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Need of a paradigm shift in disaster management approach: A case study from coastal Sundarbans

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Abstract

Disaster management in recent years experienced a paradigm shift from the disaster response to disaster preparedness approach. Assessment of sustainability in this aspect became contextual especially for slow onset disasters, those makes a region more vulnerable promoting an event to become disaster. The coastal zones seek maximum attention of being disaster prone especially out of its vulnerability to global warming and climate change related disasters. Fallout of sea level rise, cyclonic surges and embankment failures, land loss due to erosion, salinisation of soil and water etc. are discussed and being addressed. On the other hand, slow degradation of soil fertility (due to causes other than salinisation), ionic imbalance in groundwater, non-sustainable shifting of professional activities, infrastructural ill-development and disaster perceptions of inhabitants jeopardizing the management efforts are overlooked in most of the cases.

This present study unearths some of these factors for a coastal area. *Sagar, Mousuni and Ghoramana* - three islands at the western boundary of the Sundarban were chosen as study area. The *Sagar* island being the largest among them shares better infrastructural facilities and holds a population of nearly 2.12 lac (Census, 2011), whereas, the population density is maximum at *Mousuni*, which is not even having electricity in the island. Such socio-economic and infrastructural discrepancies help in universality revalidation of the results. Soil and water quality assessment reveals not salinity but, imbalance of other factors are predominant in pockets, leading to lower productivity. On the other hand, lack of disaster perceptions, warning system and infrastructural facilities are found weakening the adaptive capacity of the region. Even the existing disaster management facilities are not being spread among people for proper execution.

It seems that the disaster management system is existing, but with improper orientation, which frequently leads under-preparedness.

Introduction:

Disaster as a field of study is believed to be in practice since 1917 when Samuel Henry Prince incepted the idea of disaster sociology in his dissertation of on Canada's worst catastrophe – the 1917 Halifax explosion (de Guzman, 2003). In its development through almost a hundred years it has got several different ideas to be defined as 'a serious disruption of the functioning of society, causing widespread human, material or environmental losses which exceed the ability of the affected society to cope using its own resources' (DHA/IDNDR, 1992). World Health Organization (1995) looked upon it as, deterioration of health and health services on a scale sufficient to warrant an extraordinary response from outside the affected community or area.

More recently, IPCC defines disaster as 'severe alterations in the normal functioning of a community or a society due to hazardous physical events interacting with vulnerable social conditions, leading to widespread adverse human, material, economic, or environmental effects that require immediate emergency response to satisfy critical human needs and that may require external support for recovery (IPCC, 2012). This has given the concept of disaster management a new dimension that focuses more on overall societal development leading to preparedness. A healthy society is less vulnerable and can fight back any consequence better.

When Disasters strike an unprepared community, the damage can be incredible. But ironically with no sense of immediate need Community Preparedness is rarely a priority (Anonymous, 2011). Even the people sometimes do not get themselves prepared for the odds, as they do not perceive the need of it. It has already been established while the hazardous events cannot be averted, the consequences may be minimized. Hence, the disaster is averted. The working principle of Disaster preparedness is to minimizes the adverse effects of a hazard through effective precautionary actions, rehabilitation and recovery to ensure the timely, appropriate and effective organization and delivery of relief and assistance following a disaster (Kent, 1994)

Human societies have the capacity to recognize the risks and potential causes of disasters and also the appropriate interventions to control or manage them as well. It is the society – that needs to recognize the importance of community action such as capacity and capability building, including planning for the response to potential disasters, managing and mitigating their effects (de Guzman, 2003). Interest is growing in supporting vulnerable people and communities to

adapt to the impacts of a changing environment. There is a general assumption that there are close links between development and adaptation. But, in reality, the impacts, those development interventions have on adaptive capacity at the local level remains limited (Jones et al. 2010). In most of the cases, either a lack of perception among the people regarding potential risk or a lack of coordination between the society and the management authority jeopardize the process. The disaster management initiatives of the Government of India have focused on disaster preparedness primarily on the institutional level where preparedness in dealt with arrangement of rapid and effective relief and rehabilitation operation. However, it also feels the need of community based capacity building at village level for disaster mitigation and to make it a day to day affaire. Even the disaster management has been introduced under social science study at school levels having a goal of grass-root penetration (NDMD, GOI, 2004).

This present study was designed to unearth the gaps lying over the disaster prone regions, where most of these preparedness and mitigation strategies seems to have failed over years. The three islands under study, share the similar environmental setup and consequent disaster threats while enjoying different extent of infrastructure facilities. *Ghoramara* is a vanishing island with more than 50% of its land already eroded out since 1969 (Jana et al., 2012), while *Mousuni* is facing the threats of erosion at its southern tip (WWF, 2010). In contrary to these two, *Sagar* island covering an area 10 times of *Mousuni* and 50 times of *Ghoramara*, is having both erosion and accretion at places. The island is economically more stable and enjoys better infrastructural facilities, like electricity, black topped road network, community health centre, higher education institutes etc. The annual gathering at *Gangasagar Mela* strengthens its economic backbone further. Such variability among islands enables the researcher to have a comprehensive idea regarding the overall disaster management set up.

Methodology:

Sundarbans has been identified as one of the vulnerable areas in the climate change context due to its ecological fragility (Jagtap, 2007; Erwin, 2009). *Sagar* and adjacent islands of Western Sundarbans host high rate of inhabitation and least mangrove protection. The pathways of major cyclonic events further add up to its vulnerability. Considering these factors the area was chosen to be an ideal study area for the present study.

Although, the infrastructural facilities leading to better resilience and establishment of protective measures and warning system for averting the disastrous consequences of any event are assessed for disaster preparedness, but this particular study focused on the societal linkages. Household level survey and simultaneous assessment of environmental quality was conducted tracing out the answers of the following issues:

i. Whether the proposed and set preparedness reaches the stakeholders or not?
ii. Whether the people are ready to accept the set preparedness options or not?
iii. What makes some inhabitants evasive of using the stated guidelines?
iv. Is there any environmental factor remains unnoticed, which otherwise leads to reduced resilience?

The survey was conducted using a pretested questionnaire for one to one interview. Caution was taken to cover respondents from all the age groups, sex and casts. A total of 27 villages (*Mouzas*) in the study area were covered that includes all the *mouzas* of *Mousuni* and Ghramara island and 52% *mouzas* of *Sagar* island. However, at each of the *mouzas* 12 to 22 households were chosen randomly, that accounts to a total sample size of 338 households representing a population size of 1657, as in case of disaster management or preparedness individual variations are not expected among family members and more as the questionnaire was so framed.

Simultaneous with the survey, samples of soil and groundwater were collected and analysed following the standard methodologies for the essential qualities, those affect the systems resilience. The soil sampling was done from different locations selected randomly within the study area covering all *mouza*s under study. Each of the samples are composite sample for the field of sampling. A total of 90 samples were collected from *Sagar*, all of which were analysed from pH and salinity and 59 among those were subjected to additional parameters like organic Carbon, Organic matters and NPK. 4 samples from *Ghoramara* and 17 samples from *Mousuni* were also analysed for all the parameters.

Ground water quality was assessed for 48 tubewells at *Sagar* island, 3 tube wells at *Ghoramara* and 6 tube wells at Maousuni island.

All the parameter concerned were analysed on site following the standard methodologies (APHA, 1986).

Results and Discussions:

Sagar, being the largest island of Sundarban island system has been a centre of attraction for the climate scientists for its vulnerability specifically to the cyclonic surges and sea level rise. Coastal erosion, prolonged inundation and soil salinisation have been discussed vividly in different literatures (Hazra et al., 2002; Ghosh et al., 2003; Jayappa et al., 2006; Gopinath, 2010). Strengthening of embankment, shore protections with mangrove plantations, road network development and other measures have been tried to reduce the vulnerability of the region of enhance the resilience. Very recent development includes electricity connections from the main land and construction of a few cyclone or flood shelters in the island. However, both *Mousuni* and *Ghoramara* islands are devoid of these infrastructural developments. While the former one is having two solar power stations and two under construction flood houses, *Ghoramara* has nothing (Table 1).

The road connectivity and availability of health care facilities are also much better at the *Sagar* island followed by *Mousuni* and *Ghoramara*. While 84.8% households of *Sagar* is having proper road connections including 11.8% blacktopped 1.9% RCC and 71.1% brick roads, on the other hand none of the other islands are having any black topped or RCC roads. However, the *Mousuni* and *Ghoramara* is having 86.8% and 90.9% brick road connectivity to its households (Table 1). Very recently, a major portion of these brick roads are found be reconstructed as RCC roads in *Mousuni* and *Sagar* island.

The major lacunae in disaster preparedness as was found during this study is lack of proper warning system, which plays cornerstone in most of the disaster management plans. Only 51% people at *Sagar* , 9.45% at *Mousuni* and 4.55% at *Ghoramara* are having access to local warning spread by the police station.

Table 1: *Infrastructure available for disaster preparedness*

The Study Island	**Population* Density (2011)**	**Pop. Growth Rate (%)**	**Road Condition (%)**				**Health Care**			**Warning**		**Electricity**		**Cyclone Shelter** (all under construction)
			BT	**RCC**	**Brick**	**Earthen**	**CHC**	**PHC**	**Sub Centre**	**Siren**	**PS (Access %)**	**Grid**	**Community Solar**	
Sagar	822	14.6	11.8	1.9	71.1	15.2	√	√	√	X	51.3	√	√	4
Mousuni	919	10.3	X	X	86.8	13.2	X	√	√	X	9.45	X	√	2
Ghoaramara	1081[#]	- 0.8	X	X	90.9	9.1	X	X	√	X	4.55	X	X	0

[# Considering the estimated land area in 2010 as per Jana et.al, 2012; * *Source:* Census of India Report(PCA), GOI 2011]

Consideration of management activities for reducing physical vulnerability of the island systems shows some positive trends and optimistic condition. But, this particular study has revealed a few unique societal responses which do not supplement the disaster preparedness. The disaster perception varied widely from that was expected. With our surprise, less than 1% respondents of *Sagar* island and none of the respondents in other two islands consider cyclonic storm as a disaster that demands any preparedness. They are most concerned about the surges and flooding of the area irrespective of the origin of the event (Table 2). Consequently very few of them think of moving out of their houses to a safe shelter during cyclone and surges, even when the shelters are available in vicinity and remained connected with roads.

Table 2: *Proportion of people perceive different events as disaster*

Area	Cyclone	Surge	Flooding	None
Sagar	0.76%	22.43%	69.96%	14.46%
Mousuni	0.00%	35.85%	75.47%	5.66%
Ghoramara	0.00%	59.09%	75.47%	0.00%

The percentage of people voluntarily moving to a safe shelter is as low as 28.6%, 37.74% and 31.82% at *Sagar, Mousuni* and *Ghoramara* respectively. It is estimated that, among those who prefer staying at home even during cyclonic storm and flooded condition 39.39% are having safe shelters within 1km from their home at *Mousuni* and *Ghoramara*. The proportion of such inhabitants are slightly lower (35.1%) at *Sagar* island. In fact, all the blacktopped roads in *Sagar* and as much as 80% of the brick roads at all the islands remain usable or partially usable during the event (Table 3).

Table 3: *Availability of scopes to those who are not ready to leave their houses during event.*

Study Area	People who do not avail a safe shelter					
	% of people	Distance of Safe shelter		Road condition remains		Aware of evacuation route
		<500m	< 1 km	Usable	Partly usable	
Sagar	71.4%	14.36%	20.74%	38.30%	43.62%	22.87%
Mousuni	68.18%	12.12%	27.27%	12.12%	60.60%	36.36%
Ghoramara	62.26%	26.26%	13.13%	46.67%	26.67%	33.33%

Hence, it seems neither the road condition nor distance from a safe shelter, but the lack of disaster perceptions among the people resist them to go for a safe shelter facilitating any relief operation.

This study simultaneously kept a close eye on some physical factors related to resilience building of the set up. The portion may otherwise be termed as slow onset disaster and includes soil and water quality having direct bearings on health and productivity. As a general trend, most of the respondents who complained for reducing productivity held salinity responsible for it. But, soil salinity tests even with the samples from direst months, did not report such trend. Only 5.7% soil samples from the *Sagar island* falls under minimum salinity regime, i.e. an ECe value of $1.9dSm^{-1}$ or more (Mitra & Santra 2011). In a few specific areas where already specifically, salinity problems were identified (due to vicinity of aquafarms and regular sea water intrusion) were excluded from this estimate. On the other hand, from *Mousuni* a similar proportion of soil salinity was reported while none of the samples from *Ghoramara* falls under the regime. However, if an ECe value of $1.0dS\ m^{-1}$ is considered as an indication of elevated salinity then 17% soil of *Sagar*, and 23.5% soil samples at *Mousuni* island are sharing the regime. However, major threat to the productivity of the study island systems have been identified as altered balance in NPK values and low organic content in soil. 75% soil samples of *Ghoramara*, 49.1% samples from *Sagar* and only 17% samples from *Mousuni* island have been estimated to have less than 1% organic matter. This is indicative of excessive tillage (Lal, 2008; Chan, 2008). The changes in cropping pattern from seasonal vegetables like chilli, tomato, water melon etc. to paddy monoculture may also have bearings on it. Land conversions (agricultural lands to aquaculture) and shifting in cropping patterns (from seasonal vegetables to paddy monoculture) seems reducing the resilience of the area slowly and unnoticed.

All the three islands under study have been found having a good numbers of deep tube wells of depth reportedly more than 200ft. None of the ground water samples represent a saline condition, although in general higher salt content (within the fresh water regime) was found at *Ghoramara*, followed by *Mousuni*. However, in another set of ground water quality assessment in drier season at *Sagar* island, a trend of patchy variations in ion concentration was reported. The ionic concentrations were found similar to that of *Ghoramara* at the north-western tip of *Sagar*. As the

region is adjacent to Gharamara, it may have some sorts of geological control. The water quality distribution is not indicative of any deteriorating condition as yet, but it suggests a regular monitoring is needed to keep proper track on it.

Conclusion:

The results are quite capable of answering the central queries put forward and sheds light on some issues of slow onset disasters and/or factors those can make a disaster management ineffective. Although, there are differences among the environmental and infrastructural set up of the three islands under study, but the major findings on disaster perception remains to some extent similar. Lack of awareness regarding disaster preparedness in those areas is apparent, instead of formal and non-formal efforts of Governmental agencies and NGOs working in the field for years. It seems there have been some hindrances in percolation of the matter at grass root. Even at *Mousuni* with only 24sq.kms area such problem has been found. While an international NGO is working on community development and disaster preparedness in one of the four *mouza*s, respondents from the other three *mouza*s and even same *mouza* could not say anything about the programme. The matter is similarly predominant in *Sagar* island too.

Regarding the slow onset disaster management, no proper set up was found to identify the grey areas of productivity reduction and suggest an ideal management plan. Instead of showing concern about soil salinisation very few respondents were found to be aware of any salt tolerant variety. Even, the shifting cropping patters are very sporadic in nature, which leads to ineffective management in case of any natural disaster happens.

It is apparent that, underutilization of adaptive capacity may jeopardize the disaster management plan of the authority due to lack of awareness and acceptance of the approach. There remains an unnoticed or unattended wide gap in coordination of different sectors. Therefore, a paradigm shift seems necessary to invade the grass root. Mere establishment of cyclone shelters, evacuation route etc. would cease to work until a proper capacity building among stakeholders is executed.

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References:

American Public Health Association (APHA), 1985. Standard Methods for the Examination of Water and Waste water. 16th edition. pp. 1268.

Anonymous, (2011) Community Disaster Preparedness Handbook, *Dept. of Disaster Management*, *Virgin island*. www.bviddm.com

Chan, Y. (2008) Increasing soil organic carbon of agricultural land, *Primefact,* 735. 1 – 5; http://www.dpi.nsw.gov.au/__data/assets/pdf_file/0003/210756/Increasing-soil-organic-carbon.pdf

de Guzman, E.M. (2003) Towards total disaster risk management approach. UN Publications website, *Asian Conference on Disaster Reduction* 2003 Kobe, Janpan.

Department of Humanitarian Affairs – United Nations (DHA), (1992) Internationally agreed glossary of basic terms related to Disaster Management, *IDNDR*, UN, Geneva.

Erwin, K.L. (2009) Wetlands and global climate change: the role of wetland restoration in a changing world, *Wetlands Ecol Manage*, 17, 71–84

Ghosh, T. Bhandari, G. and Hazra, S. (2001) Assessment of Landuse/ Landcover Dynamics and Shoreline Changes of Sagar Island through Remote Sensing, *Proceedings of 22nd Asian Conference on Remote Sensing*, 5- 9 November, 2001, Singapore.

Gopinath, G. (2010) Critical coastal issues of Sagar Island, east coast of India, *Env. Monitor. Assest*., 160, 555–561. (Published online, 2009).

Hazra S, Ghosh, T. Dasgupta, R. Sen, G.K. (2002) Sea Level and Associated Changes in the Sundarbans, *Science and Culture,* 68 (9-12), 309 – 321.

IPCC (2012) Managing The Risks of Extreme Events and Disasters to Advance Climate Change Adaptation. *Special Report*, WG1 & WG2.

Jagtap, T.G. (2007) Response and adaptability of mangrove habitats from Indian subcontinent to changing climate, *Ambio*, 36 (4), 328 – 334.

Jana, A. Sheena, S. Biswas, A. (2012) Morphological Change Study of *Ghoramara* island, Eastern India using Multi Temporal Satellite data, *Research J. of Recent Sc.* , 1(10), 72 – 81.

Jayappa, K. S. Mitra, D. and Mishra, A. K. (2006) Coastal geomorphological and land-use and landcover study of Sagar Island, Bay of Bengal (India) using remotely sensed data. International Journal of Remote Sensing, 27: 17,p 3671 — 3682.

Jones, L. Ludi, E. and Levine, S. (2010) Towards a charecterisation of adaptive capacity: a framework for analyzing adaptive capacity at local level. *Background Note,* Overseas Dev. Institute, UK.

Kent, R. (1994) Disaster Preparedness (2nd Ed.), Module for Disaster Management Training Programme, UNDP.

Lal, R. (2008) Crop residue and soil carbon. *Proceedings of Conservation Agriculture Carbon Offset consultation.* FAO of the UN and Conservation technology Information Centre, Beck Agricultural Centre, Indiana. http://www.fao.org/ag/ca/Carbon%20Offset%20Consultation/carbonmeeting/3fullpapersbyconsultationspeakers/paperlal.pdf

Mitra, R. Santra, S.C. (2011) Influence of Brackish water aquaculture on soil salinisation. *Int. J. of Res. In Chemistry and Environment,* 1(2), 166-168.

National Disaster Management Division (NDMD), MHA, Govt. of India (2004), Disaster Management in India. pp.98.

World Health Organization, Coping with emergencies: WHO strategies and approaches to humanitarian action, 1995, Geneva.

WWF (2010) Sundarbans: Future Imperfect – Climate Adaptation Report, *WWF(India) Report*. Pp. 28.