

Transformation of Wetland at Taidu Area of South Tripura District, India

Sunil Kumar De, Sunando Bandyopadhyay, Kapil Ghosh, Shreya Bandyopadhyay and Sushmita Saha

Abstract

Characteristics of wetland types are wide ranging and vary from natural to manmade, permanent to seasonal and freshwater to saline. Their ecological and economic importance are well-known. Wetland degradation is a common phenomenon in Tripura especially in the districts of South and West Tripura. In the present study, an investigation was conducted on the spatio-temporal changes in a wetland area at Taidu, South Tripura, in the upper catchments of river Gumti.

The study revealed that during the 1920s a lake and wide areas of marshes were present in the Taidu area. Population was very low as was the extent of agricultural land. After the 1960s, population of the area increased significantly leading to increased pressure for conversion of wetlands to paddy farms. In 1932 the amount of agricultural land within the Taidu mouza was 20.88 ha which increased to 484.01 ha in 1976 and 826.5 ha in 2008. It seems that the Taidu lake was completely drained by 1968 along with its adjacent wetlands through a canal excavated up to the nearby San Gang river. In addition, deforestation and grazing in the surrounding hills lead to fast sedimentation of the lake.

Introduction

Since the dawn of civilization, humans have altered the face of the Earth while acquiring valuable resources such as food, fiber, and fresh water (Goldewijk and Ramankutty, 2000). Land is in a continuous state of transformation due to various natural and human-made processes (Richards, 1990). Wetlands are areas where water is the prime factor of controlling environment including the associated plant and animal life. They occur where the water table is at or near the surface of the land or where the land is covered by shallow water. Wetlands are characterized by specific vegetation, particular soils and the presence or absence of water at least for a period of time in the year. Presence or absence of

water determines their mode of formation. Ramsar Convention (<http://www.ramsar.org>) defines Wetlands as 'areas of marsh or fen, peat-land or water, whether artificial or natural, permanent or temporary, with the water that is static or flowing, fresh, brackish or salt including areas of marine water, the depth of which at low tide does not exceed 6 m'. Wetlands generally include swamps, marshes, bogs and similar areas (Mitch and Gosselink, 1986).

Wetlands occur in every country, from the tundra to the tropics. How much of the earth's surface is presently composed of wetlands is not known exactly. The World Conservation Monitoring Centre has suggested an estimate of about 570 million hectares, roughly 6% of the Earth surface of

which 2% are lakes, 30% bogs, 26% fens, 20% swamp and 15% flood plains.

Wetlands provide tremendous direct as well as indirect benefits. The former includes fisheries, agriculture, timber production, energy resources, transport, recreation and tourism opportunities while the later takes into account the maintenance of water table, nutrient retention in flood plains and water supply (quantity and quality). Indirect benefits are improved water quality (including drinking water) by intercepting surface runoff and removing or retaining its nutrients, processing organic wastes, reducing sediment before it reaches open water, flood control and other cultural aspects. (Ramachandra, Kiran and Ahalya, 2002)

These functions, values and attributes can only be maintained if the ecological processes of wetlands are allowed to continue functioning. Unfortunately about 50% of the total wetland areas today have been subjected to negative transformation and degradation, and in spite of important progress made in recent decades, wetlands continue to be among the world's most threatened ecosystem, owing mainly to ongoing drainage, convention, pollution, and over exploitation of their resources (Çalışkan, 2008). Land transformation is one of the most important fields of human induced environmental transformation, with an extensive history dating back to antiquity (Wolman and Fournier, 1987).

Wetland degradation is a common phenomenon in Tripura especially in West Tripura and South Tripura district. Most of the wetland have been degraded or lost by human intervention including unscientific and unplanned usage of land and haphazard

development of settlement, cutting the slopes of *tilla* lands, clearing of vegetation cover etc. A number of wetland has been lost in the west and south Tripura districts which have created an environmental complexity (Menon, 1976). About 50 years back a lake (Taidubari Lake) and marsh land of an adjacent wide area was in Haripur- Dhanlakha- Ampichhara area and at that time there were very few numbers of settlements in this area. The area of agricultural land was also very low. In total amount of agricultural land was only 0.208824 sq km (1932). All sides of the lake and adjacent marsh land were covered with dense vegetation. In 1932 an area of 12.47966 sq km was under forest. (Fig: 3). With the passage of time, population in the area had increased significantly resulting the increase of settlement and thereby increased the demand of agricultural land. To reclaim agricultural land, local people of this area had excavated a canal to drain water of the lake and marsh land into the river of Dhanlakha (Fig: 11, see page 18) and altered the whole geo-ecological set up of the area. The present paper is an outcome of a detailed geographical investigation in Taidu area of South Tripura district in order to find out the nature of such changes.

Geographical set-up of the study area

The study area is located at Haripur-Dhanlakha-Ampichhara A.D.C.village area (23°42'22"N & 91°41'54"E to 23°45'N & 91°36'46"E) in Ampu block of Amarapur subdivision of South Tripura district, which is about 40 km. away from Talamura Bazaar and about 90 km. from the state capital, Agartala. Having an area of about 28.65 km² the village is characterized by a depressed

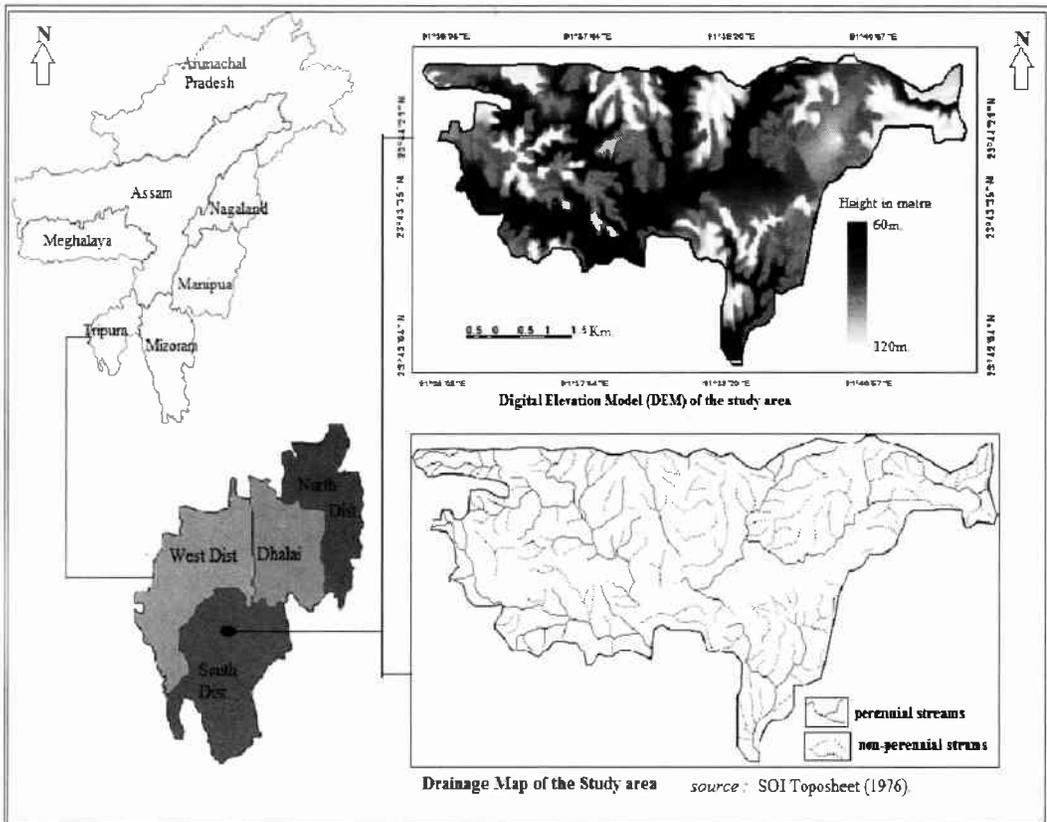


Fig. 1: Location of Study Area..

land situated in the upper catchment of the Gumti river basin. This low lying area is mainly surrounded by Tilla lands. The altitude of this area ranges between 60 m and 120 m. (Fig.1).

The area is drained by the rivers of San-Gang and Dhanlakha. River Dhanlakha is flowing from the south-western part of the study area and meeting with the river San Gang near Ampinagar Bazaar. Other perennial rivers of this area are Holua Chhara, Jabbuk Chhar and Palka Chhara, (Fig.1). Most of the rivers have formed dendritic drainage pattern, which indicates that they are flowing through a youthful stage.

The overall climatic condition of the area is tropical monsoon type. The rain bearing Monsoon winds reach Tripura towards the middle of May and continue up to end of September. Storms and thunder showers are common during pre monsoon season. The annual average rainfall is almost 2500 mm and about 80% of total annual rainfall occurs between March-September. Average maximum and minimum temperatures of the area are 35°C (June/July) and 10.50°C (December/January) respectively.

Most parts of the study area are underlain by red and alluvial soils. Texture of the soil ranges between loamy to sandy-loamy and clay percent increases down the profile.

Methods and Materials:

To show the temporal changes of such wetland, agricultural land and forest cover of the study area Survey of India topographical sheets (79 M/9) of 1932 and 1976 of 1:63360 and 1:50000 respectively were scanned and geo-referenced using PCI Geomatica 10.1 software. Apart from toposheets Google Image (2005) and satellite data -LISS III (IRS fused L3+L4-mono) of 2008 were also used.

To analyze the present condition of study area a cross section is drawn across the present agricultural land between the foot of the tilla land up to left bank of the Dhanlakha Chhara, which is transformed from the earlier wetland.

Soil samples from different layers at different depth have been collected from the study area and tested in laboratory. Soil layers have also been studied intensively during field survey in order to understand the nature and characteristics of deposition. An intensive socio-economic survey was conducted to delineate the impact of these changes on the local people. Secondary data like rain fall, temperature, were collected from Agricultural department of Amarapur and census data of different years were collected from census office of Agartala. Photographs of different parts of the study area were taken to represent the visual evidence of the nature of the changes of the wet land environment.

Findings and Discussion

Loss of wetland area

From the topographical sheet of 1932 it is found that there was a lake in Taidu bari area and a wide area of marshy land in Haripur-

Ampichhara area. The lake was covering an area of about 0.18855 sq km. (1932) and the marshy land was covering 3.677558 sq km. (1932). This wetland area belonged to Gumti river basin and used to act as of the recharge areas of the Gumti river, because which most of the tributaries of the river remained perennial. But the topographical sheet of 1976 does not show the existence of any permanent water body in the area like before. Such drastic change took place mainly due to human intervention. From the field investigation it has revealed that in 1962 some local people of the concerned area excavated a canal to drain out the water from the lake and marshes land to the river Gumti. They excavated this canal for reclaiming some land for agricultural purpose. Due to the transformation of the wetland the total length of non perennial streams has increased. In 1932 total length of the non perennial streams was 3.188 km. but in 1976 it has increased to 6.60 km. During this time period (1932-1976) the length of the non-perennial streams has increased by 3.45 km. (table: 1). The total length of perennial streams has also been increased. In 1932 the total lengths of the perennial streams was 3.89 km and in 1976 it has increased to 5.40 km with an increase of 38.78%. This had happened due to the formation of some new streams across the previous wetland area.

1.2 Increase of agricultural land

From the topographical sheet of 1932 it has found that the amount of agricultural land was very low only 0.21 Km². But the topographical sheet of 1976 shows that the agricultural land has increased significantly and by that time it had reached to 4.84 Km².

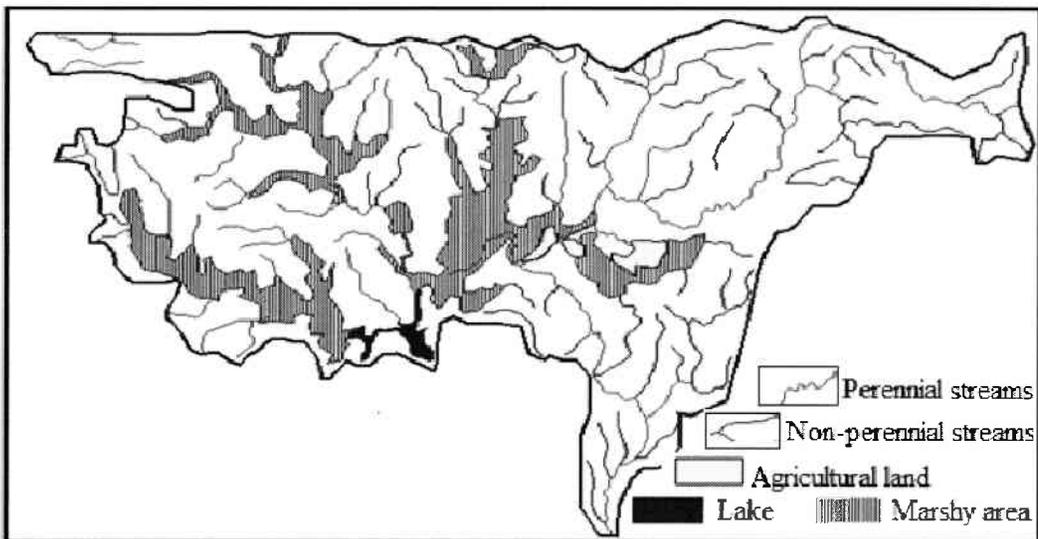
This excess amount of agricultural lands was mainly formed by the transformation of the previous wetland areas.

The satellite image of 2008 shows further extension of sedimented area as well as the extension of agricultural land in stead of any water body. Similar result was also noticed during intensive field observation. From 1932 to 1976 the area of agricultural land has increased about 23 times and between 1976 and 2008 it has increased by 70.79%. Increasing population pressure is mainly responsible for the replenishment of such wet land having a total area of 3.68 Km² into agricultural land. In 1930's there was very few number of settlement but the number has started to increase rapidly since 1960.

1.3 Loss of vegetation cover

Between 1932 and 1976 the areal coverage of vegetation has decreased by 13.24%. The topographical sheet of 1932 indicates that about 23.096 km² of the study area of 28.65 km² (about 80.61%) was densely covered by vegetation and 3.866 km² area was under wetland. In 1976 the forest cover has come down to 20.034 km² (69.93%) with a deforestation rate of 2.27% per year and in 2008 it has further declined to 13.854 km² (48.36%). Because of growing population in and around the study area those deforested lands have started to transform into agricultural land and settled areas. The increased population exerted pressure on the forest land resulting into increase of agricultural land to the extent of 8.27 km² in 2008.

Fig. 3: Map of the study area showing the existence of agricultural land, lake area, marshy area, perennial and non-perennial streams in 1932.



Source: survey of India Topographical sheet (1932).

Table 1. Changes in stream length

Streams	Year	Total length of the streams	Increase of streams length		Period
			Km.	%	
Perennial	1932	3.894	1.510	38.78	1932-1976
	1976	5.405			
Non-perennial	1932	3.188	3.457	108.44	
	1976	6.604			

Source: Survey of India topographical sheets of 1932 and 1976.

1.4 Cross Section

The highest flood level in the area has been determined on the basis of the opinion of the local residents. According to them presently flood is not a frequent event in the area; it was frequent before the excavation of the canal. Huge amount of sediments were deposited during every flood period that resulted the filling up of the low lying areas including the wetland basin. The shape of the cross section shows that the elevation of this area is higher in the middle and decreasing towards west and east of the cross section. It is a common in most of the depositional features in inland water bodies. (for location of cross section see fig 2 page 18 and cross section in fig 9).

1.5 Soil analysis

Laboratory analysis of soil samples collected from different layers at the middle of the desiccated wetland indicate that the soil types vary from sandy loam to sandy clay loam with high percentage of sand (>60%). Loamy soil bears the character of water action. pH values in all layers are very close to neutrality (6.3 to 6.4). It indicates the whole area was almost devoid of any human interference. Bottom part of the profiles possess moderate to high concentration of organic carbon which indicates the presence of aquatic life (weeds). The concentration of organic carbon is the highest at the top soil layer, which is common in all soils because of the presence of biotic life

Table 2. Increase of agricultural land

Year	Area under Agriculture	Increase of Agricultural area		Period in Years	Arithmetic mean increase per year		Period
		Sq Km.	%		Sq Km.	%	
1932	0.209	4.631	23 times	44	0.105	2.272	1932-1976
1976	4.840						
2008	8.265	3.425	70.79	32	0.107	3.124	1976-2008

Source: Survey of India topographical sheets of 1932, 1976 and satellite image of 2008.

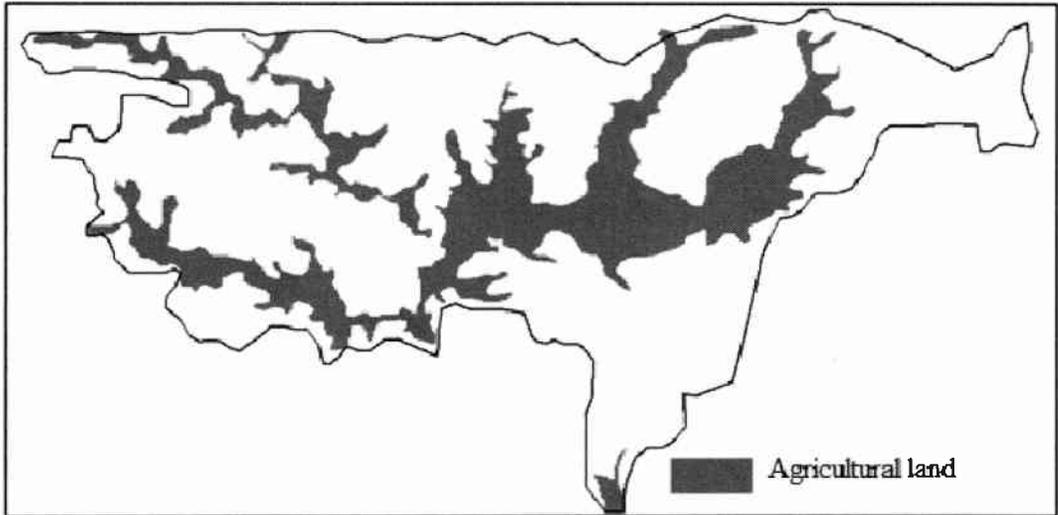


Fig: 4. extension of agricultural land in the study area in 1976. Source: survey of India topographical sheet of 1976.

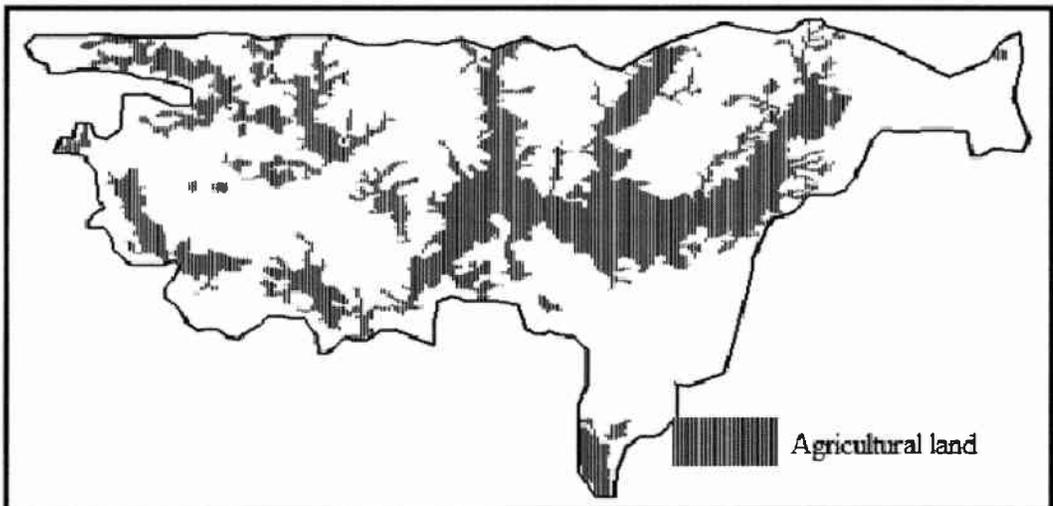


Fig: 5. extension of agricultural land in the study area in 2008. Source: satellite image of 2008

and water. Organic matter distribution is also showing the similar result. Thus, from the soil properties the existence of water

body in the present agricultural field can be derived.

Table 3. Loss of vegetation cover

Year	Area under vegetation	Decrease of vegetation cover		Time in Year	Arithmetic mean decrease per year		Period
		Sq Km.	%		Sq Km.	%	
1932	23.096	3.062	13.24	44	0.07	2.266	1932-1976
1976	20.034						
2008	13.854	6.179	30.84	32	0.193	3.0117	1976-2008

Source: Survey of India topographical sheet of 1932 , 1976 and satellite image of 2008

Conclusion

A wetland may disappear due to both natural and anthropogenic activities. In case of the present study area, anthropogenic activities are mainly responsible for the alteration of this wetland into agricultural land. From the said study it is clearly revealed that the wetland was present before 1960's. Due to the destruction of dam by the local tribal community the water from such land had drained into Gumti river and small uplands (tilla lands) got exposed. Most of these tilla lands were occupied by such people for

residential purposes. Dry bed of the water body had started to be used for agricultural use. Due to this agricultural practices and successive erosion of tilla side slope during monsoon period, the lowland area have been sedimented and presently it is existing as a low lying flat-bedded agricultural field (locally called *lunga* land). Sedimentation of such water bodies has a great impact on the overall environment of area. If this happens in different places, it may change the global environmental scenario.

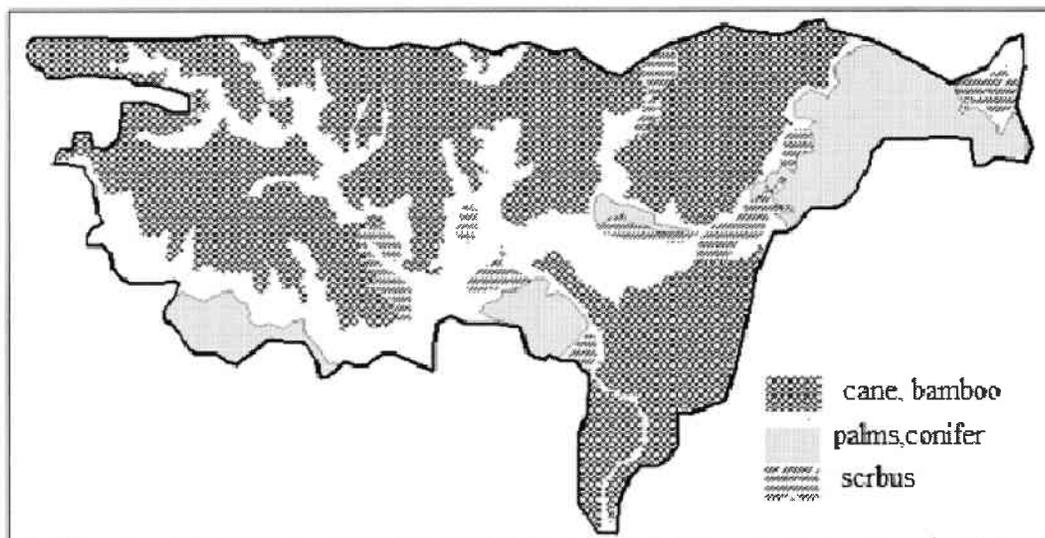


Fig. 6: Vegetation covers in the study area in 1932. Source: SOI Toposheet (1932)

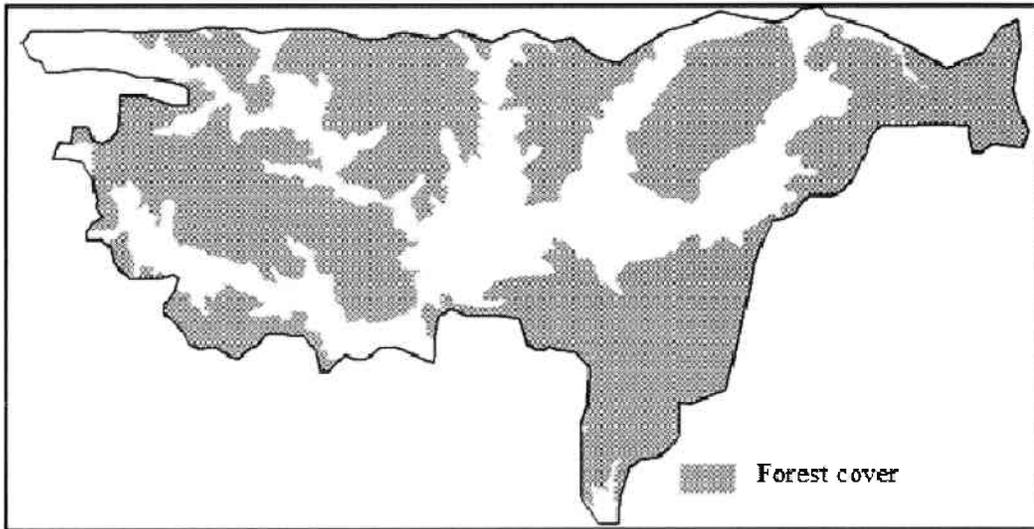
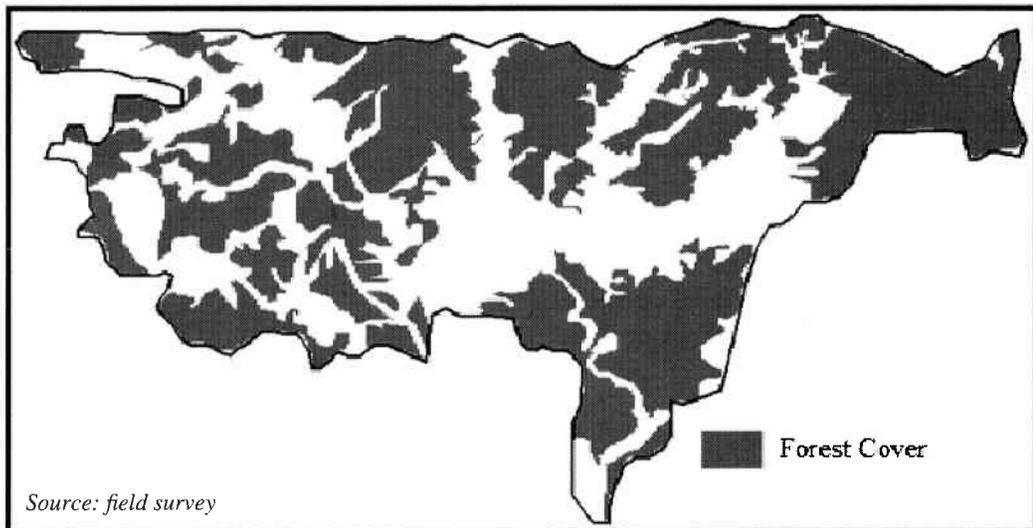


Fig: 7. Vegetation covers in the study area in 1976. Source: SOI Toposheet (1976).

High population has the potential to exert significant direct and indirect influences on wetland existence and processes. In case of the present study area, population has been changed significantly which affected the land use pattern of this area. During

1950's & 1960's population was very low in and around the area, but since 1971 it has increased significantly. To fulfill the need and greed of this increased population the land was reclaimed and destroyed the lake and surrounding marshy land.

Fig: 8. Vegetation covers in the study area in 2008. Source: Satellite image (2008).



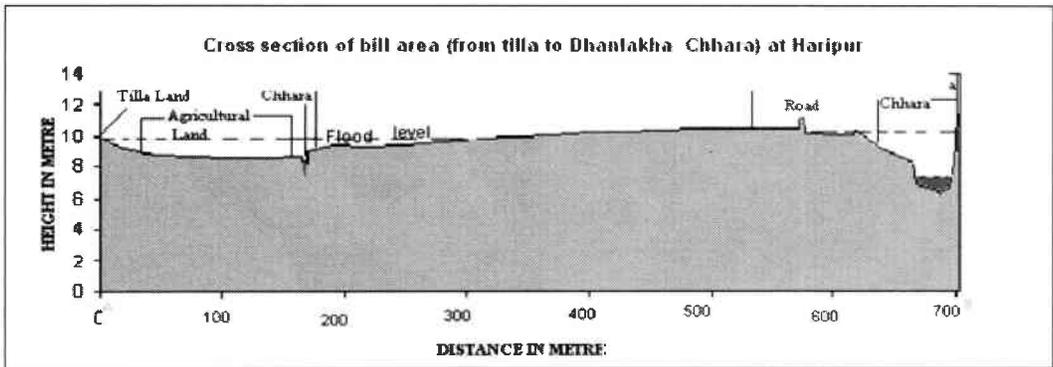


Fig 9 : Cross Section of Bill

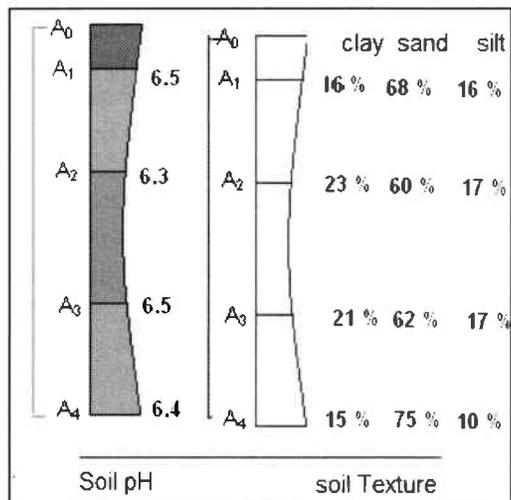
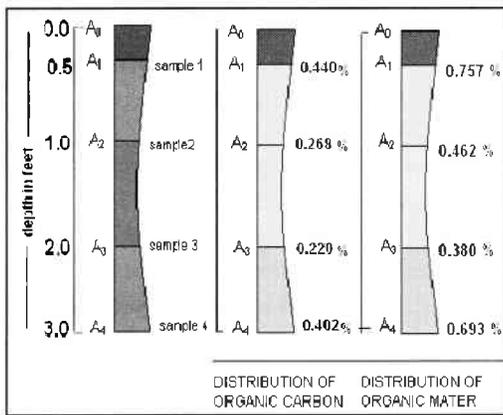


Fig 10a & 10b : Soil Characteristics

Wetland loss and degradation through the hydrologic alteration by man has occurred historically. Water diversion structures, such as canals have been used to modify the wet lands to achieve flood control, drainage agriculture and settlement development activity. The local people of this area excavated a canal to release water from the lake and marshes land to the river in order to reclaim agricultural land. They excavated this canal from the Taidubari lake to Halua Chhara across the marshy area and the whole water was released within a short

period of time. This Chhara meets with the river San-Gang, an important perennial tributary of the river Gumti. Presently water does not stay in the area even in the monsoon period.

Acknowledgement

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References

- Goldewijk, K.K. and Ramankutty, N. (2000): Land Use Changes During the Past 300 Years. In Land use, Land cover and Soil Science, Vol.-I. Encyclopedia of Life Support Systems, UNESCO.
- Menon, K.D. (1975): Tripura District's Gazetteers; Government of Tripura Educational Publications, Department of Education, Govt. of Tripura.
- Richards, J. F. (1990), "Land transformation". In The Earth as Transformed by Human Action; Turner II, B.L. *et al* (eds.). Cambridge University Press, Cambridge, UK. 163-178p
- Çalışkan, V.(2008): Human-Induced Wetland Degradation: A case study of Lake of Amik (Southern Turkey). *BALWOIS, Ohrid, Republic of Macedonia*
- Wolman, M.G. and Fournier, F.G.A. (1987): Land Transformation in Agriculture, John Wiley and Sons, Chichester, UK
- Mitsch, W.J. and J.G. Gosselink. 1986. Wetlands. Van Nostrand Reinhold, New York. 539 PP
- Ramachandra, T.V., Kiran R. and Ahalya, N. (2002). Status, Conservation and Management of Wetlands. Allied Publishers Pvt Ltd, Bangalore

Sunil Kumar De*

Kapil Ghosh

Shreya Bandyopadhyay and

Sushmita Saha

Department of Geography and

Disaster Management,

Tripura University,

Agartala 799022, Tripura

Sunando Bandyopadhyay

Department of Geography,

University of Calcutta, Kolkata - 700019

*Corresponding Author: desunil@yahoo.com