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Impact of In-Bed and On-Bank Soil Cutting by Brick Fields on Moribund Deltaic Rivers: A Study of Nadia River in West Bengal

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Abstract

Soil and sand cutting from river banks and bed has become a major issue of environmental concern. Jalangi is one of the Nadia Rivers of the district of Nadia in West Bengal and classified as moribund river. Soil cutting by brick-fields from banks and bed of the river has transformed it into literally a dead river. Present paper, based on both primary as well as secondary data will focus on this greedy bustle of man on the river and its impact on deltaic moribund river channels.

Keywords: khadan, bank erosion, bank material, soil-cutting, river jalangi

Introduction

During British colonial rule, three rivers of moribund deltaic Bengal namely River Bhagirathi, River Mathabhanga and River Jalanti came to be known as Nadia Rivers (Majumder, 1978: Biswas 2001; Bagchi, 1978). River Jalangi, which has been the focus of the paper, is one of the distributaries of the River Padma which takes-off from at Jalangi, a settlement of the district of Murshidabad from which the river got its name during 18th century (Rennel, 1788; Bhattacharya, 1959; Biswas 2001; Chakraborty 1972). However, after leaving Padma at 24°04′30′′N and 88°43′00′′E, (Bhattacharya, 1963; James Fergusson, 1912; Majaumder, 1941, 1978, 1985) River Jalangi pursues a meandering course along the north-west border of Nadia district for 90.5 km, up to Gopinathpur and Sahebnagar villages of P.S.Tehatta-I and P.S.Tehatta-II respectively. Then onwards it follows a tortuous course in a southerly direction until it reaches Krishnagar, chief town of the district of Nadia,

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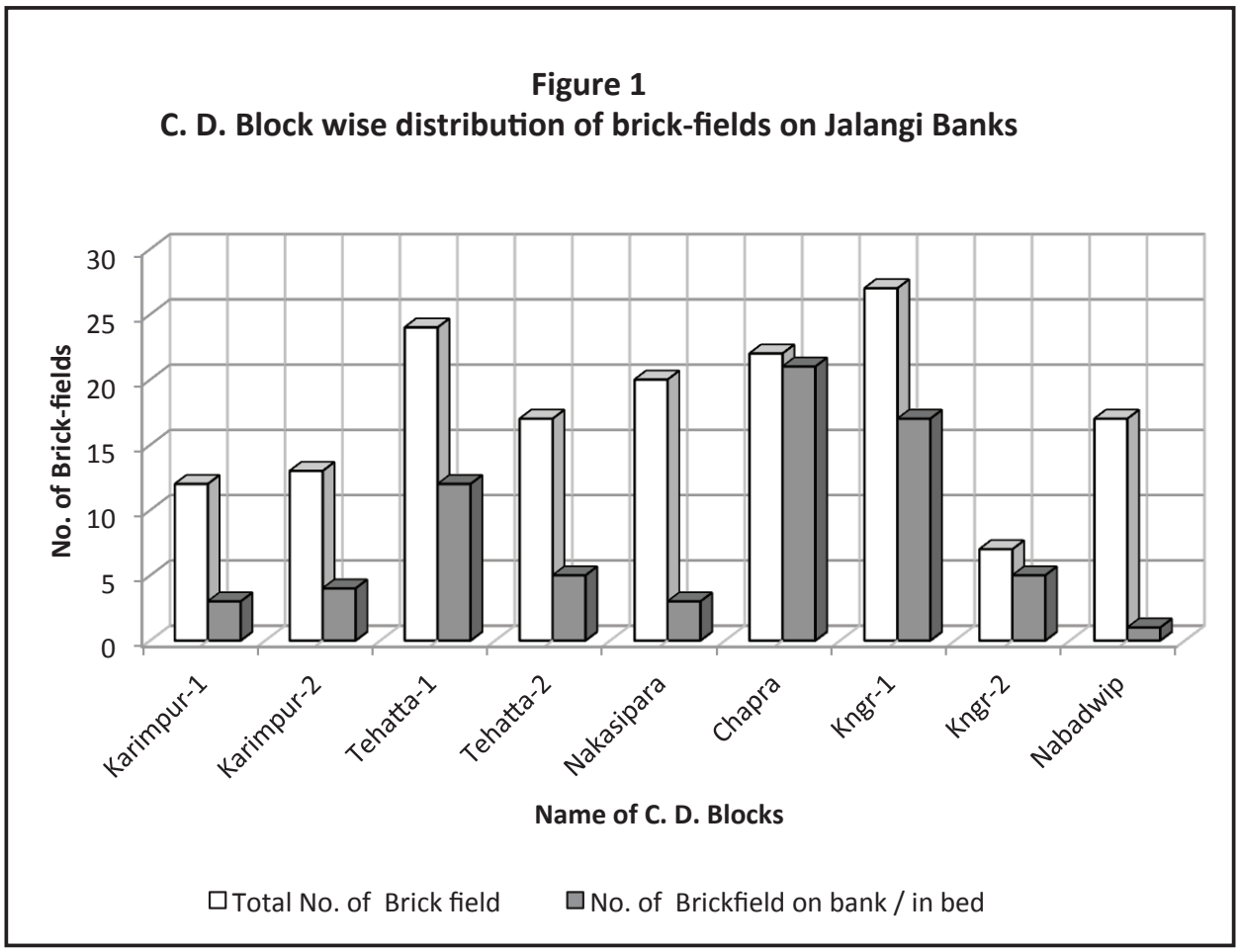
from which the river proceeds due west and after a total course of 220.5 km, debouches into the river Bhagirathi at Swarupganj, opposite the town of Nabadwip (*Choudhury, 2004, 2004a)*, in 23°29′23′′N and 88°28′57′′ E. The united flow of Jalangi and Bhagirathi is named as River Hooghly. Out of total course of 220.5 km, 90.5 km is along the border of Nadia and Murshidabad district, and rest 130 km through the Nadia district on left and right banks. That is why, unlike two other Nadia rivers, Jalangi is 'Nadia River' in true sense. Rest reach is deteriorating at a very faster rate owing to the severe human interference with the natural regime of the river. Under natural conditions, a river seeks to establish a channel morphology, which is well adjusted to its channel morphology that will allow it to carry its discharges and load with least effort and minimum resistance (Ben Chie Yen and F.ASCE, 2002; John D. Fenton, 2010). By changing the surface of the watershed, man may affect the hydrological cycle and thus sediment yield (Newson and Leeks, 1987). He may also directly change hydrologic and morphologic characteristics of a river by channeling, dredging or damming it (Sear, 1995, Kondolf, 1997).

Soil cutting from bank and bed by brick-fields is one of the most triggering human activities affecting the river. This illegal practice causes bank erosion leading to loss of property and life. It also multiplies silt charge (Moscrip and Montogomery, 1997) and consequently the river becomes shallow and deteriorates rapidly (Collier et al, 1996). Given the context, the paper seeks to focus on reckless soil and sand cutting from banks and beds of River Jalangi and assess the impact of those soil and sand cutting from banks and beds on the channel morphology and inhabitants on the banks of the river.

Materials and Methods

Materials for the present study is River Jalangi itself over which a prolonged survey has been carried out during the period 2007 to 2012 to get detailed information of its morphological and hydrological regimes and soil cut by brick-fields along the river.



Source: - Field Survey from 2007 to 2011 and data from D.L. & L.R.O., Government of West Bengal, Krishnagar.

For this study, information on 159 brick-fields of 9 C. D. Blocks along River Jalangi is collected from District Land and Land Reform Officer (D.L. & L.R.O.), Nadia (Figure 1). Information about impact of soil and sand cutting from banks and beds on the channel morphology and inhabitants on the banks has been collected in terms of bank erosion and other property loss. To obtain numerical result of impact of soil cutting on river bank erosion, simple bi-variant correlation co-efficient has been derived with the help of New Microsoft Office Excel Worksheet, 2007.

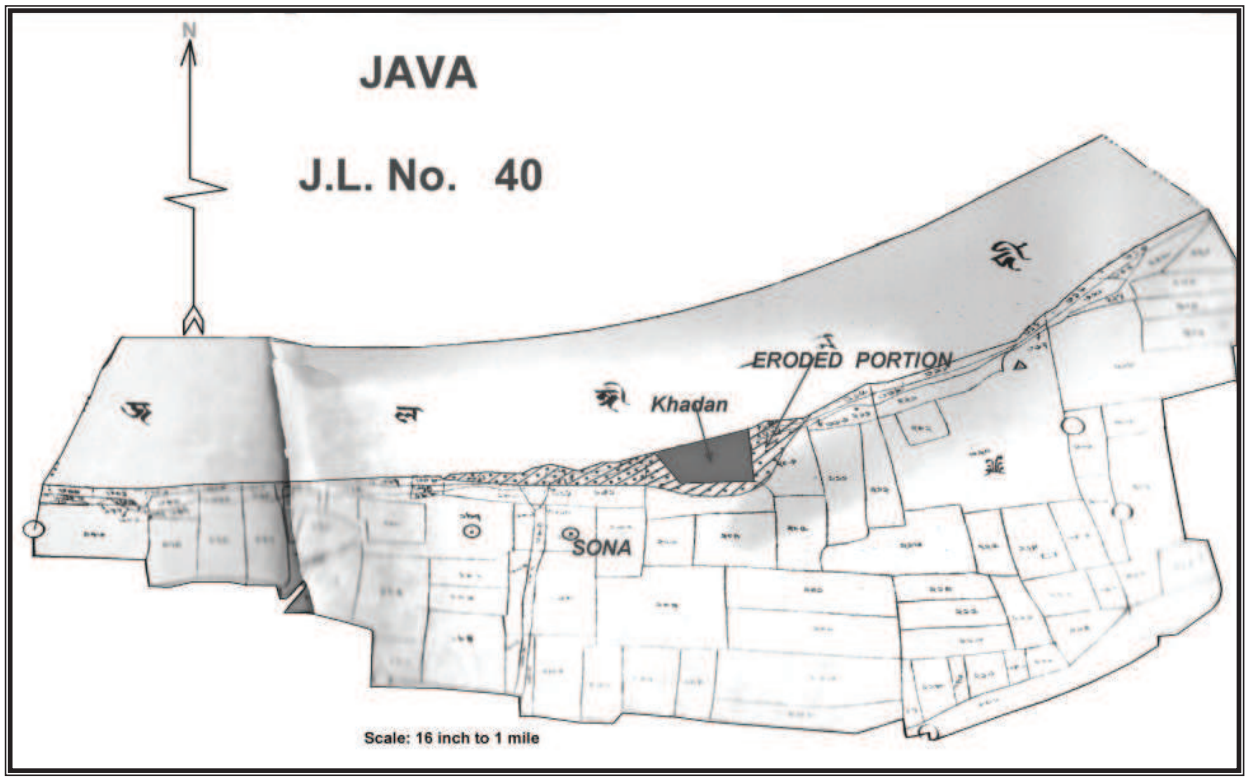
Findings of the Study

Soil Cutting from Banks

It was found that out of 17 C. D. Blocks of the district of Nadia, 9 C. D. Blocks are along the course of River Jalangi within which there are a total

of 159 brick-fields. Out of this total number, 71 (44.65 %) are on Jalangi banks or in bed. As per government record, 159 brick-fields cut 19835669 cft soils per year. 71 brick-fields cut 9559995 cft of soils per year out of which 2867999 cft (30%) soils are cut from banks and bed of River Jalangi. Soil cutting from river banks is a problem exclusively related to the brick-field. Most of the brick-fields are on the higher concave bank of meander and the owners make Khadan (pond like water body attached to the river by cutting soil on bank) to trap silt in those Khadan during floods. But these Khadans becomes further extended by attack of current on concave bank (Simon and Downs, 1995; Sear et al 1995) causing gradual shifting of the river (Fig. 2).

Figure 2
Map showing effect of soil cutting on bank erosion



Source:- Field Survey from 2007-2011, Cadastral Map, and data from D.L. & L.R.O., Government of West Bengal, Krishnagar.

Soil Cutting from Bed

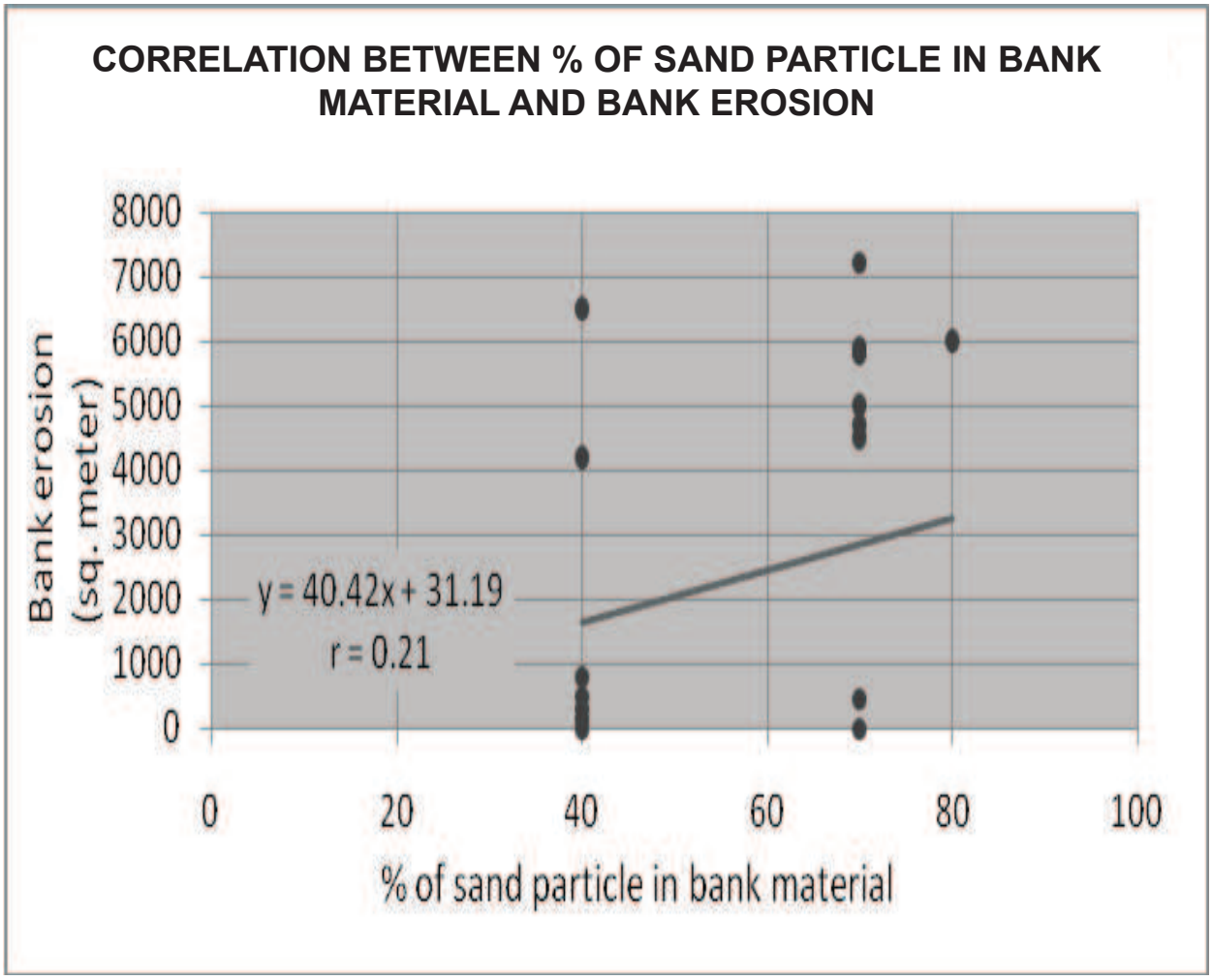
In bed soil, cutting is not so much influential to bank erosion and aerial changes in the course of River Jalangi. It might be disturbing the hydro

Table 1
Impact of Bank Erosion on Villages on Banks of River Jalangi

Block	Name of villages	Impact	Remarks
Karimpur-II	Fazilnagar	Mouza is under bank erosion but not the settlement.	
	Taranipur	Do. Part of the village is eroded. Old Krishnagar- Tehatta road has gone into the river 60 years back. Present one was also under threat. Neighboring Islampur village shifted form of Muslim Para from Taranipur which again threatened by erosion during 2003	Protective measure against road erosion was taken by I.W.W.D. Nadia. River transport is totally stopped.
	Gopinathpur	Mouza is under bank erosion but not the settlement.	
	Raninagar	No significant impact	Raninagar – Palasipara River transport is confined to rainy season only.
Tehatta -II	Chanderghat	About 12-15 m from the southern side of the village is eroded during last 50 years	
Nakasipara	Sibpur	Mouza is under bank erosion but not the settlement.	
	Radhanagar	About 30 m from the southern side of the village is eroded during last 50 years. 8 houses are partly swallowed, 3 totally gone.	Protective measure of stone guard wall was taken by I.W.W.D. Nadia.
Chapra	Bara Andulia	About 10 m from the western side of the village is eroded during last 50 years	
	Mahatpur	No significant impact except indirect effect of deterioration. During dry season , villagers need no boat to cross the river.	
Krishnagar-II	Srikrishnapur	Mouza is under bank erosion but not the settlement. Srikrishnapur-Panditpur road has totally gone into the river.	
	Panditpur	8 houses are totally swallowed and 13 are partly swallowed during last 50 years. Purba Para has been almost encircled by the river to be isolated from rest of the village	
Krishnagar-I	Ruipukur	About 10 m from the north side of the village Shambhunagar is eroded during last 50 years	Protective measure of stone guard wall of 1100 m was taken in 2007-8 by I.W.W.D. Nadia.

dynamic stability of the river locally (Gailot and Piegy, 1999) and must have some long term effect on changes in river course, but it has no immediate or short term impact on bank erosion. This practice of soil cutting from river bed may be a substitute of dredging for keeping the river lively (Knighton, 1989). Yet the brick-industry owner should cut soil from river bed provided it is permitted by government authority and prescribed by river scientists and engineers.

Figure 3



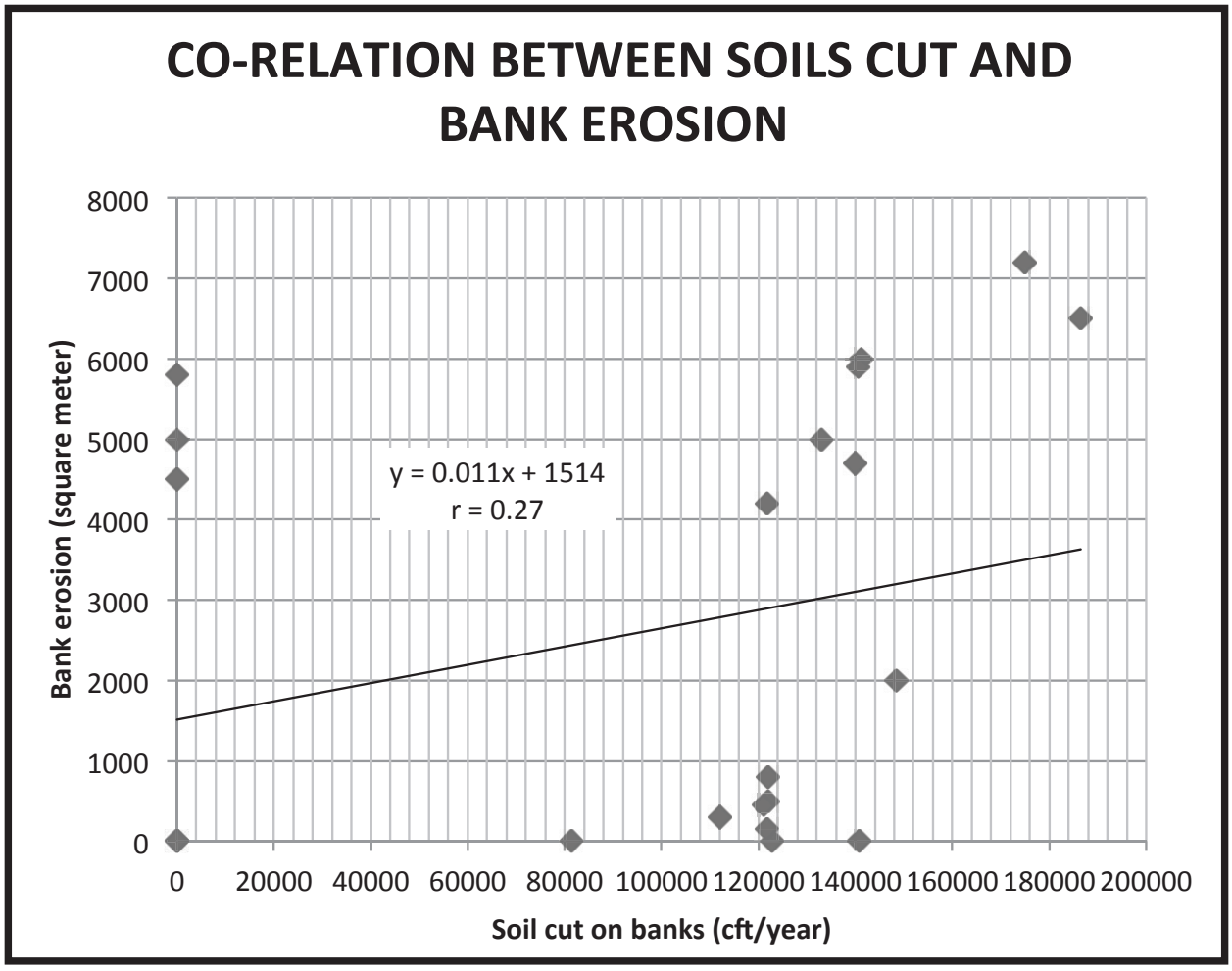
Source:- 1. Field survey and 2. Action Plan 2000-2001, Principal Agricultural Office, Nadia District, Krishnagar, West Bengal, p- 13, 26.

Impact of Soil Cutting

On Channel Morphology

On-bank soil cutting is a crucial problem of the day. To meet the ever expanding need for bricks, more and more brick-fields are being mushroomed rapidly and cutting soils from banks. As a result, river width is being enlarged (James, 1991) engulfing valuable fertile lands. Eroded materials from banks get deposited on opposite bank with gradual shift of the channel. Downstream of the reach may experience formation of bar due to deposition of soil carried from eroded bank of upstream. Soil cutting also enhances the processes of meandering of the channel.

Figure 4



Source:- 1. Field survey and 2. Action Plan 2000-2001, Principal Agricultural Office, Nadia District, Krishnagar, West Bengal, pp. 13, 26.

On Inhabitants on Banks (settlement, land loss)

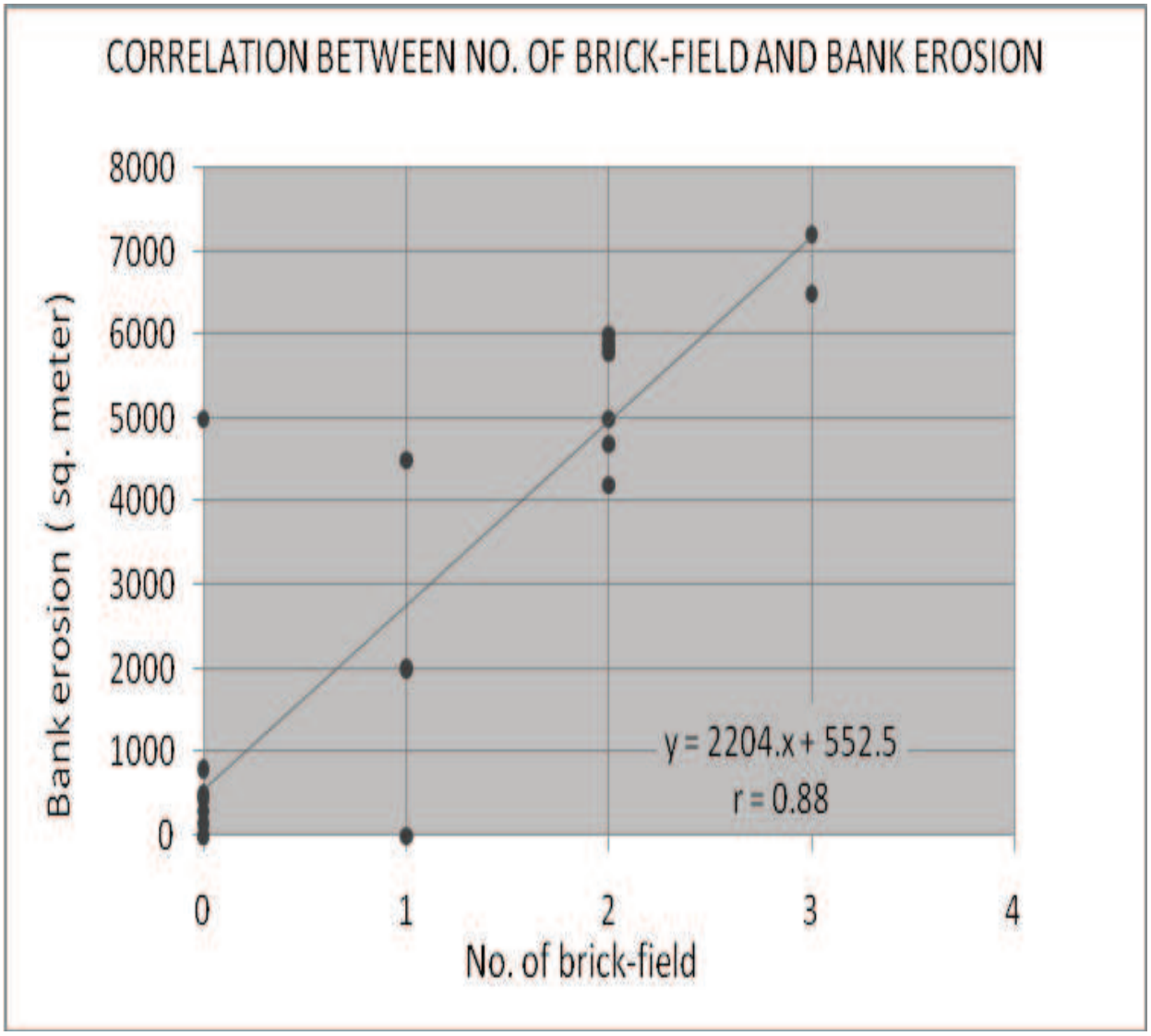
Soil-cutting leads to bank erosion which in turn affects human life through land-loss and property loss. The effect of bank erosion on different villages on Jalangi banks is given below (Table 1).

Discussion

The natural phenomenon of bank erosion is aggravated by anthropogenic activity (Knighton, 1989) in terms of soil cutting from banks and bed. For bank erosion, the soil cutting from river banks and river bed is more powerful factor than that of distribution of particle size of bank material.

Correlation between % of silt particle distribution in bank material and area of eroded-bank is negative and the correlation– coefficient is - 0.14. The correlation between % of clay particle distribution in bank material and area of bank erosion is more negative and the correlation–coefficient is - 0.21. Only the % of sand particle distribution in bank material controls the magnitude of erosion of bank of River Jalangi. There is a direct but very negligible correlation (r = 0.21) between percentage of sand particle of bank materials and bank erosion (Figure 3).

Figure 5



Source:- 1. Field survey and 2. Action Plan 2000-2001, Principal Agricultural Office, Nadia District, Krishnagar, West Bengal, pp. 13, 26.

On the other hand correlation between soil-cut from banks and bed and area of eroded-banks are slightly positive having the value 0.27

(Figure 4) slightly higher than the correlation (r) between percentage of sand particle of bank materials and bank erosion (0.21).

But as the data regarding amount of soil cut was collected from D.L. and L.R.O. office, there is an ample scope of false information. An official said that as revenue to be paid to the government is proportional to the amount of soil cut, owners of brick-field often report much less amount of soil cut by them. The fact is revealed in the correlation (r) between number of brick-fields on river banks and bank erosion. It is strongly positive (r = 0.88) which implies that data about amount of soil-cut by brick-fields supplied by owners of brick-fields are false (Figure 5). Moreover there is a strong control of soil cutting by brick–fields from banks over bank erosion.

The correlation between number of brick-fields on river banks and bank erosion is 4.20 times stronger than the correlation between percentage of sand particle of bank materials and bank erosion. Therefore, the anthropogenic factor for the bank erosion or change and deterioration of the course of River Jalangi is far greater than the natural cause of sand particle distribution in bank material.

Conclusion and Recommendations

From the study it can be concluded that, in–bed and on–bank soil cutting by brick fields triggers the processes of bank erosion and in turn the channel form. This reckless practice of soil cutting from banks and consequent bank erosion multiplies silt charge of the river and get deposited in bed. This makes the river shallow but wide with larger channel form-ratio (Richard,1982; Knighton, 1984, 1998). However for the sake of long active life of rivers which are crucial for the very existence of man, reckless practice of soil cutting from banks and bed should be checked.

References

Bagchi, K. (1978), *Diagnostic Survey Of Deltaic West Bengal, A Research and Development Project*, Department Of Geography, Calcutta University, p. 17.

Ben Chie Yen and F.ASCE (2002), “Open Channel Flow Resistance, Abstract”, *Journal of Hydraulic Engineering*, Vol. 128, No. 1, January.

Bhattacharya, K., (1959), *Bangladesher Nadnadi O Parikalapana* (in Bengali), Vidyadaya Lib. Pvt. Ltd., Calcutta, p. 13.

Bhattacharya, N. D. (1963), "Changing Course of the Padma and Human Settlements", *National Geographical Journal of India*, Vol.14, No.1 and 2, pp. 62-76.

Bhattacharya, T., (2003), *Sampadak Samipesu, Ananda Bazar Patrika*, 18.2.03.

Biswas K.R. (2001), *Rivers of Bengal*, Vol. I, Government of West Bengal, pp. xviii, xxix, 87, plate-18 and 19.

Chakraborty K. (1972), "Land use in relation to fluvial ecology in the Bhagirathi-Jalangi riparian tract : Nadia District, The Bhagirathi – Hooghly Basin", *Proceedings of the Inter-disciplinary Symposium*, edited by K. G. Bagchi, pp. 239-245

Choudhury. J (2004), Sri Chaitanyadev O Samakalin Nabadwip (in Bengali), Puratatva Parisad, Nabadwip, pp. 5-15.

Choudhury. J (2004a), *Yugasrosta Sri Chaitanya*, Nadadwip Puratattwa Parisad, pp. 4-9.

Collier, M. Webb, R. H. and Schmidt, J. C. (1996), "Dams and Rivers, Primer on the Downstream Effects of Dam", *US Geological Survey*, circular 1126, Tucson Arizona, p. 94.

Gailot, S. and Piegy, H. (1999), "Impact of gravel mining on stream channel and coastal sediment supply: Example of the Clavi bay in Corsica (France)", *Journal of Coastal Research*, 15 (3), pp. 774-788.

Hirst, Major F.C. (1916), "Report on the Nadia Rivers 1915", in Biswas K.R. (2001), *Rivers of Bengal, Vol-III*, Government of West Bengal, pp. 108-113.

James Fergusson, F.R.S. (1912), "On Recent Changes in the Delta of Ganges", Bengal Secretariat Press, Reprinted from the *Quarterly Journal of the Geological Society of London*, Vol. XIX, 1863, p. 184.

James, L. A. (1991), "Incision and Morphologic Evolution of an Alluvial Channel Recovering from Hydraulic Mining Sediment", *Bulletin of Geological Society of America*, 103, 723-36.

John D. Fenton (2010), "Calculating Resistance to Flow in Open Channels", *Alternative Hydraulics,* 5 April.

Knighton, A.D., (1984), "Indices of Flow Asymmetry in Natural Streams: Definition and Performance, *Journal of Hydrology*, 73:1-19.

Knighton, A.D., (1989), "River Adjustment to Changes in Sediment Load: The Effect of Tin Mining on the Ringarooma River, Tasmania, 1875-1984", *Earth Surface Processes and Landforms*, 14, pp. 333-359.

Kondolf, G. M. (1997), Hungry Water: Effects of Dams and Gravel Mining on River Channel, *Environmental Management*, 21, pp. 533-551.

Majaumder. S (1985), Sri Chaitanya Janasthan Bitarka, Tar Truti O Samadhan (in Bengali), p. 26.

Majumder S. C. (1941), "Rivers of the Bengal Delta" in Biswas K.R. ed. (2001), *Rivers of Bengal,* Department of Higher Education, Government of West Bengal, pp. 17, 18, 54.

Majumder, D. (1978), *West Bengal District Gazetters Nadia*., Government of West Bengal, pp. 5,7,16.

Moscrip and Montogomary (1997), "Urbanization, Flood Frequency and Salmon Abundance in Puget Lowland Streams", *Journal of the American Water Resources Association*, 33, pp. 1289-1297.

Newson, M. D. and Leeks, G. J. L. (1987), Transport processes at the Catchment scale - A Regional Study of Increasing Sediment Yields and its Effect in Mid-Wales, UK", in Thorne, C. R. Bathurst, J. C. and Hey, R. D. eds, *Sediment Transport in Gravell bed Rivers*, Chichester, UK, John Wiley and Sons, pp-187-223.

Rennel l (1788), *Memoir of a Map of Hindoostan or Mughal Empire*, London. pp. 127, 182, 255, 278, 281.

Richards, K. (1982), Rivers Form and Process in Alluvial Channels, Methuen & Co, New York, p. 11.

Sear, D. A. (1995), "The Effects of 10 years River Regulation for Hydropower on the Morphology and Sedimentology of a Gravel-bed River", *Regulated Rivers: Research and Management*, 10, pp. 247-264.

Simon, A. and Downs, P. W. (1995), "An Interdisciplinary Approach to Evaluation of Potential Instability in Alluvial Channels", *Geomorphology*, 12, pp. 215-232.

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