Understanding Kosi River

During the last two centuries, for which records are available, the river has changed its course in a westerly direction and it has laterally moved nearly 150 kilometers. The movement of the river has not been gradual but of avulsive nature (sudden change in river course) originating from a nodal point (Picture). The average avulsion frequency has been recorded as 24 years which is among the lowest in the world compared to 1400 years for the Mississippi river. A number of paleochannels on the satellite image of the Kosi basin testify the migratory behaviour of the river (figure on the right, Figure 1 and Figure2). The river is typically braided in nature and has formed a very large alluvial fan due to a large sediment supply from the Himalaya and a generally aggradational regime. Further complications arise due to (a) very high rainfall in the catchment (1200-2000 mm in most part and (b) high seismicity in the hinterland causing landslides and large sediment production which eventually fill up the basin.

The Kosi River has laid waste large fertile tracts during frequent migrations and has caused extensive damage through overbank flooding and inundation. For this reason, it is often called "Sorrow of Bihar**"**.

Describing Kosi's destructive power, the British administrator, and the author of the Imperial Gazetteer of India, L.S.S O'Malley, wrote in 1913:

> *"Sweeping down from the hills, it brings with it volumes of sand, which it heaps over the surfaceof the country, destroying the productive power of the land, choking the wells, and driving the villagers from their homesteads…. and changing the whole face of the country from a fruitful landscape to a wilderness of sand and swamp."*

Its fury comes from the fact that the place where river meets ground(gangetic plain) from Nepal foothills is quite narrow (only 5 to 8 KMs wide) and steep (vertical) (as shown Figure 3). Enormous amounts of water, laden with silt, sand and *kankar* brought down from the Himalaya passes through such narrow and steep range and this provides the river with all the velocity and power to become the sorrow of Bihar.

Initial suggestions for flood control for the Kosi river during late 19th century included construction of marginal embankments, high dam at upstream section, river training in lower reaches and a series of barrages and canals. However, no consensus was reached and no definitive action could be taken until 1953. A very severe flood in 1953-54 and the subsequent social and political pressure led to the first serious attempts towards flood control in the Kosi basin and the formulation of the 'Kosi project' in 1954. This project was primarily aimed at flood control and to provide irrigation for increasing agricultural productivity. The project started in 1959 and the river was diverted through the barrage in 1963. The embankments on both sides have been designed to protect ~2800 km^2 of land in north Bihar and Nepal. Although the embankments have checked the lateral movements of the Kosi, the flooding problem continues in the Kosi basin and the objectives envisaged in the Kosi project have been only partially met. Several large floods and frequent breaches in the embankments have continued to occur in the region. In addition, several adverse effects of the Kosi project have been noted viz. drainage congestion and waterlogging, rise of river bed level, and reduction in crop productivity due to reduced silt flux on the floodplains.

The Kosi river basin

The Kosi, known as Kaushiki in Sanskrit books, is one of the most ancient rivers of India. It rises in the Himalaya and drains the foothills to the east of Kathmandu and to the west of Kanchenjunga in Nepal. It has seven tributaries within the Himalaya, the Sun Kosi, the Tama Kosi or Tamba (copper) Kosi, the Dudh Kosi, the Indravati, the Likhu River, the Arun and the Tamur join together at a point ~10 km upstream of Barahkshetra and the combined channel debouches into the plains (figure 1 and figure 2). The Dudh Kosi joins the Sun Koshi at the Nepalese village of Harkapur. At Triveni Sun Kosi is joined by the Arun and the Tamar, after which the river is called the Sapta Kosi. At Barahkshetra in Nepal, it descends from the mountains and it is then called simply the Kosi (Figure 2). These tributaries encircle Mt Everest from all sides and are fed by the world's highest glaciers. Further down the Triveni, the river cuts a deep gorge across the lesser Himalayan range of Mahabharat Lekh in a length of 10 km and debouches into the plains near Chatra. After flowing for another 58 km, it enters the north Bihar plains near Bhimnagar and after another 260 km , flows into the Ganges near Kursela (Figure 2). The river travels a distance of 729 km from its source to the confluence with the Ganges.

Kosi system can be understood as an 'inland delta' built by large sediment flux which was also attributed to be the primary factor causing westward shifting of Kosi and extensive flooding. The dynamic nature of the Kosi River has attracted attention for over a century and a variety of mechanisms have been suggested ranging from tectonic tilting and nodal avulsions.

The braided channel of the Kosi river flows towards south west after debouching into the plains but takes a sharp turn towards south east and then flows parallel to the Ganga in its lowermost reaches before its final confluence with the Ganga surprisingly everytime at Kursela (Figure 2). The river is embanked on both sides; the left embankment, running close to the river, is continuous but the right bank is discontinuous particularly in the lower reaches around the confluence with the Ganga.

Flood risk of the Kosi flood plain area

The river breached its western constraining embankments near Kusaha village in Nepal on August 18, 2008 and flooded Madhepura, Supaul, Saharsa, Purnea and Araria districts in Bihar (Figure 3). The breach was nearly 2-3 KMs wide and suddenly started flowing from one its old paleochannels. Kosi is such a dynamic system that people living along its flood plains will always face this risk. Embankments don't offer a permanent solution to flood control. Bringing the river back to the original channel without controlling the sedimentation is not going to solve the problem entirely. Due to heavy sedimentation, the entire riverbed between the embankments has gone up, government has been constantly raising the height of the embankments. According to Professor Emeritus Brahm Prakash of IIT Roorkee, "We must acknowledge that this is not a solution as the riverbed is higher than the plains nearby. The water will always create heavy pressure on the embankments. These reparations are only postponing a bigger problem". The danger is that global warming might make the monsoons more erratic at the same time resulting in more concentrated periods of rains. Coupled with increased summer melting due to the accelerated decline of Himalayan glaciers, the situation will strain the capacity of embankments to hold the river back. It is a question of till what time we can avoid the failure of the next embankment. Although there have been much focus in the media and also concerns raised in the National Action Plan on Climate Change (18MB) about sea-level rise and coastal populations being displaced. But that as matter of fact the interior of the country will also see its share of water refugees as a result of climate and environmental change in the from of draughts and floods and other natural calamities.

In the past also population living in this flood plain has been constantly relocating themselves. Added with these challenges the population living under the risk of flood faces another challenge of dealing with corrupt and incompetent authorities (as it is clear from the events that are explined in figure 3 originally appeared in *India Today* a weekly news magazine of India. For full report on carelessness of the State by *India Today* click.

http://indiatoday.digitaltoday.in/index.php?option=com_content&task=view&id=14596&Itemid=1&issueid=72&limit=1&limitstart=0

Please visist http://zakku78.wordpress.com/ for comprehensive information of the JNSU's work on Bihar Flood.

Figure 1

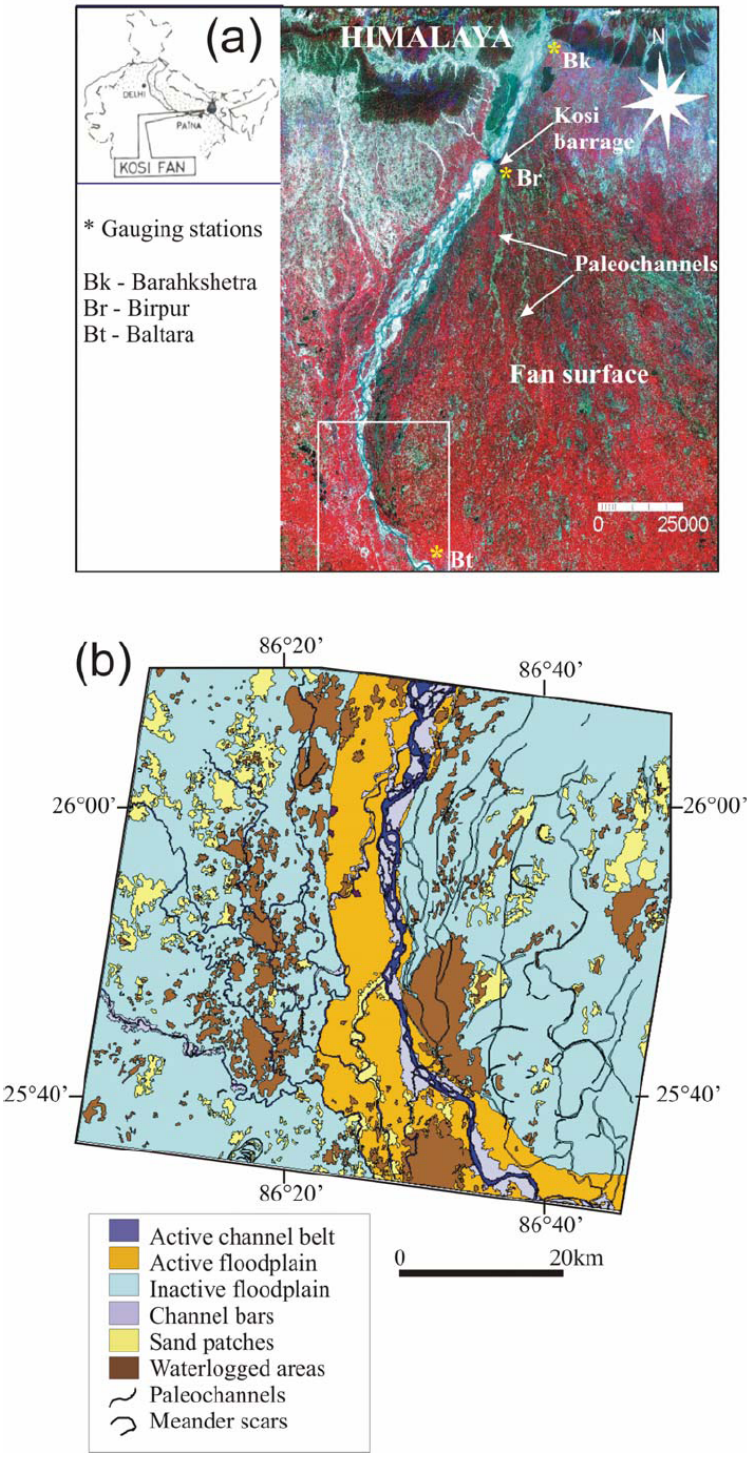

Figure 2

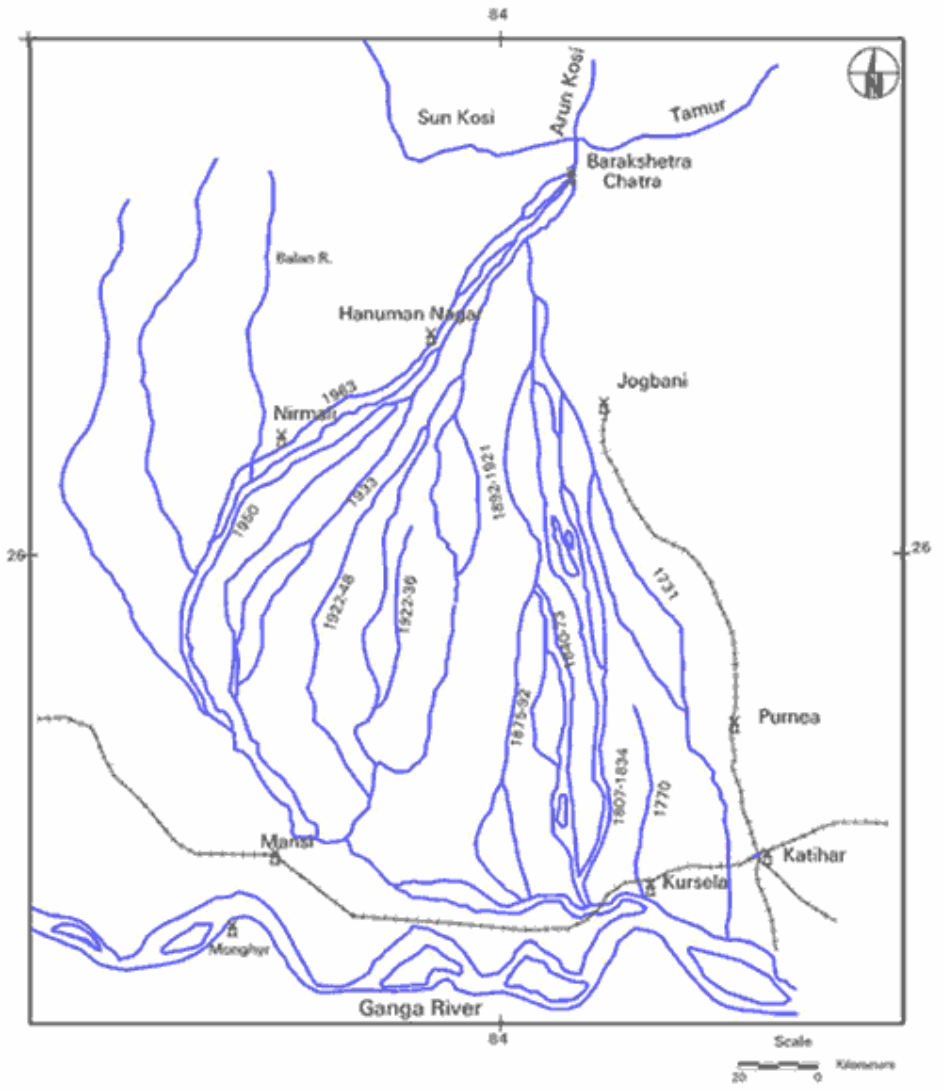
84
Sun Kosi
Arun Kosi
Tamur
Barakshetra
Chatra
Balan R.
Hanuman Nagar
Jogbani
Nirmali
1963
1950
1933
1922-48
1922-39
1892-1921
1875-92
1860-75
1807-1834
1770
1731
Purnea
Katihar
Kursela
Mansi
Monghyr
Ganga River
26
84
Scale
Kilometers
20
0

Figure 3


The Shocking FAILURE 1
THE STATE SIMPLY SLEPT
It was not a flash flood by a temperamental river but a story of delay and neglect compounded by embankments that had outlived their utility, which led to the disaster
1 AUGUST 5
River Kosi mounts pressure on the spurs at Kusaha, some 12 km upstream in Nepal and begins eroding embankments that ultimately suffer 1 km wide breach.
2 AUGUST 5
Bihar's Chief Engineer E. Satyanarayan stationed at Birpur first alerts state Government's Kosi project liaison officer in Kathmandu, Arun Kumar Singh. Singh on leave, no action taken.
3 AUGUST 9-16
With the situation worsening, Satyanarayan sends telegrams to 11 senior officials associated with flood water management in Patna, warning them against the imminent danger.
4 AUGUST 16
Nepali locals prevent contractor from repairing embankment. Engineers treat labour dispute with local workers as an attack by the Maoists.
5 AUGUST 17
The bulletin of the Bihar irrigation and flood control department claims that all the embankments are safe despite erosion starting.
6 AUGUST 18
Breach in eastern embankment of Kosi. More than 3.7 mn litres of water is discharged through the breach, flood situation steadily deteriorates, inundating hundreds of villages in northern and central Bihar districts.
7 AUGUST 19
Even as breach widens, State Irrigation Minister Bijendra Prasad Yadav (left) takes only routine steps and fails to alert the Centre. Sand bags not stocked in advance while 5 lakh cubic-ft boulders in stock lie unused.
NEPAL
KUSAHA
THE BREACH
West Champaran
Saran
Patna
Nalanda
Sheikhpura
Begusarai
Supaul
Saharsa
Araria
Purnia
Katihar
Bhagalpur
BIHAR
Normal course of river Kosi
Changed course of river Kosi after Aug 18
Area of Detail
INDIA
District
Bihar
Flood-hit area