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Mangrove Reforestation through Participation of Vulnerable Population: Engineering a Sustainable Management Solution for Resource Conservation

Abhiroop Chowdhury[1] and Subodh Kumar Maiti[2]

[1]Department of Environmental Science and Engineering, Indian School of Mines, Dhanbad- 826004. (Ex-Programme Coordinator, P.E.M.R Project, Tagore Society for Rural Development, Kolkata-700005)
[2]Department of Environmental Science and Engineering, Indian School of Mines, Dhanbad- 826004.

Abstract

Sundarbans, is the world's largest contiguous mangrove patch covering an area of 10,000 Km^2 and is the part of the progradation delta of Ganga-Brahmaputra-Meghna river systems that covers 80,000 km^2. It is recognized internationally as the UNESCO World-Heritage site Sundarban but is affected by the recent trends of Global climate change and increased frequency of tropical cyclones.

The most important role of mangroves is that they protect vulnerable mudflat from wave action; protect embankments by soil consolidation. Mangroves shield inland areas during storms and minimize damage. But Indian sundarbans are also one of the most densely populated region of the globe (37.6 Lakh as per 2001 census). Deforestation rate is high in the mangrove patches in the habitated islands of sundarbans (102 total islands of which 54 island is habitated), which accounts for 18% reduction from 2001-2009. Arable land is also facing serious loss of fertility due to raising salinity and other associative factors (21% loss of arable land from 2001-2009), which is putting stress on the socio-economic scenario of the region.

An endeavor is taken to reforest the naked mudflats in Satjelia Island (Goasaba Block, South 24 Parganas, India) by motivating local populace to encourage sustainable mangrove reforestation in place of nature exploitive resource extraction prevalent in this highly populated ecosystem. Most mangrove species produce propagules that are easy to

collect and plant. In the right conditions, growth is fast. Propagules may be planted directly which is generally adequate (particularly for Rhizophora spp.), although seedlings and saplings can be grown to a height of 0.3-1.2m beforehand. Partly because of the ease with which they can be re-planted, there have been many attempts at mangrove restoration, undertaken often as a forestry management initiative and for conservation of the ecosystem. Replanting mangroves as a forest is a useful first step to restore the ecosystem. Apart from this alternative livelihood options are provided to deter the inhabitants to engage in unsustainable resource utilization.

A total of 16.96 Hectors (Ha.), mudflat is reforested by plantation of selected mangrove flora in Satjelia and Dayapur mouja (Hamlet). Implementation of a sustainable management model for mangrove reforestation by involvement of local populace is elucidated in this paper.

Keywords: community participation, mangrove reforestation, common pool resource, sustainability.

1. Introduction

1.1 Background

Sundarbans is the largest single mangrove ecosystem in the world, lying within both India and Bangladesh, with about 40 percent of the eco-region within the Indian state of West Bengal. Recognizing its importance and uniqueness, the UNESCO declared the Indian portion of the forest as a world heritage site in 1987 (Seidensticker and hai, 1983; Das and Siddiqi, 1985). About 45 percent of the total area of the Indian Sundarbans is under mangrove forests, which is protected and consists of the Sundarban Tiger Reserve and the Reserve Forest West of Matla and Bidya Rivers. The remaining area consists of 54 islands inhabited by about 4 million people facing limited development opportunities

(http://www.sadepartmentwb.org/Socio_Econimic.htm).

The greatest hazard due to global climate change in Sundarbans is the increasing salinity of creek and ground waters (Ahmed et al. 2011). The winter irrigation is restricted and the productivity of crops is affected due to physiological stress put up by augmented salinity of waters.

1.2 Socioeconomic condition of Sundarbans

The ethnic composition of the Sundarbans is dominated by Scheduled Caste and Scheduled Tribe and other backward classes. The area is pre-dominantly mono-cropped and the productivity is pretty low. The occupational opportunities are few and far between in the absence of any sort of industry - big, medium or small, infrastructure, etc. Sundarban populace in the absence of alternative employment suffers from livelihood vacuum. In a situation like this, the socio-economic status of a

large section of the population is appalling. This paucity, rather virtual absence of income generating opportunities to a large section of the population drives them to fall back on forest and mangrove (Jalais, 2010).

The resources available to the people are land, water and forest. Forest provides some alternative sources of income such as collection of minor forest products like honey, wood etc. While entering inside the forest greedy dishonest timber yards approach the poor villagers if they can cut & supply trees to them. In doing so they use to damage the wildlife. Today's forest management needs alternative livelihood of the dwellers, reforestation and resource conservation. Alternative livelihood promotion required horizontal expansion of women empowerment. But migration of the male folk after AILA creates more vulnerability in the lives & living of women & children. Sometimes the entire family migrates even in distant places having no destination as an environmental refugee where everything & anything may happen in their lives. Power-brokers with vested interest utilise the opportunities of the entire situation.

2. Objective

The main **objectives** is Sustenance of people's economy & natural environment through promotion of alternative livelihood ,disaster risk reduction ,gender equality, in view of restoration of mangrove vegetation & resource conservation. A total of 16.96 Ha of mudflat is reforested through the participation of community in a phase of one year between January,'12 to December,'12.

3. Methodology

3.1 Location

The location is the Satjelia island (Goasaba Block, South 24 Parganas, West bengal, India), which is the last inhabitable island of Indian Sundarbans with Seven Hamlets in two Gram Panchayets (Satjelia G.P and Lahiripur G.P). The naked mudflat area is identified by field survey and suitable site is selected for plantation.

This programme is carried out in Sajelia Gram Panchayets. For the plantation programme Emblibari and Dayapur mudflats are selected in Satjelia and Dayapur mouja respectively. The area lies on the eastern side of the Satjelia island, overlooking Gomor river. The mudflats face two high tides per day and are inundated during those times by saline waters of the river.

3.2 Selection of vulnerable population

A total of 600 families are selected amongst the community through a baseline survey, and divided into 10 SHG (Self Help Groups-Women Groups) and 10 PCFC (Primary Committee for Forest Conservation-Male Groups) in each of the two hamlets. Selection was done based on Participatory Rural assessment (PRA) after assessing the socio-economic condition of the target population by a baseline survey. The organisational structures of the groups are given in the Figure 1a.

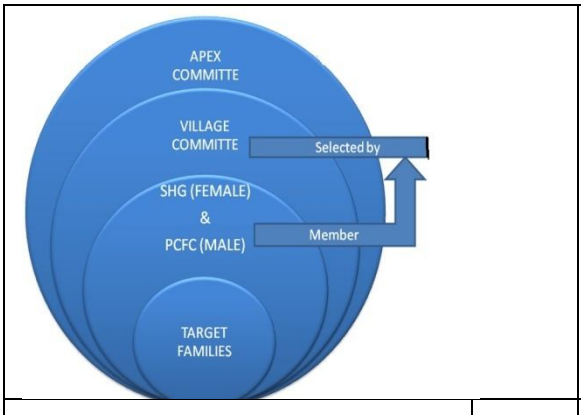

Figure 1a: The organizational structure of the groups

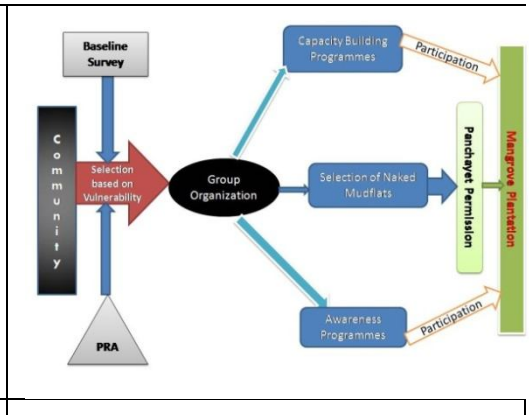

Figure 1b: Mangrove Restoration process through community participation.

This organizational structure created within the committee has given impetus to a bottom up structure empowered through grass root level prioritizing, planning, participation, and implementation and monitoring. Success of these groups reflects in regular meetings and follows up actions taken which signify communitisation and collective responsibility of the community to sustain the activities initiated. The process model adapted for the execution of the target resource conservation objective through community mobilization is elucidated in Figure 1b.

3.3 Capacity building investments

Resource conservation is not possible without the active participation, awareness of the local populace. So capacity building programmes are undertaken and groups (PCFC) are given responsibility for plantations.

4. Result and Discussion

Forest in the biosphere reserve is a “common pool resource”. The reason can be the injudicious utilization of resources that can exceed the caring capacity of an ecosystem and so can also degrade the same. Unrestricted public land is a “Common-pool resource”. “Common-pool resources [or commons]” (Wade, 1988) give rise to “commons dilemmas” (Wade, 1988; Agrawal, 2001) and in commons dilemmas, private actions of users have costs that cannot be overcome without collective action (organization) to regulate use, and therefore, collective action is found where commons situation have become commons dilemmas (Wade, 1988). Commons Dilemmas turn into “Tragedy of Commons” (Hardin, 1968) when society fails to control the exploitation of the recourses. This is the angle the Conservationists use to legitimize Resource Conservation by restricting its exploitation. The proportion of the unemployed population of Indian Sundarbans, in 1991 was 70%, with 27% in major employment categories and 3% in marginal employment. Only 10% are employed in agriculture and another 10% as laborers, among the major employment category

(http://www.sadepartmentwb.org/Socio_Econimic.htm). So, where poverty is a reality and population rise and immigration is a pressing problem, these conservation strategies, and bureaucrats implementing them are in a serious tussle with the resident populace of the area. The forest resources shared by the resident community outside the sanctuaries and National Park, is a common pool resource, and overexploitation of the same has turned the scenario into the "Tragedy of the commons", in perspective of Indian Sundarbans.

Biosphere Reserve is segregated into several distinct zones such as the Core Zone comprised of the National Park and the Tiger Reserve, a Development Zone which includes the reclaimed areas, a Manipulation Zone (2,400 km^2 of mangrove patch), a Restoration Zone covering 240 km^2 of degraded forest and saline mudflats and a Development Zone which including mostly of the reclaimed areas (Gopal and Chauhan, 2006). Only the Core Zone is under strict conservation measures. Income generating activities using common pool resource, such as the collection of seeds of black tiger prawn (*Penaeus monodon*), the collection of oysters and crabs, and apiculture are allowed in the Manipulation Zone. Afforestation of degraded areas is a major concern in this century (Gopal and Chauhan, 2006).

Group based governance of common pool resource is an effective concept used in different areas of the globe affected by commons dilemmas (Agrawal, 2001). Here in the scenario of Indian sundarbans, a dichotomy exists between conservation regimentation and constricted income opportunities of resident population, which is reflected on the condition of mangrove forests in the Biosphere reserve. It is shared by the community, so hugely exploited for fishing, animal husbandry, and land encroachment for habitation.

Food, shelter, and employment opportunities are the primary concern of the population of sundarbans leading a marginal existence. AILA in 2009 have devastated many villages rendering the arable lands useless due to intrusion of salt water. So capacity building ventures are initiated to motivate people to invest in sustainable resource utilization, namely organic farming (to rejuvenate low fertile arable land), Poultry (with native breed of hen), small business (tea stall, rickshaw van, and grocery shop), promoting fruit tree plantation, plantation of fuel wood tree (*Acacia* sp), vegetable garden to augment nutritional value of food and to sell in market and pond re-excavation programmes to hold rain water, to sustainably utilize water resources as a source of fresh water during the dry months (summer season). Capacity building trainings are given in order to equip the members with necessary knowledge to follow their chosen form of alternative livelihood. Group members have saved INR 20/month each in the collective bank account of the group, and they could apply for loan to continue the above mentioned activities, after the initial support, from the total savings of the group. The application and disbursement of the loan rest upon the decision of group members along with consent of the apex committee. This imparts sustainability to the support system, and motivates the group members to continue following their chosen alternative livelihood.

A total of 16.96 Ha. Mudflat is stabilized through plantation programme (table 1). The only variety considered for direct seeding method is *Avicennia* Sp, locally known as Bain. Apart from that other species like *Bruguiera cylindrica*, *Aegialitis rotundiflia*, *Ceriops tagal*, *Rhizophora mucronata* and *Xylocarpus mekongensis* are also been planted there. Approximately 2250 saplings were planted in 1 Ha mudflat. Direct seeding is done on this area and also some plants are brought from neighboring nurseries. Community and group member took part in mudflat plantation (Figure 2 and 3). All the species selected are mangrove plants to rehabilitate the degraded mangrove patches along the mudflats of which *Rhizophora* sp, *Ceripos* sp and *Bruguiera* sp. belongs to Rhizophoraceae family (True Mangroves- Tomlinson, 1986). As community of the same village is involved in the plantation process (member of the PCFC groups), they dissuade the other villagers from damaging the plantation during fishing and watch over it so that it is not exploited by grazing goats.

Figure 2: Plantation work with community participation

Figure 3: Mangrove plantation at Satjelia mouja

Table 1: Plantation Details.

Sl. No.	Gram Panchayat	Mouja	Location of Mudflat	Area Covered	No. of saplings planted
1	SATJELIA	STATELIER	EMLIBARI	12.1	22909
2		DAYAPUR	DAYAPUR	4.86	16901
	Total			**16.96**	**39810**

5. Conclusion

Mangrove forest of sundarbans is a national heritage. But nature exploitive activities like hunting for Tiger Prawn shrimps (Meendhara-local language), fishing in restricted water and poaching is the only option for the local populace in absence of any meaningful livelihood. Only enforcement of laws is not enough to effectively tackle this grappling problem. But alternative sustainable resource friendly livelihood options need to be introduced to the residents. So organized management schemes incorporating developmental incentives, in view of resource conservation, is an

effective tool to achieve this goal. This paper highlights an effective in-field implementation of such management model. Conservation along with awareness of alternative livelihood can be achieved by group based micro developmental schemes promoting sustainable resource utilization.

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