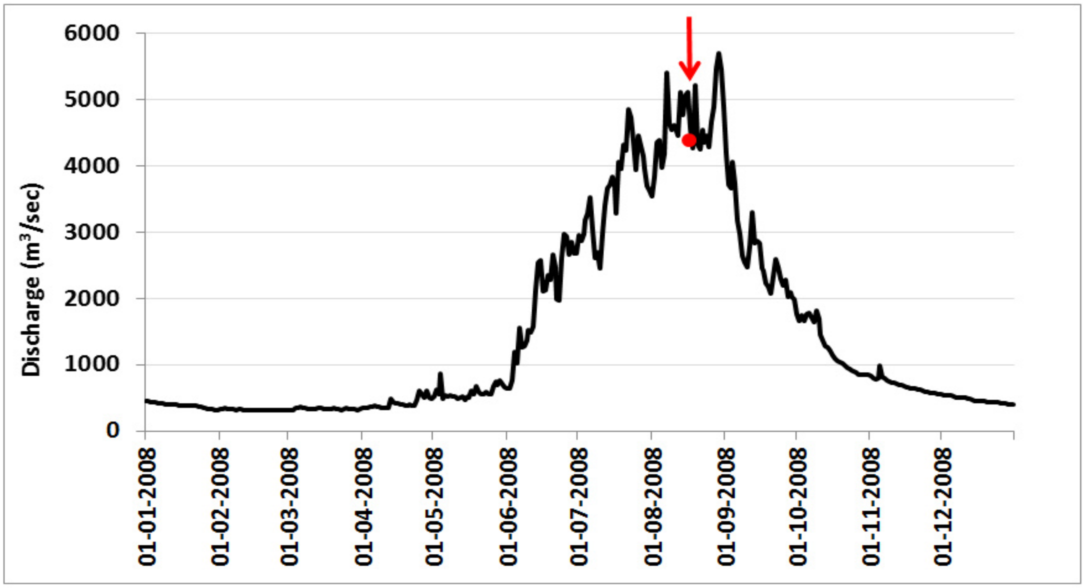


Figure 3: HYDROGRAPH OF THE KOSHI RIVER BASIN IN 2008 INDICATING FLOW (RED DOT) AT THE TIME OF THE EMBANKMENT BREACH (4270 M3/SEC). DATA SOURCE: DHM, NEPAL

Had the embankment breach occurred during such a high peak, one can only imagine the scale of the disaster. According to Dixit (2009), the breach and related flood were not the result of the larger context within which the embankment was conceptualized, built, and maintained. Dixit (2009) has discussed the possible causes of the breach extensively, they can be summarized as inappropriate technology for a high-sediment river, poor management of the embankment infrastructure, lack of a warning mechanism, institutional dysfunction, and government deficit and poor capacity to respond to the humanitarian crisis.

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