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RESEARCH ARTICLE

Degradation of Drainage and its Consequences on Society: A Case of Microlevel Study in Some Muzas of West Bengal

Golam Mostafa

C/O- Sk Monsur Ali, Vill- Sarangpur, P.O.-Pawnan, District-Hugli, P.S.-Polba, PIN- 712 305, West Bengal, India

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ABSTRACT

Riverine plains are gifted with regular supply of water and silts inevitable for the sustenance of the existing functioning of the ecosystems. Periodic floods sometimes proved beneficial to those ecosystems which human had long adjustments for production activities. The abandoned courses of river play the role of inundation canals with capacity either to carry water to the low lying wetlands or to hold the excess water for a longer time from which water for irrigation during dry spells could be available. These types of inundation canals were made with human efforts in some places both to control flood, irrigate crop fields and pisciculture. These channels may become dry after complete eutrophication as a result of the degradation of the channels with frequent disruption, extension of cultivable lands, diversions, constructions of culverts, bridges and roads. The district of Hugli in West Bengal is a part of the lower Ganga plain, of which 12 mouzas of Polba-Dadpur and Singur CD Blocks have been selected for micro level study on impacts of degradation of water channels on environment and people. The area had experienced the changes in the status of river channels with decreased water holding capacity, shortages in supply of water on the one hand and siltation of water courses, eutrophication of water bodies, extension of agricultural land, wanton diversion of channels, construction of culverts etc. by narrowing the channels on the other. These activities have brought in effects on the ecology and economy of the area. This paper attempts to investigate the factors and processes of channel diversion, to identify the changes in the physical and social environment and to analyze the impacts of those changes with appropriate methodology and information collect from the field.

INTRODUCTION

In any rural area of deltaic origin, existence and health of rives have direct effect upon the economic and social activities of the human community settled in that area. Rivers supply water required for all aspects of economic activities, such as, water for agriculture, industry and domestic uses followed in riverine plains. The lands formed in the past by the deposition of sediments and replenish the nutrients through periodic supply of sediments rich with nutrient. Diversion of these river channels invite problems of supply of water, the shortage of which is caused through over siltation and channel diversion. Twelve *mouzas* of Polba-Dadpur and Singur CD Blocks of Hugli District attest the problem just mentioned (Gaz. Hug., 1985). This paper attempts to clarify the causes and consequences of channel diversion in that area.

Objectives

The objectives of the present work are to identify the nature and extent of diversion of the river channels in selected 12 mouzas of Polba- Dadpur and Singur CD Blocks of Hugli district of West Bengal, to recognize the impacts of such diversion of surface drainage channels upon the environment and people of the study area and to work out suitable measures to sustain the stability through recovery of river channels.

The Study Area

The study area is composed of 12 mouzas of Polba- Dadpur and Singur CD Blocks of Hugli District of West Bengal, namely, Panjipukur, Karicharbheri, Dogachhia, Ranagachha, Mahesbati, Haripur, Kaswara, Harit and Narayanpara mouza of Polba-Dadpur CD Block and Bagdanga, Chhutipur and Anandanagar mouza of Singur CD Block. The area is bounded by Panduah and Balagarh CD Blocks on the north, Chanditala I and II CD Blocks on the south, Chinsura-Magra and Serampur-Uttarpara CD Blocks on east, and Dhaniakhali and Haripal CD Blocks on west. The area is located between 22° 50' to 22° 55' North latitude and between 88° 15' to 88° 20' East longitude.

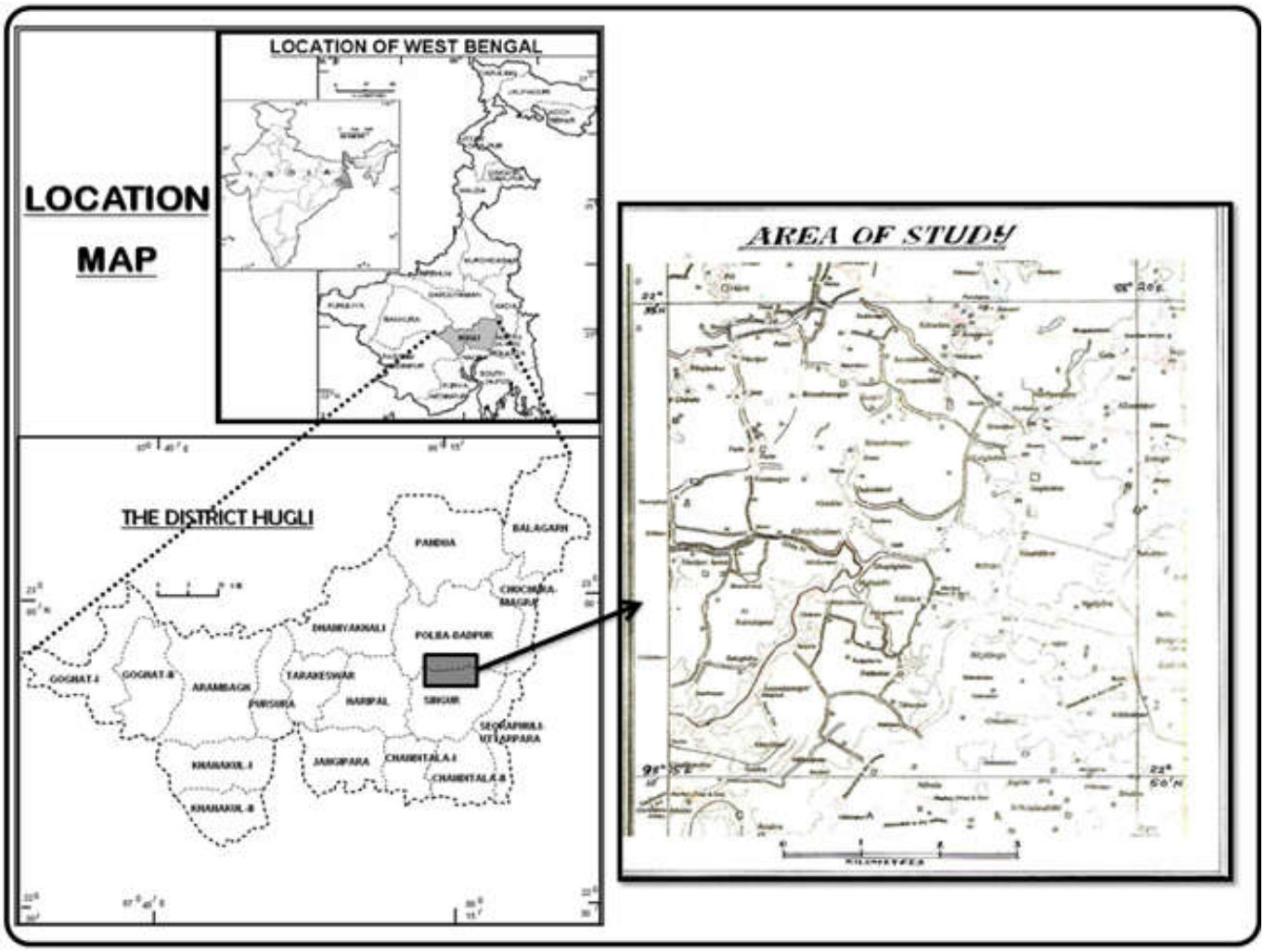
The Database

The data base for the present work includes a number of government and non-government published and unpublished reports and records related to geology, hydrology, topography, soil, climate, rivers, streams and tanks, irrigation, agriculture, transport and communication, settlements, economic activities etc. The database also incorporates District Gazetteers and Census Handbooks on the area concerned mainly to take out information on land use records and population characteristics.

Methodology

The methodology of the present work includes the following steps:
The pre-fieldwork stage of the present work has been based upon the collection of information related to geology, topography, surface and subsurface drainage, soil and climate; collection of information on human ecological issues, economic activities, settlement characteristics; collection of data on land holdings and land tenure systems, data on population characteristics, transport and communication system like roads and waterways, bridges and culverts, household industries and collection of information on rivers, floods etc. Frequent fieldworks have been done to generate primary data on diverse aspects of the physical ecological and human

Corresponding author: gmgolammostafa@gmail.com



ecological aspects and socio economic aspects of the human communities residing in the area concerned through empiric observations, oral interviews and surveys conducted with structured questionnaire schedules including ground truth verification. The post fieldwork stage includes sufficient analysis and interpretation of the information collected from various database accumulated in different time with the help of suitable quantitative and cartographic techniques. Finally conclusions have been drawn on the basis of complete analysis to fulfill the objectives stated above.

Land Characteristics

The topography of the study area is flat in character, but with a gradual slope towards the south and south-east (Hunter, 1876). In the southern border, there are a number of marshes, small stream channels *jhores* or *nallas*, as spill channels formed by the Saraswati, the main river flowing through this area, has formed the lowland locally known as *nabal desh* characterizing seasonal wetland (Gaz. Hug., 1985). A series of shallow wetlands and swamps are evident behind the banks of Kunti and Saraswati (Toposheet No-79 B/5). The area under study is constituted of deep alluvial deposition. The area is a small part of the Hugli district which is a part of the Great Bengal Basin. In the district of Hugli this depth has been counted up to 714 feet near Santragachhi of Haora District (Hunter, 1876). Near Sibpur Botanical Garden the depth is 690 feet. In 1835-40, the boring project undertaken reached a depth of 481 feet without signs either of a rocky bottom or marine beds (Gaz. Hug., 1985). It has been already noted that topographically the land of the area under investigation is flat in character with very gentle slope towards the north (Hunter, 1876) where the shallow channels are existing. The agricultural plots demarcated by low boundary walls have very little variation in height, during rains the boundaries are totally submerged. Local slopes are evident only on the banks of the creaks already covered with water hyacinths. The houses of the villages are built on relatively up slopes thus the area contains a very little variation in slope character. The banks of the creaks and the channel sides have been terraced there by minimizing the residual slope. This character is helpful of inundating the relatively low lands very fast.

The Rivers

The main rivers of the area under study are Saraswati, branching out from the Hooghly River near Tribeni and falling further in the same river near Andul of Haora district; and Kedarmati, a tributary of the Saraswati (Hunter, 1876). The area is also drained by a number of streams and excavated water courses locally known as khals which run in accordance with the regional slope (Census W.B., 1961). The river Saraswati has formed the southernmost boundary of Polba-Dadpur CD Block and the northern boundary of the CD Singur Block, wherein exist a number of wide swamps and marshes. The area under study is drained by a number of streams and *jhores* (creaks) from the very earlier times. Their beds have been silted up heavily with the sediments carried by themselves simultaneously with the human actions like agriculture (Gaz. Hug., 1985). Their past existence is recognizable from their abandoned courses at ground, old toposheets and identifying the typical textures of satellite images. Some older irrigation channels or canals are evident which were used for release of inundation water accumulated in rainy season (Gaz. Hug., 1985). Encroachment to these canals has resulted in their siltation with simultaneous swallowing and narrowing of their beds gradually preparing for conversion into cultural lands and at the same time increasing the chances of flooding.

Ecosystem Mosaics

In its broader sense, the area is dominated with cultural ecosystem with seasonal monoculture. Nothing is left of the original natural

ecosystem dominated with land-water system of the past. With the introduction of land and water based economy, the natural ecosystem was gradually altered into cultural ecosystem. Presently, the area comprises some definite ecosystems existing side by side framing a mosaic of aquatic, agricultural and mixed terrestrial plantation ecosystem. But no ecosystem remains natural in true sense, even the aquatic ones. They are, however, deeply interrelated in terms of energy flow.

Population Characteristics

The study area is one of the oldest settled areas of West Bengal inhabited by people dependent upon primary activities. Census Reports from 1951 to 2001 show a continuous growth of population with which the settled area has been extended an even encroaching upon the orchards and engulfing the river beds. The following table shows that the total population in 1991 was 20064 and in 2001 it has been increased to 22688 with a decadal growth rate of 16.32 for the selected mouzas of Polba-Dadpur CD Block And 2.76 for the mouzas of Singur CD Block. The area contains the total number of households 4714, and the density of population is 2171 persons/km², for the selected mouzas of Polba-Dadpur CD Block and 1671 persons/km² for the mouzas of Singur CD Block. In context of population composition the area has 67.58%, 22.83% and 9.59% of General, SC and ST categories respectively (Census W.B., 1991, 2001).

PROFILE OF POPULATION, 2001

NAME	*No of Household*	*Total population*	*Total male*	*Total Female*	*Total SC*	*Total ST*
Karichar Bheri	380	1703	823	880	334	0
Maheswarbati	332	1523	778	745	74	356
Kashwara	829	4407	2376	2031	1257	575
Narayanpara	196	1000	496	504	211	116
Ranagachha	122	563	284	279	64	8
Dogachhia	182	855	423	432	458	291
Haripur	221	1012	483	529	541	43
Panjipukur	115	747	470	277	85	242
Harit	789	3846	1933	1913	1636	333
Bagdanga	407	1995	1015	980	396	19
Chhutipur	244	1074	571	503	81	0
Anandanagar	897	3963	1847	2116	44	192
Total	4714	22688	11499	11189	5181	2175

Source: Census of India, 2001

The following table displays the distribution of working population in the area showing maximum concentration of labourers in agricultural sector, signifying the importance of primary sector economy, nearly 50% of the total population is following agriculture as their mainstay (Census W.B., 2001).

PROFILE OF WORKING POPULATION,2001

NAME	Total Workers	Cultivator Labourer	Agricultural Labourer	Marginal worker	Non Workers
Karichar Bheri	691	271	117	168	1012
Maheswarbati	649	223	302	46	874
Kashwara	1911	229	539	640	2496
Narayanpara	412	176	141	18	588
Ranagachha	215	73	45	31	348
Dogachhia	326	50	213	34	529
Haripur	483	52	208	8	529
Panjipukur	208	33	62	58	539
Harit	1757	238	266	702	2089
Bagdanga	775	211	140	144	1220
Chhutipur	446	128	45	72	628
Anandanagar	1729	342	106	464	2234
Total	9602	2026	2184	2385	13086

Source: Census of India, 2001

Deterioration of Surface Drainage by Natural Causes

The deterioration of surface drainage system is mainly caused in the study area by changes in the courses of the major rivers from the historical past. The changes have found maximum for the river Damodar which confluence to the river Hooghly, appears to have silted up gradually, and it is shown in Rennell's map (1779-81) as the 'Old Damoodah'. This change in the very river Damodar, have been the prime cause of the silting up of the Saraswati at its head and of the decay of the once famous port of Satgaon, now Adisaptagram (Hunter, 1876). The main volume of the Damodar water appears next to have flowed south along the channel now called *Kana* (choked) Damodar (Siddique 2009). Subsequently, it is necessary to denote the deterioration of the river Saraswati, which has been silted up from the last quarter of the 18th century that it became a small stream; and now it is merely a shallow narrow creak, except for a few miles above its outfall (Govt. of W.B., 2001).

Deterioration of Surface Drainage by Anthropogenic causes

The deterioration of the river in the area under study is mainly caused by siltation in the river beds. Fluctuation in the amount in river discharge is mainly related to the periodic floods and droughts because there is no evidence of reduction in the amount of rainfall in the area. The shortage of the supply of water from the catchment areas therefore, cannot be taken as the natural cause forceful to the drying up of the river channels (Gaz. Hug., 1985). The major anthropogenic causes of the changes in the river channels of the study area are:

- The area is enough populous with a density of 2171 persons/km² for mouzas of Polba-Dadpur CD Block and 1671 persons/km² for the Mozas of Singur CD Block (census 2001). With a growth of population at the rate of 16.32% within a decade from 1991 to 2001, the rural areas are experiencing considerable expansion of settlements. Even the areas close to the stream banks are converted into settlement plots by further narrowing the channel beds.
- Being deltaic lowland the area is endowed with very fertile alluvial soils rich in organic and inorganic nutrients and the presence of moisture in soil is assured all to cultivate through the year round. Gradually lands were reclaimed through altering the wetlands and river banks into croplands. Thus the channels were silted up naturally and narrowed down by anthropogenic activities (Census, 1951).
- Lift irrigation from the river courses and other water bodies through traditional and modern techniques in this area is well known for long time. But from the second half of the 1970s, intensive cultivation practice of *boro* paddy has caused excessive demand on water as it needs more water than traditional varieties of paddy which ultimately forced people to shift to ground water led irrigation by replacing the traditional river lift irrigation. The exhaustion of water from ground water sources is lowering the underground water Table to an alarming rate.
- The area is enough populous with a density of 2171 persons/km² for mouzas of Polba-Dadpur CD Block and 1671 persons/km² for the Mozas of Singur CD Block (2001). With a growth of population at the rate of 16.32% within a decade from 1991 to 2001, the rural areas are experiencing considerable expansion of settlements. Even the areas close to the stream banks are converted into settlement plots by further narrowing the channel beds.
- An extensive network of metalled and unmetalled roads has been established, for which almost all the channels has been sliced off or the channel beds are filled up in many places. Construction of bridges and culverts needs making of approach-roads projecting towards the channel beds. It makes obstacle in the free flow of water forcing sediment loads to be dropped.
- The wanton destruction of forest cover of those areas are now susceptible to intense soil erosion, and huge amount of sands produced in those areas are being carried out by the rivers are being deposited in those areas of slow flow.

Changes in Production System

A change in production system is noticeable throughout the area, agriculture still being the basis of economy (Census W.B., 1961). Throughout the area single crop system has been changed into double, even triple cropping system has become normal practice. This practice has created a huge demand of irrigation water which the present volume of water resource is proving inadequate. Thus extraction of water from underground aquifers has been followed there by recession of underground water table. Even before ten years, water was available within twenty feet below the surface. But installation of fuel powered shallow pumps wherever necessary has almost depleted the upper layer of water table. There after came the deep tube wells followed by submersible pump sets with the notion of higher production. The mud collected from riverbeds very rich in humus was once used for manuring purpose is now as a raw material of high quality bricks. The brick kilns are responsible for diversion of channels for their commercial benefits.

Impacts of changes

The impacts of diversion of channels in the area under investigation may be stated as below:

The impact is the shortage of surface water which has forced the resident community to pull out ground water in huge amount. This has direct effect upon the surface water bodies which are drying up at an abnormal rate. Another important impact is the threat to the wet land ecosystems. In the *jhores*, the numbers of species dependent on water are facing extinction which may convey harm to the balance of the local ecosystem. Disappearance of channels should cause removal of wetland ecosystems as well as damage to the cultural ecosystems. The filling up of the channel beds through siltation enhanced by human actions has by now geared up the prospect of persistent floods. In addition, building of houses, roads and bridges on banks of channels and even on the lands reclaimed from river beds have reduced not only the volume of reserved surface water but also the speed of release of water in rainy season. In population characteristics it has already been noted that almost 50% of population in the study area are either small cultivators or agricultural laborers who dependent upon production from land, that is agriculture and fishing from water bodies., These people should have to face profound trouble, if the most valuable resource, that is, water is absent.

Conclusion

In conclusion, it may be stated that the area under study needs a scientific plan first for the revival of the river channels for the survival of the human community inhabiting therein. Firstly, the river courses must be released from infringement through extension of settlement, agriculture and industries like brick kilns. Secondly, as a significant portion of the population is dependent upon agriculture, must be secured of incessant supply of irrigation water, not from subsurface but from surface area. Thus diversion and slicing off of channels must not be encouraged; it will be more prudent decision to utilize them as innate reservoir. Thirdly, the wet lands facing fear of drying up through over siltation, excessive withdrawal of water and encroachment. Fourthly, plantation on both sides of every reclaimed channel is needed immediately to hold the sediments flowing free. This plan should be extended to the source areas of random soil erosion active in the upper courses. Lastly, for the continued existence of the human community of the area, integrated approach incorporating all the points stated above is necessary.

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