



Livelihood Dynamics as a Response to Natural Hazards: A Case Study of Selected Places of Basanti and Gosaba Blocks, West Bengal

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Abstract: The Indian Sundarban with a shore length of 130 km is topographically a low lying flat alluvial plain, dissected by a large number of tidal rivers, estuaries and creeks. The reclamation activity in the islands of Sundarbans for resource generation and resource consumption was accentuated in the latter half of the 19th century replacing mangroves by the Colonial Government of India. The premature reclamation was done by raising embankments all along the river banks which has reduced the spill areas of rivers leading to in channel siltation. Thus the tidal floodplain, devoid of silt is always at a lower level than the water level of the rivers. Moreover the creeks of Sundarban are severed from their freshwater upland sources and record increase in salinity. Comparison of data of 1984 and that of 2001 shows drastic increase in the salinity of the outer estuary (26 ppt to 36.2 ppt) and that of mid estuary from 20 ppt to 26 ppt for summer of the eastern sector. (Chand et al, R. K Trivedi, S. K. Dubey and M. M. Beg, 2012) Ref [4]. The study area comprising of places Hogolduri, Kalahazra, Katrakhali, Bagulakhali, Chunakhali, Parbatipur, Masjidbati of Basanti block and Sambhunagar of Gosaba block of West Bengal, India are highly vulnerable to hazards and disasters like tropical cyclones, embankment breaching and subsequent salt water incursion. This has led to occupational shift as agricultural lands are transformed to aquaculture farms. This paper takes into account this budding problem over the years and studies the livelihood pattern of the study area. Survey Of India toposheets of 1969 (79 B/12, 79 B/15 and 79 B/16) followed by satellite images (LANDSAT 4, 5 and LANDSAT 7, Path – 138, Row – 45, from USGS Earth Explorer) and Google Earth imageries have been used. Questionnaire surveys have also been conducted. It has been found that the area of aquaculture farms have been increasing at the cost of agricultural lands. Since the transformation of agricultural lands to aquaculture farms is permanent and the people need to adapt to this transformation, it is highly recommended to run the aquaculture farms on a co – operative basis so that the profits will be distributed among the stakeholders according to their share of land.

Keywords: Embankment Breaching, Cyclones, Aquaculture, Saltwater Incursion

1. Introduction

Cyclones in the Sundarbans take place in between May and November with maximum frequency in August. From 1891 – 2014 all types of cyclones is 79, that of severe cyclonic storms (1891 – 2013) is 20, that of cyclonic storms (1891 – 2013) is 11 and depressions (1891 – 2013) is 48 Ref [13]. During last part of the decade (2006 – 2009) the northern part of Bay of Bengal registered 4 cyclones – Sidr, Nargis, Bijli and Aila. On an average 9 cyclonic storms arise in every 10 years. Among 9 storms 3 storms become severe

cyclonic storms. Ref [14] Analysis of data over a period of 5 years has revealed that rivers like Matla, Thakuran and Saptamukhi have recorded an increase in salinity while the rivers still having connections with upstream fresh water sources record a decrease in salinity. Ref [3] Under the scenario of frequent cyclones, embankment breaching and salt water flooding the people of Sundarbans face a decrease of soil fertility and an inevitable and abrupt transformation of agricultural lands to aquaculture farms. In this scenario, the local people have adopted a livelihood strategy and have encountered an occupational shift. This paper aims to address the transformation to fish farm plots and see how this

modification can be adapted to with maintenance of economic balance.

2. Study Area

The study area comprises of village panchayats of Chunakhali, Ramchandrakhali, Masjidbati, Jharkhali of Basanti block and Sambhunagar island unit of Gosaba block, West Bengal, India. Ramchandrakhali village panchayat can be considered as the proper village panchayat as Basanti block office is located here. This is surrounded by river Matla to the west, Hana river to the east, Hogol river in south and Uttar Mokamberia village panchayat in north. Ref [9]. Chunakhali village panchayat is same as Ramchandrakhali.

Scope of employment is less here also. However, the brackish water fisheries generate additional employment in the village panchayat. Masjidbati village panchayat under Basanti Panchayat Samity is located around 5 km SE of the block headquarters at Sonakhali and to the southern side of river Hogol. This is surrounded by Basanti and Bharatgarh GP to the west, Hogol river in the north, Karatal river in the east and Bidya river in the south. This comprises of 5 mouzas. Located in the southernmost part of Basanti block, the village panchayat of Jharkhali consists of 3 mouzas. Sambhunagar island unit comprises of the village panchayats of Sambhunagar, Pathankhali and Bipradaspur taken together for ease. This is a part of Gosaba block.

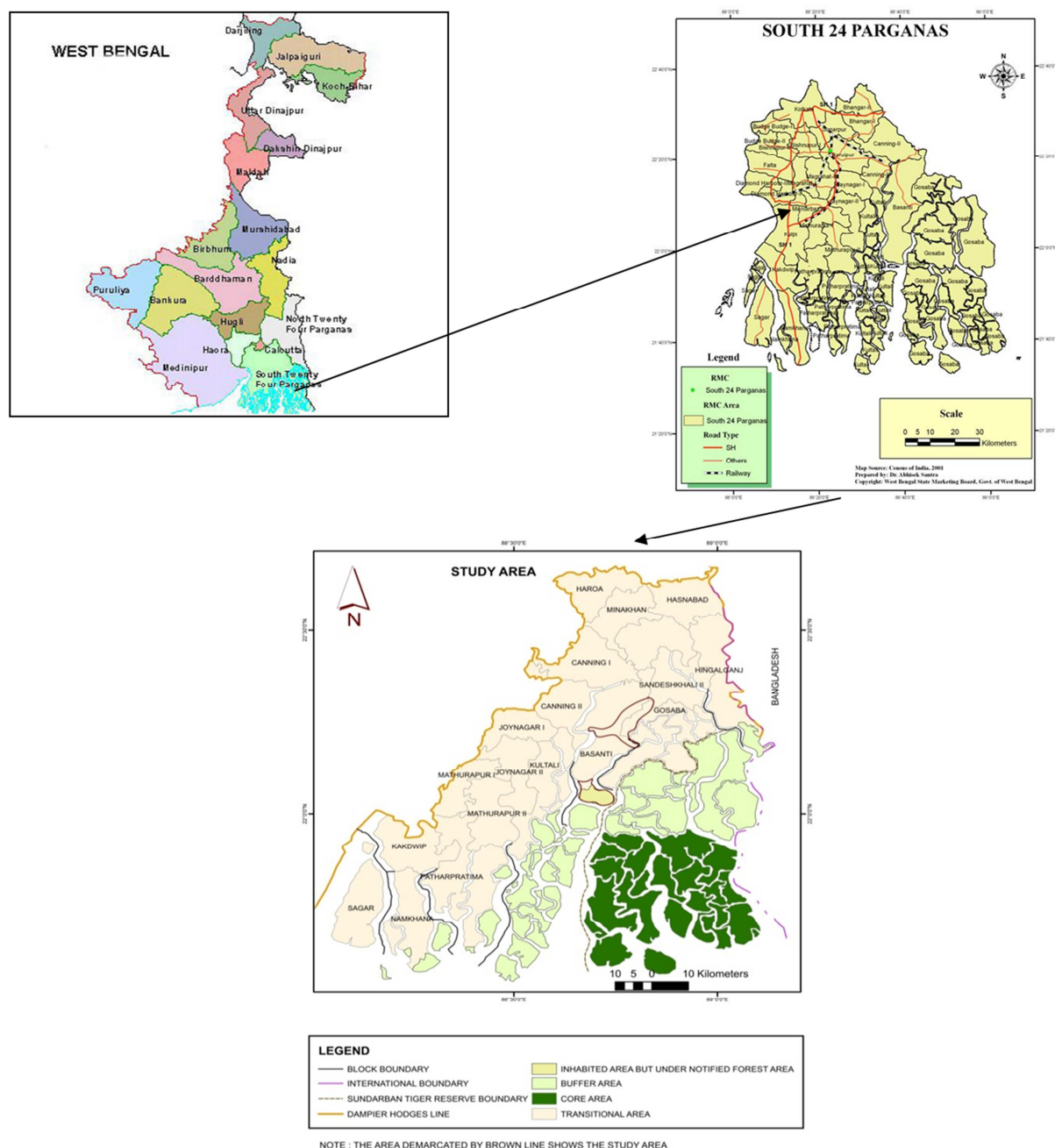


Fig. 1. Location map of the study area.

3. Population Dynamics

Population pressure forms an important indicator of the development of a place. Increasing population pressure often leads to hindrances in the way of development of the places.

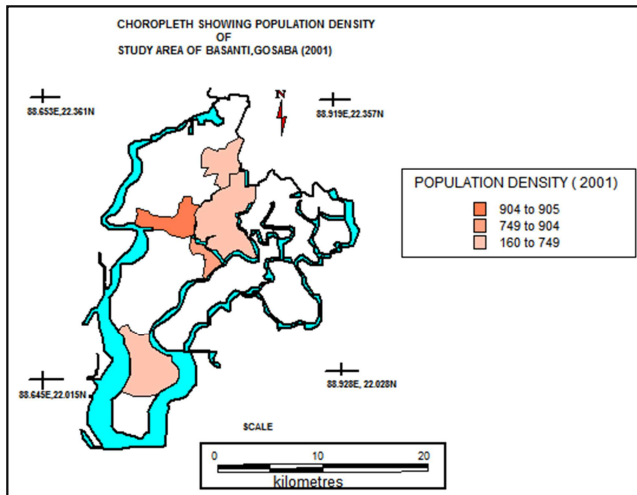


Fig. 2. Population density, 2001.

This choropleth map shows the population density of the GPs of the study area taken. Jharkhali has the lowest population density as large stretches of lands are uninhabited, while Ramchandrkhalali has the highest population density of all in 2001.

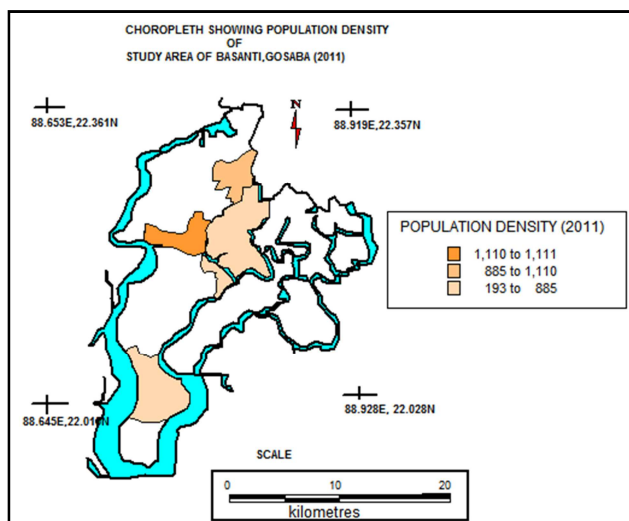


Fig. 3. Population density, 2011.

This map shows the population density of the same places in the year 2011. Still Jharkhali has the lowest population density and Ramchandrkhalali, the highest of all but there hasn't been much increase in population density, only a meager amount of 100. This suggests that there hasn't been much development owing to which these places have failed to attract population. Ref [9, 11]

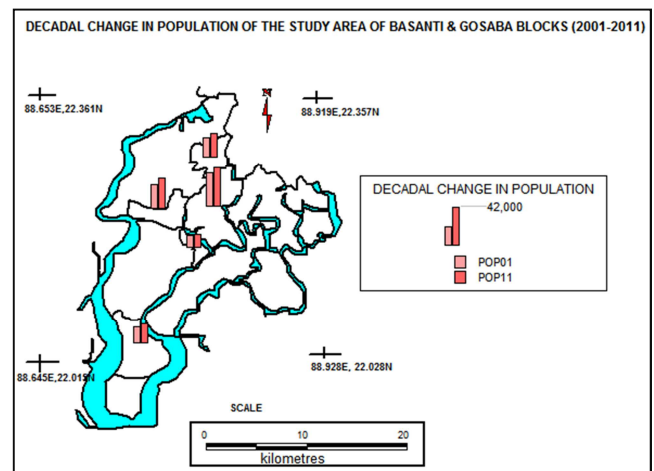


Fig. 4. Decadal change in population (2001- 2011).

Over the years it can be noted that with the increase in the area coverage of aquaculture farms, the agricultural lands also have increased in areal coverage at the cost of vegetation. At some places settlements have come up whereas at some places the settlements have shifted a bit owing to the establishment of the aquaculture farms. Vegetated areas are now found to border the rivers and creeks.

4. The Situation

Transformation of agricultural land to aquaculture farms –

Table 1. Transformation of agricultural land to aquaculture farms ((1986 – 2004) (after Chopra et al. 2007).

BLOCKS	TRANSFORM ATION FROM (km ²)	TRANSFORMATION TO AQUACULTURE (km ²)	PERCENTAGE TO TOTAL
BASANTI	Dense forest	1.184	3.17
	Paddy	25.79	69
	Others	7.53	20.16
	Total	37.37	100.00
GOSABA	Dense forest	0.71	2.21
	Paddy	21.14	66.23
	Others	7.72	24.19
	Total	31.91	100.00

Tracing the impact of embankment breaching and saltwater flooding as a result of frequent cyclones, it can be noted that over the years stretches of agricultural lands have been transformed into aquaculture farms, locally called bheries. SOI Toposheets numbered 79B/12, 79B/15 and 79B/16 of the year 1969 have been considered and no such aquaculture farms could be spotted. Laden with vegetation and settlement, the dominant land use of that time was that of agriculture. The LANDSAT 5 images of the study area having path 138 and row 45 have also been taken into account. For the year 1978 no such change in land use have been noted. No aquaculture farms are seen. However at Parbatipur of Jharkhali, a mangrove swamp is seen, a

potential site for bheries. The satellite image of 1980 also does not show any aquaculture farm in North Basanti but the mangrove swamp at Parbatipur has increased in area and a small aquaculture farm is seen to crop up at the western side of Parbatipur towards river Matla. The satellite image of 1992 shows the aquaculture farm of Parbatipur and it has increased in area. Another small aquaculture farm is seen to come up to the north of the first aquaculture farm. Aquaculture farms are noticed to come up at Ramchandrakhalai of North Basanti. Also, aquaculture farms can be seen to be set up at Chandipur of Sambhunagar island. The year 1999 witnesses a full fledged aquaculture farm at Parbatipur of Jharkhalai. Aquaculture farm at Ramchandrakhalai has increased in area. New aquaculture farms have come up at Kalahazra, Hogolduri, Bagulakhali,

Katrakhali. Aquaculture farms have increased in area in case of Chandipur and other area of southern part of Sambhunagar island unit. The year 2000 encounters further increase of area of the aquaculture farms which were established previously. Another notable feature is the establishment of new aquaculture farms beside Hogolduri and Kalahazra. The south western side of Sambhunagar island can be seen to be dotted with two new small aquaculture farms. In the year 2002 – 2010, the aquaculture farms have been increasing in area and in the year 2013 the aquaculture farms have come to prominence. Notable aquaculture farms are now seen at Chunakhali, Katrakhali, Bagulakhali and Sambhunagar along with the farms already present. North Basanti includes bheries of Chunakhali, Bagulakhali, Katrakhali, Kalahazra, Hogolduri, Ramchandrakhalai and those of Sambhunagar.

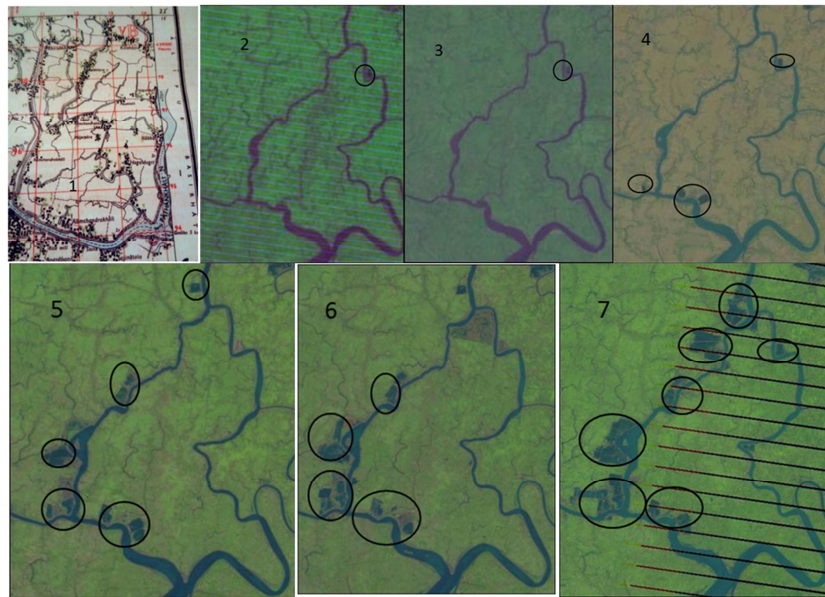


Fig. 5. Increasing fish farm plots of North Basanti (1 – 1969 SOI Toposheet 79 B/12, 2 – 1970, 3 – 1978, 4 – 1992, 5 – 1999, 6 – 2000, 7 – 2013 – LANDSAT 7, encircled plots are fish farm plots)

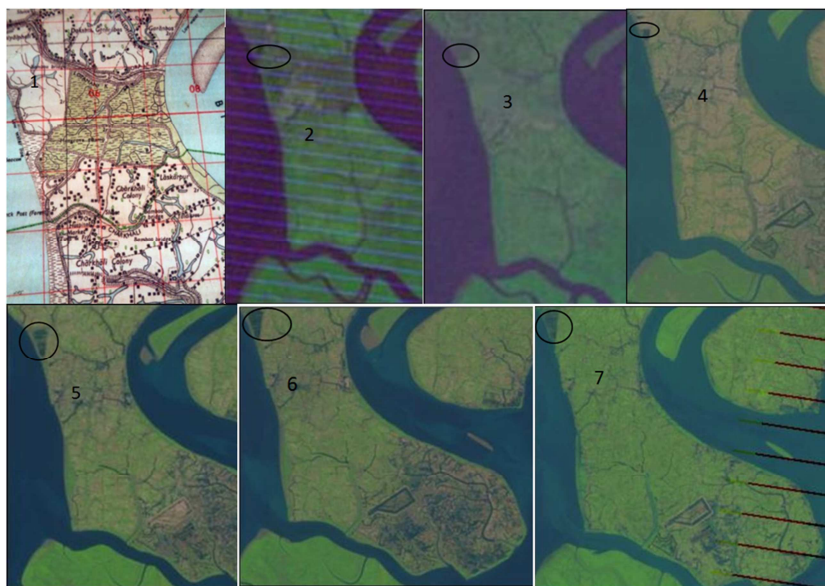


Fig. 6. Increasing fish farm plots of Jharkhalai of South Basanti (1 – 1969 SOI Toposheet 79 B/12, 2 – 1970, 3 – 1978, 4 – 1980, 5 – 1992, 6 – 2000, 7 – 2013 – LANDSAT 7, encircled plots are fish farm plots).

Table 2. Increasing coverage of aquaculture farms in sq km (calculated from Google Earth).

PLACES	2003	2004	2008	2010	2015
NORTH BASANTI	4.59	4.802	5.13	8.00	8.42
MASJIDBATI	0.029	0.029	0.1014	0.03	0.21
PARBATIPUR	0.196	0.252	0.252	0.30	0.33

It is notable from toposheets and satellite images that the sites having fish farm plots are bordered by rivers. This proximity to rivers accentuates embankment breaching during rainy season and subsequent salt water flooding. This drains away the fertility of soil and it becomes unsuitable for cultivation. As an adaptation strategy the local people transform these lands to aquaculture farms. Except Sambhunagar no other area of Gosaba block has big aquacultural enterprises. Gosaba block has an intricate network of rivers and is more vulnerable than Basanti but it has not developed a large number of aquacultural farms due to less proximity to Canning, a commercial hub. Sambhunagar island unit has some aquacultural farms due to nearness to Canning as compared to other remote locations of Gosaba.

5. Peoples' Perception

Villages of Masjidbati, Napitkhali and Sambhunagar were considered for questionnaire surveys. In case of Masjidbati the people engaged in fishery earn a monthly income of about 6000 rupees per bigha. The fishes farmed are mainly tilapia, prawns of various species, bhetki, bhangan, parse, tyangra. About 17 people were inquired in case of Masjidbati. In case of Masjidbati it was found that most of the people were engaged in works like daily labour and farming, some engaged in fisheries. Masjidbati has small fisheries unlike Hogolduri and other places. They earn a small income of nearly 2000 rupees which is not suitable for their sustenance. They live in mud houses mostly and the major problem faced there are storms, also the schools and health centres, moreover the drinking source lies beyond 2 km at times which is not good sign of development.

In case of Sambhunagar a total of 18 people were surveyed and they have opined that their major occupation is that of agriculture and minor occupations range from farming, to van driver, tailoring, animal husbandry, green grocery to fisheries. The income status is higher here than that of Masjidbati, here most people are of the income group of 9000 rupees. The major problem here is that of embankment breaching owing to which they need to shift their houses thrice a year. The case of Napitkhali in the vicinity of the big fisheries of Hogolduri is the worst. The land here is infertile and is not at all suitable for agriculture. Monocropping is the prime characteristic of the land here. The people of Napitkhali and Itabhati have ceded their lands to the owners of the fisheries who are primarily outsiders. The local people do get a monthly income from the lease of their lands but

most of the people earn a meager of 4500 rupees. The major problem here is embankment breaching and saltwater incursion. No electrification has been done as yet.

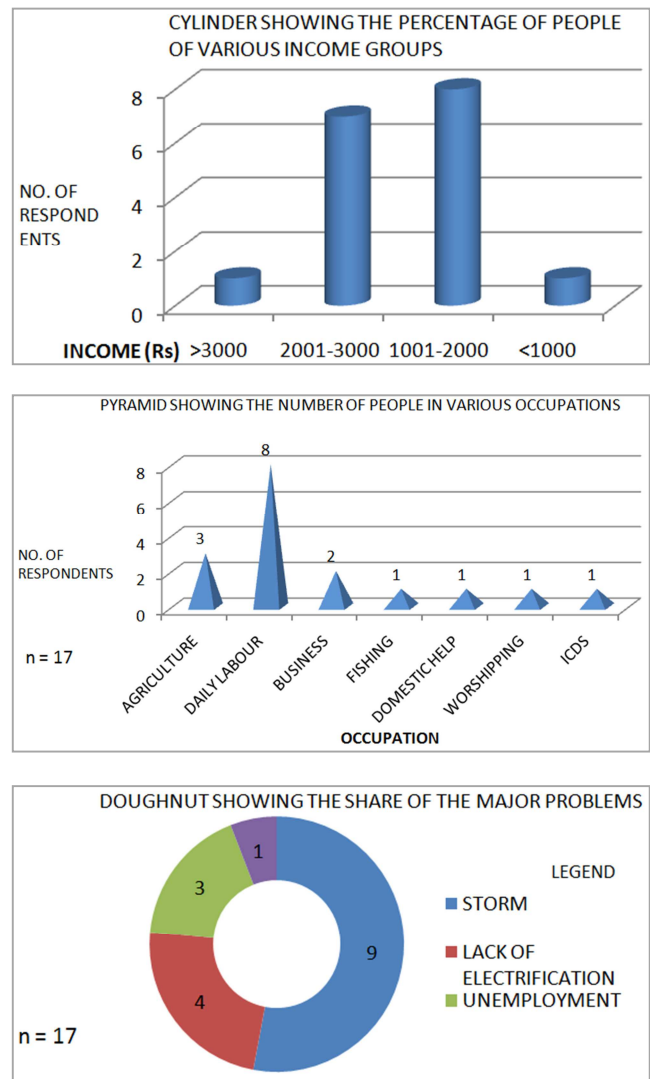


Fig. 7. Case of Masjidbati.

6. Conclusion

From the above analyses it has been evident that aquaculture farms are steadily increasing in their areal coverage at the cost of vegetation and agricultural land. However this change can't always be attributed to climate change and the increasing number of cyclones that follow. The strategic location of the study areas at the confluence of three or more rivers often leads to such a situation where repeated embankment breaching and subsequent salt water ingress leads to a change in occupation. This has been an adaptation strategy of the people of these places. However more capacity building to cope up the hazards is needed. Also more aids should be provided to these families who on the verge of this change are losing out their previous occupation and are at a loss of income. In case of all areas

encompassed in the study area aquaculture has proved successful. Investment initially is low as the only resource invested is land but the profits earned are reasonably high. If the land would have been used for agriculture, investment would have been high as extra cost would have to be incurred for seeds and other farming equipments. However, the local people of Masjidbati take aquaculture as a part time job and rely more on agriculture. In Jharkhali village panchayat approximately 700 bighas (3 bighas = 1 acre, 9 bighas = 1 hectare) of fish farm plot is run on a co – operative basis. 7 bighas of land are assigned to each person. The profits earned are distributed among the stakeholders. This is not the case of Hogolduri and Chunakhali which are privately managed. The stakeholders get only 15,000 rupees on an acre of land yearly. Government monitoring is absent and has to be enhanced. Co – operative pisci culture can be a fruitful measure as the land once transformed to fish farm plot is non renewable (seepage of salt water will continue and brackish water will enter with the eggs of fishes) and people need to adjust to it. Previously those who were engaged in cultivation have now turned to rickshaw pullers and daily labourers. It should also be seen if eco tourism can be developed around these aquaculture farms.

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