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Coastal Bio-Shields in Ampara District, Sri Lanka: Evaluation of Greenbelt Plantation

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ABSTRACT

Bioshields are the most important protection of the coast from extreme events such as storms andTsunamis. It was promoted to protect at large scale against severe natural disasters, though considerable debate over their efficacy as protection measures. This paper attempted to provide framework for evaluating and monitoring coastal plantation in Ampara district, Sri Lanka. The socio-ecological questionnaire-based survey on government and non-government organizations directly involved in coastal plantation efforts was conducted in Ampara District Sri Lanka.This study suggests that local communities need to be actively engaged in the decision making process. The pre and post-plantation phases had several gaps and need further planning and consideration in future. Lack of awareness and lack of public involvement, short term projects, lack of follow up programmes, removal of the sand, short distance from the sea, planting inappropriate time and not cover the rainy season, and destroyed by visitors/ local tourists were the important issues addressed should be considered in pre and post plantation phases could save precious time, effort and financial resources.

Key words *Biosheild, Greenbelts, Coastal plantation, AmparaDistirct*

Bio-shields are generally defined as planting vegetation belt along coastlines, which protect the inland from coastal storms, waves, tsunami and cyclones. They are considered low cost disaster mitigating option when compared with hard solutions (IUCN, 2007). Some of them are mangroves, coral reefs, sand dunes, Casuarina and coastal home garden which have different degree of protection to the coastal areas. In Sri Lanka, the importance of coastal protection had been realized after severe impacts of 2004-tsunami (Zoysa, 2008). A greenbelt is an area of green vegetation which formed for any purpose.

Informations from a range of sources strongly suggested that coastal forests had afforded some degree of protection from the devastation caused by the tsunami. After this tsunami, environmental restoration took an important part in the rehabilitation programme. Many programmes were implemented during the post-tsunami period to restore coastal trees and forests, and in particular mangrove forests. Many donor agencies poured the money to build up coastal bioshields and green belt. It is not clear how much all the institution worked on the coastal bioshield and greenbelt programmes reached their goals and targets (Mukherjee, *et al*., 2015).

The aim of this survey is to identify the types of coastal bio shields present, status of the bio shield, its sustainability and maintenance in Ampara district of the bio shieldprogrammes. The study also discuss the issue provide the recommendations for sustainability of the future projects.

MATERIALS AND METHODS

Field visits were made to all coastal villages in Ampara district from Periyaneelavanai to Panama, stopping and collecting informations on the way.The following informations were collected in each village of DS (Divisional Secretariat), GN (GramaNiladari) and the place or location, type of project implementing and implemented, name of the important organization or partner organization and the information on coastal bio-shield, types of bio-shield, extent of bio-shield (past and present), length, width and distance from MHL, project implementation period, technologies used by implementation, presence of beach seine, existing or present situation including percentage of success, existing practices – management, protection and follow-up activities, level of destruction, success for the project.The following were interviewed for the information in each village: communities, representative of the community who involved in this project, fishermen, key informants of implementing agency in Ampara district.

Visual score performance of greenbelt/ bioshield was made. Area of the plantations also was visually assessed to the nearest quarter acre. Limitation of the time for the survey did not permit detail quantitative assessment/ informations from authorised sources. The length of coastal region of Ampara district is approximately 120 km. All the coastal areas that having coastalplantations, in the Ampara district, were selected, which lies between Periyaneelavanai to Panama (Figure 1). Coastal area in this study was defined within 300 m from mean high tide mark (CCD, 2004).

RESULTS AND DISCUSSION

The following were found the main reasons that determining the sustainability and success of the bioshield/ greenbelt programme. The reasons are attributed from the coastal community interview. Visual score is an eye estimate of success in a given area, which may be partially biased.The results of the survey are given in table below.

Table 1. Details of Coastal vegetation in the coastal areas of Ampara District.

No	Coastal village	DSD	Agency	Species	When started	Area of the land project implements (in acre)	Visual score (%)	Reason
1	Periyaneelavanai	KLM	Sarvodaya, IUCN	1,6,8,11,	1,3	0.5	35	1, 2, 3
2	Maruthamunai	KLM	Sewa Lanka	1	2	0.75	0	1, 2, 3
3	Pandiruppu	KLM	Sarvodaya, IUCN	1,6,9,11,12,17	1,3	0.25	35	1, 2, 3, 4
4	Kalmunai	KLM	Sarvodaya, IUCN	1,6,9,11,12,17	1,3	0.75	35	1, 2, 3, 4.
5	Islamabath	KLM	Sarvodaya, IUCN	1,6,9,11,12,17	1,3	0.1	35	1, 2, 3
6	Kalmunaikudy	KLM		8	4	0.1	NA	1, 2, 3
7	Sainthamaruthu	SMT		2,12,16	4	0.15	40	1
8	Maligaikadu	SMT			4	0.25		1, 2, 3 .
9	Karaitheevu	KRT	Sarvodaya, Practical action	1,8,16,	1,4	2	45	1, 2, 3, 4
10	Addalaichenai	ADC	IUCN	8	2	0.5	30	1, 2, 3.
11	Akkaraipattu	AKP	IUCN, UNOPS	2,6,7,12,16	4	0.75	65	4, 5, 6
12	Thambaddai	AVP	IUCN, UNOPS	2,5,6,12	4	1.5	50	4, 6
13	Kanaganagar	TKL	IUCN, UNOPS	2,6,9,12	4	1	50	6
14	Thambiluvil	TKL	IUCN, UNOPS	3,8,11,12,15,17	4	1.5	50	6
15	Thirukovil	TKL	IUCN, UNOPS	2,6,9,11,12	4	2	50	6
16	Vinayakapuram	TKL	IUCN, UNOPS	2,6,11,12	4	2	60	6
17	Palakuda	TKL	IUCN, Sewa Lanka		2,4	4	60	
18	Manalchenai	TKL	IUCN	6	1	0.5	45	3
19	Komari	TKL	UNDP	6	2	0.75	35	3
20	Selvapuram	TKL	UNDP	6	2	0.5	35	3
21	Urani	PVL	UNOPS, FD	2,5,13,15,18	1	16	45	3
22	Koddukal	PVL		No planting	-	-	-	
23	Pottuvil	PVL	FD, UNOPS	6	2	1	15	4, 7
24	Panama	LGL	IUCN, Sewalanka	4,9,14,17	2		50	3

DSD: KLM-Kalmunai, SMT-Sainthamaruthu, KRT-Karaiteevu, ADC-Addalaichenai, AKP-Akkaraipattu, AVP-Aalayadivembu, TKL-Thirukovil, PVL-Pottuvil, LGL-Lahugala.

Species: 1) *Anacadium, 2) Azadirecta, 3) Bauhinia, 4) Bruguira, 5) Calotropis, 6) Casuarina, 7) Cerbera, 8) Cocus, 9) Luminitzera, 10) Pandanus, 11) Pongamea, 12) Pinus, 13) Rhisophora, 14) Sigium, 15) Terminalia, 16) Thespesia, 17) Vitex*

When started: 1) 1 year before, 2) 2 years before, 3) 6 months

before, 4) This year

Reason: 1) Lack of awareness and lack of public involvement, 2) Short term projects, 3) Lack of follow up programmes, 4) Removal of the sand, 5) Short distance from the sea, 6) Planting inappropriate time and not cover the rainy season, 7)Destroyed by visitors/ local tourists.

Ampara district has 11 coastal DS divisions among the 20 DS divisions. Coastalplantation had been found in all coastal DS divisions (Table 1). Natural vegetations were less from Periyanellavanai to Akkaraipattu due to higher dense population. The coastal strip was very narrow in Kalmunaikudy, Sainthamaruthu and Maligaikadu. Further, fisheries activities were high in these areas. Almost entire beach was used as landing sites. Therefore it was difficult to find the places for the improvement of green belt programme, except few trees.

Density of the natural vegetation gradually increased from Thambaddai to Panama. There were some recently developed sand dunes observed from Thambeddai to Urani. Necessary activities should be taken to promote these small sand dunes further. The well developed sand dunes from Pottuvil to Panama should be preserved from the destruction.Home gardens were very less in the coastal belt of Ampara district. A few home gardens were observed in Vinayapuram and Manatchenai. There were opportunities to improve the home garden in Ampara district.

Lack of primary data on coral reef was a great barrier for the management of coral reef in Ampara district. Some of the informations on coral reefs were collected from fishermen. They informed the coral reefs were located 600 to 700 m from the coast. From their informations, it was deduced that tsunami devastated much of the coral patches in the Ampara district. Therefore coral reef regeneration programme should be done in these areas.

Many studies reported the successful restoration of coastal plantations and failure projects are rarely reported (Lewis, 2005). Anyhow, there are many evidences for the failure or limited success of past plantation particularly for mangroves (Bosire,*et al*., 2008; Dahdouh-Guebas and Jayatissa, 2009; Hastrup, 2011; Primavera and Esteban, 2008). Though severalfactors could affect the success or failure of plantations, were discussed three temporal phases: pre-plantation, plantation and post-plantation (Mukherjee, *etal*., 2015)..

Pre-plantation

Awareness and public involvement:

Lack of awareness and lack of public involvement were major issues which were common to all coastal areas from Periyaneelavanai to Panama in Amparadistrict . Therefore, proper awareness programmes should be done to the public. Planting trees should give the direct and indirect benefits to the public such as food, medicine and fuel. Choice of species could be made through discussion with community. The plant species should be given much priority. Therefore public involvement will increase in the green belt programmes and will make more about the importance of green belt and create more interest.

The success or failure of a plantation is often determined by motivation for the establishment of the plantation, both in terms of their value for stakeholders, as well as for the implementing agency (Bosire, *et al*., 2008; Feagin,*et al*., 2010). It was reported that there would be a few drivers for their establishment based on the ecosystem services that such plantations provide apart from the coastal protection function of bioshields (Ellison, 2000, Bosire,*et al*., 2008; Feagin,*et al*., 2010; Mukherjee,*et al*., 2009).

Social support for plantations are important for the sustenance of any coastal bioshieldprogrammes. Long-term sustenance of plantations needs local supports particularly when the plantation takes place outside government owned land (Tanaka, 2009). Community participation is essential at the initial stage of identifying drivers for the plantations to ensure continued local support during and after plantation (Biswas,*et al*., 2008). However, Involvement of local communities in the planning and implementation could be used as a proxy for social support for plantations.

Policy and Financial resources

Financial resources are important for the establishment of plantations. In the absence of adequate policy and implementation to protect plantations from human impacts, such efforts may not be viable in the long term. Since plantations require maintenance, both in the initial phase of planting and also in subsequent phases to prevent grazing, illegal harvesting, encroachment etc., it is dependent on the financial resources allocated for monitoring and maintenance. Lack of financial support is a major issue in the sustainability of plantations (Biswas,*et al*., 2008).

Duration of the projects

Many projects in my study were short term projects. Therefore it was difficult to achieve expected results. Planting and watering were done for only a few days in many projects.. There were many short term projects implemented which failed in Ampara district. For example, avenue planting implemented by Practical action in Karaithivu, Mangroves planting in Maligaikadu by CIDA and Anacardium and Casuarina planting in Periyaneelavanai and Kalmunai by Sarvodaya. There were no proper maintenance and follow up process after a plantin and all the plants died. Relevant government and private authorities would not permit to the short term projects. Public participation should be enhanced for the maintenance of the green belt programmes implemented in the past. Community based organization would take the responsibility for the maintenance of such projects with the help of NGOs.

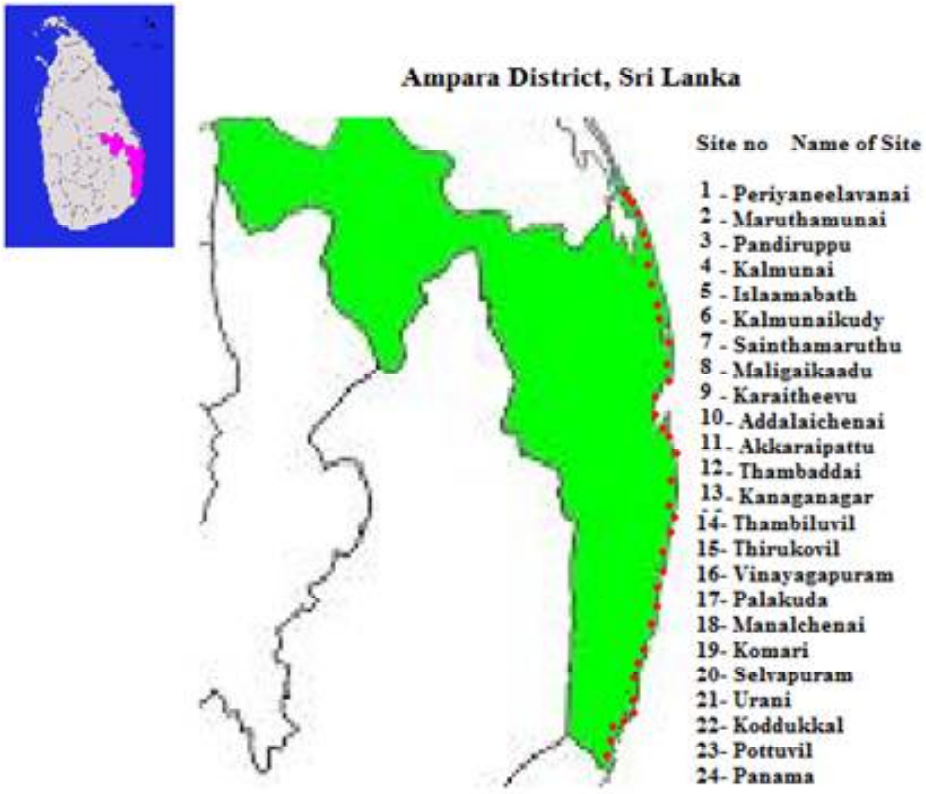

Fig. 1. The location of Biosheild plantation (study site) along Ampara District, Sri Lanka

Plantation

Site selection and a distance from the sea

Due to the tidal wave action, sea water was brought to the area of planting. Therefore water quality will affect the growth of the plants. Some of the plants of avenue planting programme by IUCN were still in the sea water which was brought due to the tidal wave action. In order to avoid such problems, proper traditional knowledge is important. For that, experiences and observations of community and fisherfolks can be utilized.

Site selection plays a key role in the success of establishment of a variety of plant species, whether they are natural or planted (Dobkowski, 2006; Wang,*et al*. 2009). The suitability of sites for plantation is particularly important for native plants like mangroves (Bosire.*et al*., 2008). Primavera and Esteban (2008) reported that inappropriate species and site selection have contributed significantly to the failure of plantations.

Time for the planting

The time chosen to plant a vegetation was obviously bad. Planting did not cover the rainy season. UNOPS and IUCN planted thousands of plants in the coastal belts ofAkkaraipattu, Thambaddai, Thambiluvil, Kanaganagar, Thirukovil and Vinayagapuram, was not covered the rainy season.One of the reason for the delay was to get the approval from funding agency for the implementing the programme. If they planted in appropriate time they would save finance and time. The CBO's involving in the green belt programme should consider that planting should be done in rainy season. At the same time, funding agency also should not be delay.

The Urani green belt programme was implemented by the UNOPS. In the budget of programme, provision for the watering was allocated only in the dry season. For more than three months watering was not done properly due to the rainy season failed. Therefore many plants were in danger. In future, NGOs and CBOS will take in to consideration of this issue.

Post-plantation

Monitoring and Follow up

Lack of follow up programes was one of the important issues in many short term and long term projects. It was noted that a plantation in Kalmunai had 2000 Casuarina and 1500 Cashew. It was only watered for few days. There was no fencing. All the plants were vanished with in a few weeks. Avenue planting in Karaithevu beach by Practical Action and Cocos planting in Addalaichenai coastal belt by IUCN were for it. A regular watering was not done in many projects. It was done a few days at the start of the project. Most of the plots where trees were planted did not have water resources, for an example many programmes implemented by UNOPS from Thambaddai to Thirukovil. A few of the plots consisted water resources like dug wells. Water quality parameters like salinity was not considered and not checked regularly. To over come this problem public participation should be enhanced and donor should make

a regular monitoring and evaluation.

It was observed that there were manybioshield plantations after a natural disaster. However, they lack long-terms sustainability focus or planning (Biswas,*et al*., 2008; Elster, 2000;Mukherjee,*et al*., 2009). It was reported the most mangrove restoration efforts have adopted atrial and error method instead of following a systematic interdisciplinary framework in Bangladash(Biswas et al., 2008). For the short term project, Post plantation care or monitoring was not included in the design of the project for most of the NGOs All bioshield project related activity ceases as soon as the funds are exhausted, with littleor no attention to monitoring and post plantation care. For instance, grazing has been reported as a major threat to the properestablishment of plantations in such areas (Biswas et al., 2008).

Removal of the sand

Illegal sand mining took place in some coastal areas such as Kalmunai, Karaithevu, Oluvil, Addlaichenai, Akkaraipattu and Sangamankanda. More than fifty tractors and Becho involved sand mining in Sangaman Kanda beach. In some case sand was removed from sand dunes (Pottuvil) and recently developed small sand dunes (Palamunai, Thambaddai and Thirukovil). The appropriate authorities such police and CCD should be informed to control the illegal activities in the coastal areas.

Disturbances from visitors and animals

It occurred due to the lack of awareness and no proper fencing. It was noticed fences were not frequently repaired in many places(ex; Pandiruppu, Kalmunai, Addalaichenai, Pottuvil and Panama). Pottuvil is famous for its Sand dune, which attracts many tourists. UNOPS implemented a green belt programme in the sand dune area of Pottuvil. They planted more than 1000 of Casuarina and fenced around the plots. But the fence and trees were destroyed by the visitors. Eventually this project was failed. The famous tourist beaches arepottuvil, Arugambay and Panama. Regular inspection and repairing should be done in related to fence.Hence, fencing could be critical for the survival of the plants in the initial stages, but it is not always used, as there are no clear plans or resources following the initial establishment. Funds earmarked for monitoring could be used as a proxy for assessing the commitment towards post plantation care. (Mukherjee, *et al*., 2015)

There is a pressing need to increase community participation in the plantation process. Local communities (primarily fishing communities),who live close to the coast are generally not consulted in the decision-making stage of the coastal plantation projects(Hastrup, 2011). It was noted that along the coast, sand dunes or sandy beaches originally occupied the areas where such plantations were established. These ecosystems are also natural bioshields (Rans,*et al*.,2011) and are currently heavily under threat due to large-scale plantation activities. It is important to view and critically analysebioshield plantations from the perspective of the ongoing debate on the valuation of ecosystems and implications for ecosystem functioning (Hooper,*et al*., 2012; McDonald, *et al*., 2008; Ochoa-Gaona, *et al*., 2010).

In conclusion, it could be said that this study suggests that local communities need to be actively engaged in the decision making proces. It was also noted that the pre and post-plantation phases had several gaps and need further planning and consideration in future. Lack of awareness and lack of public involvement, short term projects, lack of follow up programmes, removal of the sand, short distance from the sea, planting inappropriate time and not cover the rainy season, and destroyed by visitors/ local tourists were the important issues should be consideredin pre and post plantations phases that could save precious time, effort and financial resources.

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