Chapter 10
Regreening the Coast: Community-Based Mangrove Conservation and Restoration in Sri Lanka

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Abstract The importance of mangrove ecosystems in abating and controlling adverse impacts of natural disasters including tropical storms and wave action has long been recognized globally. However, following the 2004 Indian Ocean tsunami, there has been a special emphasis on reestablishing protective greenbelts such as mangroves along coastlines to reduce disaster risk. Sri Lanka, as an island nation, harbors nearly 12,000 ha of mangrove patches along the coast. In the past two decades, mangroves in the country have been destroyed and degraded significantly due to destruction of habitats and conversion to other uses. Conservation of mangrove forests has gained much attention in the recent past by different sectors due to their vulnerability to stressors and the ecological, social, and economic values of these habitats. Restoration and rehabilitation are among the available options in certain coastal areas in the island where mangrove communities have been degraded, disturbed, and destroyed to such an extent that it can no longer renewed naturally. As a result, there have been much involvements of the coastal communities and other conservation groups in mangrove conservation and restoration in Sri Lanka. This chapter focuses on two main aspects. It describes community-based mangrove conservation efforts in the country. Public awareness campaigns, efforts of capacity building, and skills development as well as disseminating of information are discussed. Secondly, it reports case studies and the steps taken by the communities to restore degraded habitats that include planning and implementation of projects. This chapter finally deals with the challenges faced by community efforts in mangrove conservation and restoration activities and the need of appropriate control over community projects by the government.

Keywords Mangrove • Conservation • Restoration • Sri Lanka

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10.1 Introduction

Impacts of natural hazards on coastal areas have been increasing evidently globally emerging new challenges. In addition, climate change and rise in the sea level are expected to generate disastrous conditions that hit on the coast including flooding, storm surges, and coastal erosion (O'Brien et al. 2006). These could result in significant environmental, social, and economic implications which could be critical specially to developing countries (Kamaruzaman and Dahlan 2008; Mitchel and Aalst 2008). On top of this, population expansion in the coastal areas and unsustainable development activities will drag more communities, property, and natural resources at risk (Helmer and Hilhorst 2006; Wickramasinghe 2010).

The importance of defense functions that natural ecosystems provide in minimizing and controlling adverse impacts of natural disasters has long been recognized in many areas in the world (Dahdouh-Guebas and Koedam 2006; Chatenoux and Peduzzi 2007). However, following the 2004 Indian Ocean tsunami, there has been a special emphasis on reestablishing protective greenbelts such as mangroves along coastlines to reduce disaster risk (Kerr et al. 2006).

Mangrove forests dissipate the force of tropical storms and reduce damage to coastal communities (IUCN 2011). These plants extend a crucial service in the context of climate change as they sequester even more carbon from the atmosphere than terrestrial rainforests, playing a key role in efforts to mitigate adverse impacts. Yet, globally, mangrove forests are diminishing in quality and rated as among the most threatened habitats, with rates of loss exceeding those of rainforests and coral reefs.

10.2 Mangroves of Sri Lanka

Sri Lanka, which is regarded as the Pearl of the Indian Ocean, is an island situated in the Indian Ocean toward the southeast of India between latitudes 5° 55′–9° 51′ north and longitudes 79° 41′–81° 54′ east. The island's land area is 65,610 km^2. The country has nearly a 1700 km long coastline and 30,000 km^2 continental shelf area which goes up to 120 m depth (CB 2006).

Being an island nation, Sri Lanka is gifted with many coastal ecosystems which include mangroves, coral reefs, and sea grass beds (Samaranayake 2000). Out of those habitats, mangroves have gained much attention due to their availability in intertidal zones being the connecting link between the sea and the land (Mittapala 2008). Mangroves are diverse ecosystems where characteristic plants and animal species live together. These living components are strongly linked with and interdependent on the nonliving factors (water, soil, air) in the location. They provide an array of ecological services that include providing feeding and breeding places for fish and other marine species, maintaining biogeochemical cycles, pollution management, and protecting the coast (Emerton and Kekulandala 2002).

Over 20 true mangrove species are found in the coastal areas of Sri Lanka covering approximately 12,000 ha. According to mangrove abundance and distribution, they can be categorized as very common, common, and rare. As per IUCN (2014), the very common species of Sri Lankan mangroves are *Avicennia marina*, *Bruguiera gymnorrhiza*, *Excoecaria aggalocha*, *Lumnitzera racemosa*, *Rhizophora mucronata*, *Rhizophora apiculata*, and *Sonneratia caseolaris*. True mangrove species are found only in intertidal zones and along lagoon edges that do not extend into terrestrial vegetation, whereas mangrove associates are found both within and in the peripheral areas of mangrove forests. True mangrove species consist of *Avicennia officinalis*, *Avicennia marina*, *Excoecaria agallocha*, *Excoecaria indica*, *Lumnitzera racemosa*, *Lumnitzera littorea*, *Rhizophora mucronata*, *Rhizophora apiculata*, *Bruguiera cylindrica*, *Bruguiera gymnorrhiza*, *Bruguiera sexangula, Xylocarpus granatum*, *Sonneratia caseolaris*, *Sonneratia alba*, *Scyphiphora hydrophyllacea*, *Pemphis acidula*, *Heritiera littoralis*, and *Premna integrifolia* (Weerasinghe and Wijesinge 2015). In addition, there are several mangrove associates too (Pinto 1986).

10.3 Conservation and Restoration of Mangroves by the Communities

Indian Ocean tsunami in 2004 was an eye opener which initiated many actions placing greater emphasis on disaster risk reduction. As a result of enhanced motivation, there have been many NGOs and other local institutions who started conducting mangrove restoration activities (IUCN 2007) (Fig. 10.1). These programs range from locally funded small-scale initiatives to island-wide projects with the aid of funding from external donor agencies. The main focus of such restoration efforts can be summarized below.

10.3.1 Education and Awareness Raising

Raising awareness has been the most common focus. Common characteristics of educational programs on mangrove conservation are presented in Fig. 10.2.

10.3.1.1 Booklets

Booklets on mangroves are not so rare, but incorporating such information in formal supplementary books that are to be distributed to the schools is still in infant stages. One success story is illustrated books and curricular published by EMES

Fig. 10.1 Mangrove planting at Kalpitiya (Northwestern Coast) (Photo credit: Deepthi Wickramsinghe)

Tools used	Elements covered	Groups targetted
• Print- leaflets, booklets • Electronic- documentaries, films, photos • Activities - dramas, role plays • Delivaries- lectures, talks, discussiosn	• Ecology of Mangroves • Distribution • Diversity • Uses/ benefits • Threats and issues • Conservation measures	• School children • Teachers • CBO/ NGO workers • Community members • Youth groups • Dependent groups - fishery, tourism etc

Fig. 10.2 Characteristics of educational programs on mangrove conservation

Foundation with educational texts in order to arouse enthusiasm among school children to conserve mangroves.

10.3.1.2 Educational Workshops for Stakeholders

Many coastal areas of the island are strengthened with supportive conservation activists who organize a wide range of educational workshops for the communities and NGO members to share knowledge on mangrove ecology and conservation. Most of these programs focus of all important aspects in mangrove conservation.

10.3.2 Capacity Building

Building capacities in the society have been addressed in many ways with the objective of strengthening public involvement. These activities have been planned and implemented in such a way that they offer something more than just education but with some hands on experience. For instance, some projects provide the community with access to resources and some on the other hand provide the visitors with skills and talents that are needed for positive actions.

10.3.2.1 Community Centers

These centers serve as "one-stop shop for information" with advocacy actions and demonstration sites. Some provide toolkits that include sustainable utilization of mangroves, restoration, and alternative livelihoods for mangrove conservation.

10.3.2.2 Mangrove Museums

In some areas, museums to display certain preserved specimens and parts of mangrove plants have been established as a means of educating the visitors.

10.3.3 Community Participation in Active Conservation

Community-led mangrove nurseries and tree planting programs have been evident in some areas with various stakeholder groups involved, such as fishermen families, traditional wetland users such as farmers and people living around mangrove areas, women groups and handicraft experts, teachers and school children, students, members of local authorities, and government agencies. Some projects provide services to entrepreneurs such as tourist boat operators. These programs get the fullest support and cooperation from the leaders of the area including priests of the temples and churches and fishery and farmer societies.

10.3.3.1 Mangrove Exhibition Gardens

In some areas mangrove exhibition gardens have been developed including common and threatened species. In one such garden there are 36 mangrove species, 6 of which are severely threatened. One salient feature is that visitors can watch not only mangrove trees but also associated environmental conditions as well as inhabitant animals.

10.3.4 Stewardship/Income Generation

Many conservation programs fail due to the simple lack or inadequacy of the immediate financial benefit they offer to the community. In this context, some mangrove conservation programs have been designed to generate tangible remunerations to the community, i.e., to provide alternative job training and microloans to impoverished women in adjacent to this nation's mangrove forests. In return, seedlings and small mangrove plants provided by mangrove conservation projects to the community members have to be raised in their home gardens and elsewhere. The next step is to plant them in selected locations and protect.

10.4 Case Studies on Community Mangrove Restoration Efforts

In this section, some success stories are described as case studies with elaborated activities that are aimed at community-led restoration initiatives. Both projects exhibit the different ways that community could get involved in projects with a vision of saving the environment and serving people. The first case study demonstrates an island-wide mangrove conservation project, whereas the other focuses on an area-specific activity.

10.4.1 Case Study 1: Island-Wide Mangrove Conservation Project by Sudeesha Foundation (Seacology (2015) http://www.seacology.org)

Recently, Sri Lanka's mangroves have been given a ray of hope in the form of island-wide conservation program. The island has got attention of the world being the first nation to promise the country-wise protection of all of its mangroves around the coastline with a major replanting program. These programs were initiated by Sadeesha Foundation, a local NGO with generous financial support

by Seacology, a US-based organization who has helped a 5-year USD 3.4 million project. In fact, such a massive project could have been possible due to continuous funding from the international donor.

Some salient features of this program include the active involvement of the coastal communities in site selection, preparation, maintaining mangrove nurseries, and replanting.

To the success of the program, the involvement of the government played a major role by providing legal protection and coastal patrolling for monitoring. Lack of incentives until now has been a major drawback in any conservation effort with community involvement. In these programs, the participant community members were first given a proper training and awareness and then offered job training as well as microloans to start an alternative livelihood or a business. Thus, around 48 lagoons in the country covering 1500 such village groups with 15,000 people have been given incentives in return of protecting their given patch of mangrove forests.

Although women play a key role in use and management of natural resource, they are often excluded from participating in decision making about resources, due to social, cultural, and other barriers. Particularly, in this project, sustainability of the activities has been achieved at least up to some extent by recognizing the central role played by female community members. Selected girls, female students, housewives, and women entrepreneurs have been identified to get financial benefits out of the project so that they in turn are encouraged to contribute effectively to the success of the activities. Among many, one key aspect of this project is providing loans for women participants to enhance their income generation activities and achieve financial security. According to the officials of Seacology, women have gained priority and almost 2000 loans have been offered to them, and the repayment rate has been 96 %. A win-win situation!

Involvement of the central government is a crucible factor in relation to the long-term sustainability of any project. Most of the conservation projects are generally poor in dealing with the government and secure continued support. Although no financial grants have been made available to the government of Sri Lanka, it had played an important role and contributed to the success of the "Seacology-Sadeesha project" in many ways. The efforts include demarcating and gazetting mangrove forests, providing legal protection for all of Sri Lanka's mangroves and providing rangers to patrol mangrove forests.

This project has covered another important aspect that improves the quality of life of low-income families by providing appropriate skills and investments for environmentally friendly vocations which safeguard coastal ecosystems and mangroves. This is one of the strategies adopted by the project to achieve conservation and development simultaneously where the interest of both groups has been served.

10.4.2 Case Study 2: Negenahiru (Rising Sun) Mangrove Restoration Project (Negenahiru (2015) http://nagenahiru.org/nagenahiru-mangrove-restoration-programme)

This particular program has been started in the southwestern coast of Sri Lanka after the 2004 Indian Ocean tsunami targeting protection of mangroves of the Madampa and Maduganga Lake Wildlife Sanctuary (Fig. 10.3). The main objective was to restore and conserve degraded mangrove habitats due to uncontrolled human interventions in the area which include illegal felling of trees, land encroachment of the wetlands, dumping of household sewage, and solid wastes as well as unsustainable fishery.

The project focuses on community-based administrative capacity development, research, and mangrove restoration by maintaining nurseries and replanting, monitoring, awareness, and education. A "mangrove exhibition garden" has been developed with 36 common and rare mangrove species, 6 of which are severely threatened. The garden serves as an "exhibition of live collection of specimens" with trees and animals as well as interactions of living and nonliving systems for the visitors of which a major component is comprised of school children. One key element of this project is the active involvement of stakeholders including traditional wetland users such as farmers and people living around the wetland, fishery community, women groups and handicraft experts, teachers and school children,

Fig. 10.3 Mangrove plant nursery maintained by Negenahiru Mangrove Restoration Programme, Maduganga, southern coast (Photo credit: http://nagenahiru.org/nagenahiru-mangrove-restoration-programme)

students, representatives from local and governmental authorities, community leaders, environmental activists, and entrepreneurs such as tourist boat operators.

The project also pays attention to obtain community participation and continuous involvement toward sustainability in many ways. They address poverty alleviation issues of the communities which obviously is a hindrance to societal development in the area by making them counterparts of the conservation actions. The project has helped establishment of community-based mangrove nurseries where they purchase plants from the local people which provides income. For instance, restoration and reforesting six acres of destroyed mangrove areas in the Madampa Wetland have been carried out by planting over 30,000 new seedlings provided by such groups. Being restricted to one particular locality in the island, this project would offer positive opportunities for collaborative and convenient participation of the local community for its sustenance.

Yet, some major obstacles have been identified as mangrove conservation which is being only one of many environmental-related activities in the mandate of this project, and this may sometimes lead to inadequate attention paid to restoration. In addition, financial allocations for smooth functioning of restoration activities could suffer due to nonavailability of funding on time since this project is partially dependent on external donor funding. In this context, it is not unfair to argue that some project component would not be operated in the same phase of others.

10.5 Challenges Faced by Community Mangrove Restoration Projects

Bringing back the species diversity, ecological coherence and natural balance to the degraded mangrove sites with the help of community are not always an easy task (Datta et al., 2012). A range of challenges may confront the successful planning, implementation, and maintenance of community mangrove restoration projects. These challenges may again vary depending on the project site, nature, and objectives of the project and communities. Table 10.1 summarizes the general challenges faced by mangrove restoration projects. This table depicts the common challenges to mangrove restoration projects that are in operation in relation to four visible aspects. However, the degree to which these issues affect a particular project is subjective and could be dependent on various other multi-causative factors. Nevertheless, the issues indicated in the table represent a broad perspective, and many projects practically encounter at least some of them during the course of operation. With appropriate frequent evaluation and correcting processes are in operation, these may be handled in a positive way or at least the extent to which these issues affect the projects could be reduced. For instance, if the goals of the projects could be achieved and tangible results could be exhibited with proper publicity, more donors specially from the international community could be attracted to secure funding for the future.

Table 10.1 General challenges faced by mangrove restoration projects

Element	Challenge
(a) Social	Inadequate commitment and interest of the participants
	Weak financial incentives for conservation activities
	Low potential for income generation for the stakeholders
	Insecurity based on ownership issues
	Too little support from the neighborhood
(b) Technical	Lack of capacity and technical know-how and skills in dealing with restoration work both in organizers and in participants
	Insufficient knowledge in "site-specific" scientific and ecological issues
	Weak research, follow-up, and monitoring activities
(c) Economic	Lack of sufficient and continued local or foreign funding for the sustainability of the project
	Inadequate support received in handling financial resources
(d) Political	Incapability of integrating restoration programs with other management plans in the area
	Poor support from the local and government authorities in planning and implementing projects
	Inflexibility in law enforcement
	Weak interagency communication

10.6 Conclusion

A brief summary of activities present in this chapter on community-driven restoration programs reveals that a great deal of efforts has been dedicated to the establishment, maintenance, and strengthening of "coastal belt of mangroves" which will support the process of regreening the coast. Nevertheless, in moving the activities of the NGOs on mangrove restoration forward successfully, it is of vital importance for an umbrella organization such as a government institution to get involved in different phases of such endeavors as an independent observer, facilitator, coordinator, steward, and a custodian.

From the two case studies, it could be learned that whether its area specific or island wide, continued community participation and benefit sharing such as livelihood support for the community play a significant role toward the success. Yet, the designing and implementation of the activities could be different depending on the situation. Secondly, it is not unfair to argue that making the local community feel important in conserving their natural heritage provided that logistical and financial support is extended by an external organization has resulted positive outcomes. Another lesson learned is that the importance of blending community awareness and capacity building with restoration activities.

As in many other countries, it is recommended that proper evaluation of threats and causes of destruction of mangrove vegetation is a must for successful restoration. It is important to note that mangroves are found in specific environmental conditions; hence availability of scientific information that include their ecology,

environmental parameters such as hydrology, and technical expertise gets priority in planning. Similarly, positive community participation with some tangible "benefits" for them as well too is vital. In addition, continuous funding from donors and support from the government too are essential for sustenance.

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