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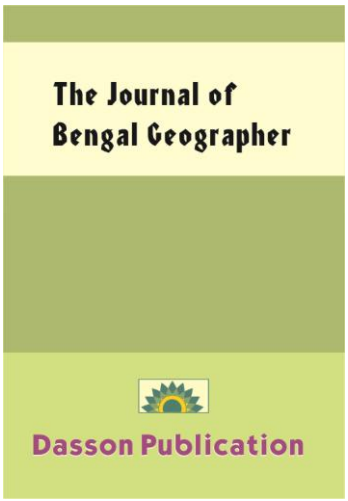

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Soil degradation and conservation of Chopra block- a case study of Uttar Dinajpur district, West Bengal

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Abstract

Erosion is a comprehensive natural process of detachment and removal of loosened rock materials and soils by exogenetic processes such as running water, ground water, sea waves, wind, glacier. In fact the damage and degradation caused to the soil due to compactness, smearing, excessive working etc. through human activities is called "Soil Degradation``. Chopra block of Uttar Dinajpur is densely populated agricultural area. It is situated in high rainfall zone including many rivers following from north to south direction. All the rivers have their origin from the Darjeeling Himalayas. Thus water volume and velocity of the rivers became high during rainy season. So in this study area stream erosion in the main cause of soil erosion. This study shows the present status of denuded soil of Chopra block and discusses the factors which are responsible for this erosion and also focuses on the efficient and scientific conservation measures which are applied to that area to check soil erosion for further improvement in soil fertility of Chopra block.

Key words: *1.Topography, 2.Land, 3.Soil properties, 4.factors of soil erosion, 5.soil conservation measures, 6.suggested remedial measures.*

Objectives: The main objective of this study is –

- To analyse the present condition of denuded soil
- To find out the main factors which are responsible for soil erosion of that area.
- What methods are taken to check soil erosion and further improvement in soil fertility in different parts of the area.

Methodology: The whole information and data have been collected from Chopra Block Development Office, Chopra Agriculture Office and District Census Handbook (2001) Secondary data collected from irrigation and agri-irrigation office of Islampur and Agriculture office of Chopra block. Few books have been studied for preparation of paper.

Study area: Chopra block is the middle area between Uttar Dinajpur and Darjeeling District. It is the most important block of Islampur sub –division. It is situated in between 26° 24'N to 26 .4 °N latitudinal extension and 88° 18'E to 88.3 ° E longitudinal extension. The northern part is formed by Darjeeling District, the eastern and north-eastern part is Bangladesh, the western part is Bihar and the southern part is Islampur.

Chopra block covers an area of 378.40 sq.km. It has 8 gram panchayats, 119 mouzas and 47 villages. River Mahananda, Kartoa, Nagor is situated in the northern boundary, eastern boundary and southern boundary respectively.

Chopra has surprising boundaries. It is bounded by Darjeeling in the north, Kishanganj district of Bihar in the west, Islampur block in the south and Panchgara district of Bangladesh in the east.

Introduction

Erosion is the process by which soil and rock are removed from the earth's surface by exogenetic process. While erosion is a natural process, human activities have increased by 10 - 40 times the rate at which erosion is occurring globally.

Soil erosion has resulted into the loss of fertile soils and thus degradation of agricultural lands, rill and gully erosion augmented by extensive use of natural resources has rendered millions of hectares of land into waste lands, sincere efforts are immediately required to halt accelerated rate of soil erosion caused by rill and gully erosion and to protect the cultivated farms slow poisoning through rain splash and sheet erosion. Natural condition and human action caused soil erosion which in term effects agriculture very seriously. Once a huge portion of fertile soil is lost, it is very difficult to replace it , soil conservation means efficient and scientific management of soil in order to ensure permanent and large production of crops . Conservation methods helps to protect the surface from rain drop impact, increase in the infiltration of rain water, maintain species of trees and vegetable cover.

Topography

This area is flat with a medium slope. Some areas are low and must be inundated by rivers during the rainy season. There are no mountain peaks within this area. It is a monotonous cultivated land and many portion of area covered with trees, forest and tea gardens.

Land:- In this area most of the land is cultivated and either irrigated or not . Chopra has 22,207 hectares cultivated land and 8,207 hectares non – cultivated land. Chopra block has 14,620 hectares high land, 7,296 hectares medium land and 344 hectares low land, Barren land - 410 hectares, area under orchard - 107.80 hectares, permanent pasture -205 hectares.

Table no.1
G.P wise total land of chopra block

SL No	Name of G.P	Land (in hectare)
1	Haptiagachh	2932.33
2	Sonapur	6629.88
3	Chopra	4075.77
4	Chukiapor	4330.66
5	Lakkhipur	2209.65
6	Ghirnigaon	5095.14
7	Daspara	4948.14
8	Majhiali	7343.19

Source: Agriculture office, chopra

Soil properties of chopra block

The study area is young and active. The soil of Chopra block is alluvial of very recent formation. It is sandy loam and the colour is grayish and in the marshy area the colour of the soil is black. The surface is sandy loam. Below the following tables shows some soil properties of Chopra Block.

Table no. 2
Soil texture

Soil texture	Parent Material	Area (in hectare)
Sandy	Alluvial	13360
Sandy Loam	Alluvial	8160
Loam	Alluvial	400
Clayey Loam	Alluvial	400
Clay	Alluvial	Nil

Source: Agriculture office, CHOPRA

Table no. 3

Soil organic status of chopra block

Sl. No	Village	% of organic carbon	Sl. No	Village	% of organic carbon
1	Dalua	.51	19	Jhumari	.60
2	Chopra	.09	20	Singha	.48
3	Goabari	.15	21	Bherberi	.83
4	Chandanidanga	.24	22	Bazargach	.83
5	Lakhipur	.37	23	Bimlabari	.20
6	Bholagachh	.67	24	Kinabari	.23
7	Madhobita	.27	25	Khunia	.42
8	Baragach	.57	26	Sadhuramgach	.42
9	Molani	.22	27	Majhiali	.47
10	Bilashi	.39	28	Banargach	.63
11	Arali	.90	29	Chugari	.76
12	Koimari	.39	30	Mithapukar	.93
13	Kumartola	.98	31	Mohangach	.97
14	Kajigach	.54	32	Binnabari	.55
15	Dhumdangi	.50	33	Jhajri	.35
16	Aramati	1.01	34	Fetehabad	.64
17	Kalagach	.98	35	Chufragachh	.97
18	Debigach	.38	36	Balarampur	.50

Source: Agriculture office, Islampur

Table no.4

N.P.K Status of chopra block

O.C %	AV P_2O_5(Kg/ha)	AV K_2O5(Kg/ha)	PH	EC(m.m ho/cm)
0.10 - 0.6	8 - 94	32 - 200	4.6 - 5.8	0.08 - 0.10

Source: Census report 2001

Table no.5

Ph of soil in different villages in islampur

Sl. No	Village	PH VALUE	Sl. No	Village	PH VALUE
1	Dalua	5.5	16	Aramati	5.3
2	Chopra	5.3	17	Jhamari	5.5
3	Goabari	5.6	18	Singha	5.0
4	Chandanidanga	5.2	19	Bherberi	5.5
5	Lakhipur	5.2	20	Bazargach	5.5
6	Bholagachh	5.2	21	Chadargach	5.3
7	Madhobita	5.4	22	Bimalbari	5.7
8	Baragach	5.0	23	Kinabari	5.7
9	Molani	5.0	24	Khunia	5.4
10	Bilashi	5.0	25	Sadhuramgach	5.0
11	Arali	5.2	26	Majhiali	5.4
12	Koimari	5.7	27	Banargach	5.4
13	Kumartola	5.5	28	Chugari	5.5
14	Kajigach	5.6	29	Mithapukur	5.2
15	Dhumdangi	5.5	30	Mohangach	5.4

Source: Agriculture office, Islampur

Factors of soil erosion in chopra block

Chopra block of Uttar Dinajpur is a densely populated agriculture area. It is situated in high rainfall zone including many rivers following through this block, followed by havoc erosion of soil which is a general problem of this block.

In this block, there are many rivers following north to south direction. Such as Dauk, Mahananda, Kartoa, Berang, Nagar. The main rivers are Dauk and Berang rises in the Darjeeling Himalayas and flows through the centre part of Chopra. Dauk river flows through some areas of Bhagabati, Dakshin Damorgach, Narayanpur, Besarbari, Berang flows Uttar and Dakshin Damorgach. In North - Western part of Dakshin Damorgach Berang river joints with Dauk river.
Mahananda flows within Borobilla, Chitalghata. The rivers are perennial. But in the monsoon time the river carries huge amount of water. The bank of the river are abrupt and the beds sandy. These sandy beds shift at the time of wet years, then the rivers water over flow their banks, thus causing flood and destroy crops as well as home land also. The soil through which the river flow being alluvium of very recent origin and largely mixed with sand is easily cut by the water and deposited on the side on which the velocity is loss. By the end of summer Season the water come down considerably.

Name of river	Gauge sta.	D.L.	E.D.L.	H.F.L
1. Mahananda	Sonapur Ghat	75.771 M	76.771 M	76.480 M (28.7.72)
2. Dauk	Chopra	69.460 M	70.0700 M	70.000 M (1969)

Various causes of soil erosion had been found in this area

1) **Soil erosion by running water:-** The greatest erosive agent is the running water or stream. A heavy shower on the earth surface loosen the soil particles which are carried on by small rivers. It results the havoc landslides. This type of soil erosion in the sloper land catchment are make heavy loss to cultivated area and there is no terraces for checking the soil removal particles.

   The bank erosion by the river water changes the course of the river. It erodes huge amount of soil around the area. In this area sheet erosion, soil erosion and gully erosion are notable erosion by running water.

   - **Sheet erosion:** Watching of surface soil by sheet from arable land is called sheet erosion. This type of erosion is occurred on the surface of the earth only. In the study area, it is found here and there in small patches.
   - **Rill erosion:** Rill erosion is the erosion of soil through the small water ways. It is very common in this area and almost covers the whole area of the block. In the south and northern part of the area it is very common.
   - **Gully erosion:** Gullies are relatively permanent steep sided water causes. This type of erosion is very common in this block. It can be found in the western part of "Dalua" along the Dauk river.

2) **Soil erosion due to over grazing of animals:** The area is mostly covered with alluvial soil. So movement of cattle here and there causes the soil layer become loosen and due to rainy season the soil eroded easily.
3) **Erosion by cultivation:** Year after year the cultivation on the same land make the area poor fertility. In rainy season huge amount of soil eroded from agricultural land.
4) **Erosion by rainfall:** The area situated in high rainfall zone. When the rain drop fall on the land, the loose material are missed with rain drop and washed away.

Table – 6

Flood affected area and rescue centres

Vulnerable villages during flood and rescue centres there-off under chopra development block, Uttar dinajpur						
Sl. No.	**Vulnerable Villages**	**Name of G.P.**	**Approx. Population likely to be affected**	**Name of nearly Rescue Centres**	**Approx. accommodation in the Rescue Centre**	**Remarks**
1	Kumartol	Chopra	1000	Chopra Girls High School	4000	Flood occurs in the village due to water carried by the river Dauk
2	Sitpara	Chopra	400			
3	Suvasnagar Colony	Chopra	500			
4	Murijhapi	Chopra	300			
5	Nainital Colony	Chopra	300	Kamargachh F.P.S.	50	
6	Rangagachh	Chopra	1000	Chopra High Schol	5000	
7	Bherbheri (Uttar & Dakshin)	Chopra	500			
8	Dhamargachh	Chopra	500			
9	Haskhari – I , II, III	Majhiali	500	Bherbheri Pry. School	50	Flood occurs in the village due to water carried by the river Dauk & Barong.
10	Chitalghata	Sonapur	1000	Sonapur hat M.G. High School	5000	Flood occurs in the village due to water carried by the river Mahananda
11	Sitpara	Sonapur	400			
12	Adraguri	Sonapur	500			
13	Rabindra Nagar	Sonapur	400			
14	Shidhu-Kanhoo Char	Haptiagachh	500			
15	Kalikapur	Chutiakhore	1500	Kalikapur pry. School	100	Flood occurs in the village due to rain water logging, the area being lowland.
				Attached Madrasa	100	
				Kaliganj High School	5000	
There is drinking water facilities, latrine & air dropping space in each rescue centres.						

Source - Block development office, Chopra

5) **Deforestation:** Most mouza of this block are remote villages. The poor villagers cutting the trees to use them as a fuel and also sell them in the market to earn some money. In this way deforestation increasing day by day.

Conservation measures taken to check soil erosion

To check soil erosion and to attain further improvement in soil fertility various methods to be practiced in different parts of the study area like Agronomic measures, Rotation of crops, strip farming, mulching, creation of protective surface, cultivating of soil binding crops, control of grazing on land, mechanical method etc.

All mechanical methods should employed in conjunction with agronomic measured. The following are the most important mechanical methods which may be applied in the study area to protect the soil against erosion. They are –

(i) Earthen Bandh of about 300 mts wide to 2 mts height has been made parallely on the both side of the river. This kinds of Bandh we can find on the left bank of the river and just down stream of Chopra bridge on Dauk at Rabindra Nagar Colony and right side of Sonapur ghat to left bank of Mahananda towards upstream. At Baro Billa the bandh protection length is above 400 mts which is up stream side Chitalghata embankment.

Earthen Bandh is helpful to protect sand deposited on the agriculture field and after flood when water come down into the river it is more effective as soil erosion protection Bandh.

(ii) Land field bandh is made for level field cultivation when more deposition of sand along the river bank is very high. This type of Bandhs are found in Rangagachh & Dalua at the left side of river Dauk.

(iii) Chopra is in high rainfall zone (average rainfall 300 cm.). Rain water run off on land and firstly occurs sheet erosion then rill and gully erosion. To protect gully erosion, there have been made many Bandhs made up of cement, boulder and earth material across the gully. In Chopra Block gully erosion protection Bandhs have been made at Haptiagachh, Lakhipur, Dalua and Rangagachh.

The bank protection measures

In this study area we can find much bank protection work along both side of Dauk river. Bolder protection work for the protection river bank erosion has been done. Approximate length on the upstream is about 700 meters and nearly about 82 meters on the down stream side. The bank protection work has been done on the left bank of Mahananda river. Another bank protection work has been found in Haptiagachh B.O.P. Camp. It has been done from the upstream to Bara Billa side of length around 220 meters (approximately) on the left bank river Dauk and at Dalua for protection of renowned Lord Shiva Temple. About 200 meter length protecting work has been done here.

Table no – 7
list of bank protection

Sl. No.	Location	River Bank	Name of the bank protection work	Length in meters
(1)	Haptiagachh	Right Bank of Mahananda	Borabilla Protection	750
(2)	Upstreams side to the Chital Ghata embankment	Mahanda	Borabilla Protection	400
(3)	Both side of Chopra Bridge on the upstream	Right bank of Dauk	Protection of Rangagachh	700
(4)	Both side of Chopra bridge on the down stream	Right bank of Dauk	Protection of Lakhipur	820
(5)	Dalua	Left bank of Dauk	Protection of Lord Shiva Temple	200

Source : Irrigation office, Islampur

Embankments

It is also a Bandh. Many kinds of embankment are found like-

a. **Earthen embankment**
b. **Boulder embankment**
c. **Pitching embankment**
d. **Cementing embankment etc.**

A. Earthen embankment:

Rabindra Nagar Colony embankment and left bank of river Dauk and just downstream of Chopra bridge on river Dauk are the earthen embankment. It is mainly made by earth or soil and for protection of Rabindra Nagar Colony. The importance of this embankment found during enormous flood. Another embankment is Chitalghata embankment, situated right side of Sonapur ghat to left bank of Mahananda river towards upstream. It has length of 6 km approximately.

B. Boulder embankment:

It is made up of earth and boulder river bandh for of erosion from flood and sand deposited the left bank protection of Mahananda river has been done by boulder on the sloped surface of river Dauk. The boulder which is used for bank protection and making spur is available at Dudhia quarry of river Balasan which is commonly known as a North Bengal variety. Both side of Chopra bridge and right bank of Dauk, boulder protection work has been done. Nagar river following basically through the boulder line of Indo-Bangladesh and also east side of Chopra section. Boulder protection has been done at the Marabari B.O.P. camp.

C. Pitching embankment:

It is made of earth, boulder and pitch, along the river bank protecting gully erosion. It is found on the right bank of Dauk river, boulder pitching on the slope bank. The pitching or revetment of the river bank is done by cutting the river bed to a slope of 2:1 and spreading the filter material on this slop bed and finally setting the boulder on the filter material.

D. Cementing embankment:

It is made of boulder, iron, cement along the river bank. It is found in Dalua to protect the temple of Lord Shiva. Besides the cementing embankments the sausage construction is also found.

Table no - 8
List of embankment

Sl. No.	Location	River Bank	Name of the Embankment
(1)	Rabindra Nagar and Rangagachh	Left and right bank of river Dauk	Boulder embankment
(2)	Rabindra Nagar Colony	Left bank of Dauk	Earthen embankment
(3)	Chitalghata	Left bank of Mahananda	Boulder embankment
(4)	Sonapurghata	Left bank of Mahananda	Earthen embankment
(5)	Morabati B.O.P. Camp	Nagar	Boulder embankment
(6)	Dalua	Right bank of Dauk	Cementing embankment
(7)	Barabilla	Right bank of Dauk	Pitching embankment

Source : Agri-Irrigation office, Islampur

Spur and sausage construction

The spur is the most important construction to protect embankment. It is come down from embankment or bank through the water or down the stream, across the embankment in bank. It is found in Dalua, Rangagachh.

Bed bar

On the up stream of Chopra bridge and left of river Dauk there are 15 no of bedbar for protecting Nainital Colony adjacent to this protection. In Mahananda the bedbar is 6 no. spur.

Toe-Wall sausage

The toe-wall is done by making wire-netting which is known as sausage toe-wall. Both side of Dauk river protection work has been done by making the toe-wall at the toe of the sloped bank.

Geotextiles

A Geotextile is any permeable textile material used with foundation, soil, rock, earth or any geotechnical engineering related material. It can be in the form of a mat, sheet, grid or web or either natural fibre, such as jute or coir or artificial fibre, such as nylon. The fibre are buried and designed to give permanent protection to a slope by rain forcing the soil, once a vegetation cover is established and the plant roots and the mixture of Mahananda and Tista's water artificially carried out by the help of aqua duct. In south eastern where the Baurigach is located there has been made an artificial waterfall with the help of this water which is the biggest waterfall in Asia, its depth is 7.15 mts. Again by the help of this water, a biggest Dam has been built.

Table – 9

Effectiveness of geotextile materials in controlling water erosion on a sandy loam soil

Material	Moisture Absorption	Soil detachment by raindrop impact % of control	Sediment removal by run off % of control	Soil loss by rain and run-off combined % of control
Jute Based net	570	14	13	22
Coir based net	250	30	49	----
Mulch	320	25	67	32
Polymide mat	120	130	n/d	72

Source : Irrigation office, islampur

The Geotextile construction is found only in some places like Rabindra Nagar Colony, Rangagachh and Dalua. But this protection work was not lasting at all.

Suggested remedial measures

To control the soil erosion of this block, area need to built dam to stop the flow of canal's water where there is some probability to damage the dam, there need forestation. Overall local people should be over careful about deforestation and husbandary.

Conclusion

Now a days it is clear that the whole world understanding the importance of soil conservation. Since erosion is a natural process, it cannot be prevented but it can be reduced to a maximum acceptable rate. That's why different types of measures have been taken. The protection work has been taken where there is some signs of destroy. Among all conservation measures, agronomic measures are applied several times. The ultimate success of conservation schemes depends on how well the erosion problem has been identified and how the measures are implemented. Dauk is the main river in this region. But in rainy season it acts as a disastrous. Soil is the mother of all resource. So we should take care to conserve soil as our natural asset. Public awareness will be grown for conservation of soil.

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