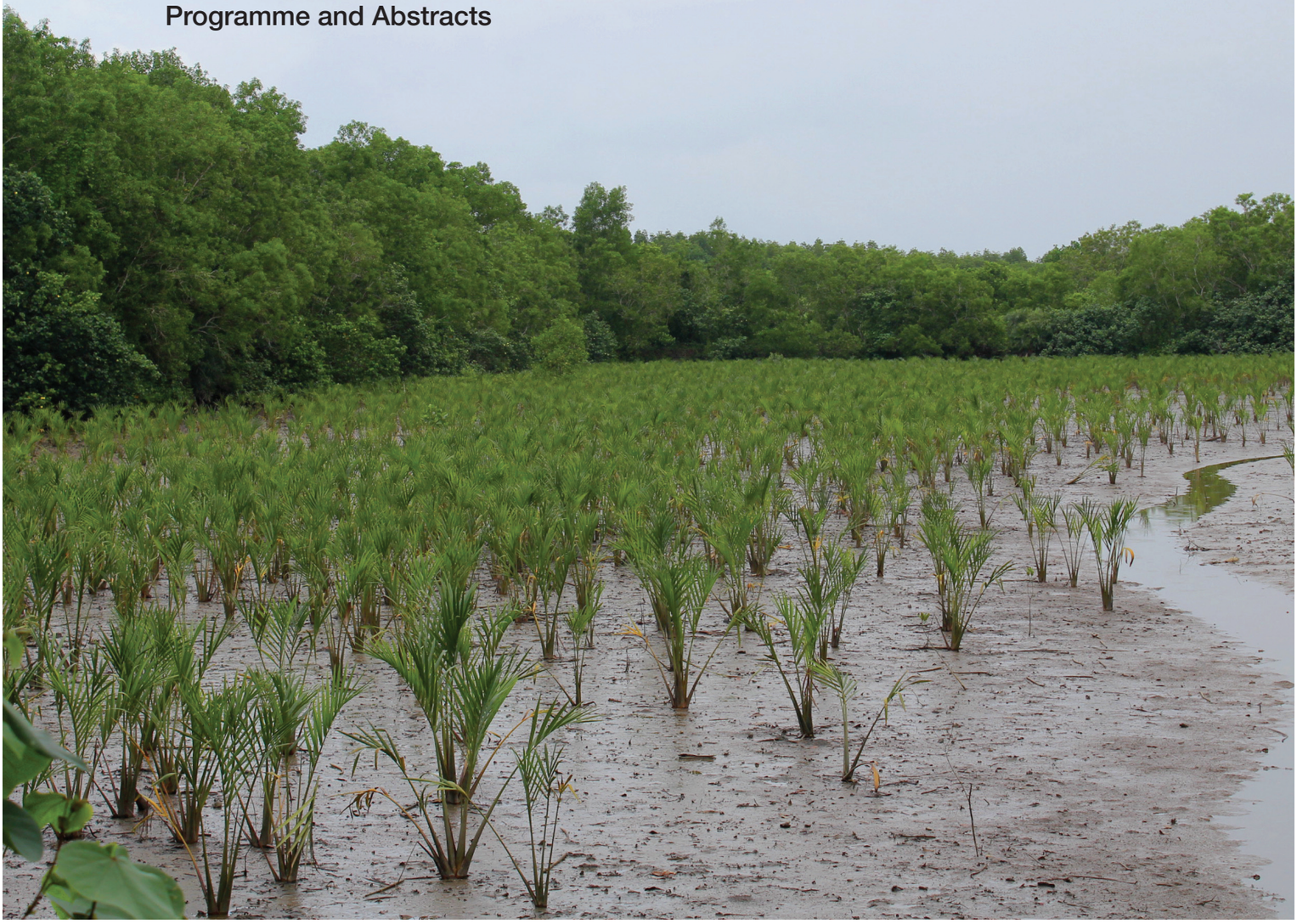
Mangroves for the Future
INVESTING IN COASTAL ECOSYSTEMS

Mangroves for the Future Regional Colloquium: Sharing Lessons on mangrove restoration

30 – 31 August, 2012

Radisson Blu Resort Temple Bay, Mamallapuram, near Chennai, India

Programme and Abstracts



Organised by:

Ministry of Environment & Forest, Government of India,

The MFF National Coordinating Body, India

and

Mangroves for the Future (MFF)

with support from

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M S Swaminathan Research Foundation, Chennai

and

IUCN India Office

Cover photo: *Nypa* planted in an abandoned shrimp farm, Trat, Thailand © MFF

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Background

Mangroves for the Future (MFF), through its small and large grant facilities has, since 2008, supported mangrove planting and restoration activities in several of its member countries. These activities have supplemented a large repository of other information and data on mangrove restoration built up over the last two to three decades, and especially following the 2004 Indian Ocean Tsunami.

Since the 2004 Tsunami, mangrove restoration has become a priority for national governments in their quest to provide security against sea storms and other natural hazards. Governments, coastal ecologists, international and national NGOs, national NGOs, local CBOs and coastal communities have shown great interest in mangrove-related activities for this and other reasons, including biodiversity conservation and livelihood support. Thus, international funding agencies and bilateral donors, as well as government agencies, have provided considerable financial support for numerous mangrove projects; these have been quite diverse in terms of their objectives, including inter alia mangrove conservation and restoration, planting of mangrove bio-shields, and mangrove education and protection. Similarly, the project implementing agencies (particularly iNGOs, NGOs and CBOs) also have displayed diverse interests and management approaches. This diversity of interests, approaches and attitudes to mangroves and their management must be understood in the context of the larger development perspective.

Members of coastal communities traditionally used mangroves and their products widely for timber, fuel, food and livelihood activities and for land development in more urbanized settings. Many of these traditional practices date back centuries but still continue in particular geographic settings, revealing that many coastal communities still remain dependent on the health and productivity of estuaries and lagoons for their needs.

Among the numerous mangrove projects that have been supported, some have provided very useful information on their contributions to improving coastal ecosystems and associated livelihoods. Yet, there are also many projects with uneven results. Overall, because of the 'project' nature of these activities, there has been very little critical evaluation of the overall consequences of these projects and the lessons that can be learned. These restoration activities need to be examined from the stand point of the societal values, improvement to coastal ecosystems, integrated coastal zone management and biodiversity aspects.

In order to address these concerns, MFF's Regional Steering Committee decided on a regional colloquium to share best practices on mangrove restoration.

Aims

1. Examine the various experiences from the countries where mangrove projects have been carried out
2. Enable countries to critically examine the merits and demerits of these mangrove projects
3. Share experiences so that countries can replicate the good practices

Date and venue

The colloquium will take place over two days, 30-31 August, with an optional mangrove field trip on 01-02 September.

Participants

International (i.e., from MFF member and outreach countries; selected MFF partners; other identified international delegates) and national (India) participants will be invited. Twenty to 25 international participants and 40-50 national participants are expected. Funding for invited presenters will be sponsored by MFF.

Scope

The colloquium will include presentations from MFF member countries and invited countries in the Asia Region on their experiences from mangrove projects, particularly in relation to the improvements to

coastal ecosystems and livelihoods of people. There will be a special reference to ecosystem services provided by mangrove ecosystems.

In particular, the colloquium is an opportunity to:

- examine the available scientific information and knowledge;
- debate the contrasting viewpoints stemming from the diversity of ideas and perceptions among different resource users and interest groups pertaining to mangrove ecosystems;
- address the inadequacy of meaningful information for building knowledge on the economic significance of mangroves; and
- seek sustainable solutions to the complex problems currently encountered, not only from science, academia, lobby groups, industries and governments representatives, but also through a society-wide dialogue.

Topics for the colloquium may include:

a. The economic and financial values of mangroves, and the need for restoration;

b. New planting and restoration – the basic tenets including geo-morphological context of coastal ecosystems, interest in mangroves, impacts of mangroves in their natural state and planted (or cultivated) state, impacts of mangroves on other economic activities/sectors such as fisheries, agriculture, tourism, biodiversity, hazard mitigation, and urban planning (in terms of flood protection and drainage);

c. Demonstration of benefits of mangrove restoration activities, and examination of and intended or unintended harmful effects of such activities on the ecosystem;

d. Mangrove planting based on simplistic thinking and insensitive to physical geography, to geomorphology and the complexity of ecosystem structure and functioning;

e. The need for accommodating the collective voice from primary resource users of mangrove ecosystems in mangrove projects;

f. Guidelines for good practices, monitoring indicators, and accountability mechanisms;

g. Examination of the predictable relationships between mangroves and impacts of climate change, specifically in regard to protection from coastal hazards (e.g. cyclones, erosion, floods, in their role as bio-shields, etc) and food security (e.g. drainage, soil salinization, water-logging).

Organization

Two committees have been formed to ensure effective implementation of tasks for the colloquium.

An Organizing Committee is formed to provide overall management of logistics related to the colloquium. MFF India, through the IUCN India Office, is the lead of this committee.

A Scientific Committee is formed from a panel of experts to decide on the acceptance of papers, presentations, posters, and proceedings of the colloquium. The Scientific Committee is also tasked to arrange the programme for the colloquium. The MFF Senior Adviser is the lead and focal point for this committee.

Mangroves for the Future Regional Colloquium: Sharing lessons on mangrove restoration

30 – 31 August, 2012

AGENDA

30 AUGUST 2012 (Day 1)	
08 00 – 08 30	**Registration**
08 30 – 10 00	**OPENING CEREMONY** (details will be provided at the Registration)
10 00 – 10 30	Coffee/Tea break
10 30 - 12 30	**SESSION I:** **Economic and Environmental Values of Mangroves and the need for their restoration/rehabilitation: Status and Challenges**
	• *Valuation, carbon sequestration and restoration of mangrove ecosystems in India (**J R Bhatt** and **K Kathiresan**)* [Pg-15] • *Indonesian mangroves: critical challenges and strategies for their sustainable management after the 26 December 2004 Tsunami (**Sukristijono Sukardjo** and **Y Felubun**)* [Pg-32] • *An overview of mangrove restoration efforts in Pakistan (**Shamsul Haq Memon**)* [Pg-20] • *A collaborative approach between tourism and coastal communities: a present-day need and opportunity for mangrove management and conservation in Sri Lanka (**P Upali Ratnayake**)* [Pg-25]
12 30 - 14 00	Lunch break
14 00 – 15 30	**SESSION I** (continued)
	• *Mangrove Restoration Efforts in Sri Lanka (**T S Ranasinghe**)* [Pg-24] • *Status of mangrove plantations in the Living Delta; An overview of the coastal afforestation experience of Bangladesh (**Ishtiaq Uddin Ahmad**)* [Pg-13] • *Mangrove Conservation and restoration in the Indian Sundarbans (**P Vyas** and **K Sengupta**)* [Pg-36]
15 30 - 16 00	Coffee/Tea break

16 00 – 18 00	**SESSION II:** **Lessons Learned from Mangrove Rehabilitation Projects**
	• *Lesson learned from the programme Let's Plant Mangroves: a case study from villages in Banten and Central Java provinces, Indonesia (**W Mahardi**)* [Pg-19] • *Restoration of deteriorated wetlands of Yala East National Park, Sri Lanka: a pilot project on mangrove restoration (**P Suranga Ratnayake**, **Y Mapatuna** and **P N Dayawansa**)* [Pg-26] • *Afforestation of coastal mudflats in Gujarat, India (**C N Pandey** and **R Pandey**)* [Pg-22] • *Genesis and present status of restoration practices in saline blanks (**V Selvam, R Ramasubramanian** and **K K Ravichandran**)* [Pg-29] • *Mangrove Restoration and Planting in Micro-tidal Barrier-built Estuaries and Lagoons in Asia - Ideology versus Sustainable Ecosystem Science? (**Jayampathi I Samarakoon**)* [Pg-27]
19 30	Colloquium Dinner (details to be informed)
31 AUGUST 2012 (Day 2)	
08 30 - 10 30	**SESSION III:** **Guidelines for Good Practices in Mangrove Restoration and Rehabilitation (including community involvement, monitoring and accountability)**
	• *Mangrove rehabilitation through community involvement: establishing mangrove conservation awareness and education (**Sylvanna Antat**, **Lyndy Bastienne** and **Terence Vel**)* [Pg-14] • *Local knowledge management for mangrove management (**Tanirat Tanawat** and **P Boonplod**)* [Pg-34] • *Active versus passive restoration of mangroves: developing models for sustainable rejuvenation of mangrove ecosystems used for shrimp farming in the north-western province of Sri Lanka (**Sevvandi Jayakody, J M P K Jayasinghe** and **Anushka H Wijesundara**)* [Pg-18] • *Restoration and return of mangroves and fisheries in abandoned aquaculture farms (**V Selvam, A Sivakumar** and **R Ramasubramanian**)* [Pg-30]
10 30-11 00	Coffee/Tea break
11 00-12 30	**SESSION III** (continued):
	• *Clam seed production and benefit-sharing in Xuan Thuy National Park, Viet Nam (**Nguyễn Viết Cách**)* [Pg-16] • *Mangrove planting, community participation and integrated management in Soc Trang Province, Viet Nam (**Klaus Schmitt**)* [Pg-28]

	• *Monitoring framework for replanted mangrove areas – Sharing the experiences from Pakistan (**Ghulam Qadir Shah**)* [Pg-31] • *Towards coastal health archive and monitoring national programmes (champs) for assessing change, and identifying drivers of change, in tidal wetlands and coastal margins (**Norman Duke**)* [Pg-17]
12 30 - 14 00	Lunch break
14 00 – 16 00	**SESSION IV:** **Mangroves, Climate Change and DRR: The Way Forward and a Call for Action**
	• *Navigating mangrove resilience through the ecosystem-based adaptation approach: lessons from Bangladesh (**Paramesh Nandy** and **Ronju Ahammad)*** [Pg-21] • *Disaster risk reduction through mangrove conservation and rehabilitation: a case study in Ayeyarwady Delta of Myanmar (**Maung Maung Than**)* [Pg-35] • *Adapting to natural disasters and contributing to climate change mitigation: mangrove community forestry in Viet Nam (**Sen Le Thi Hoa, R Suzuki and M F Thomsen**)* [Pg-33] • *Ecological mangrove restoration: re-establishing a more bio-diverse and resilient coastal ecosystem with community participation (**Alfredo Quarto**)* [Pg-23]
16 00 - 16 30	Coffee/Tea break
16 30 - 17 30	**Presentation of a Draft CALL FOR ACTION Statement**
17 30	**Vote of Thanks and Closing** (details to be informed)

1 and 2 SEPTEMBER 2012 (Field Visit)

A field visit to Chidambaram will be undertaken on 1 and 2 September, 2012. The detailed programme will be announced at the Colloquium. The tentative programme is as follows:

1 September 2012

- a visit to Auroville and its Botanical Garden;
- ICT-based Village Resource Centre of M S Swaminathan Research Foudation (MSSRF) in Pondicherry
- Overnight in Chidambaram

2 September 2012

- Visit mangroves in Pichavaram (see page 10);
- MSSRF- initiated restoration of abandoned shrimp farms.
- Expected return to Chennai around 6.30 pm

Pichavaram Mangrove Wetland

INTRODUCTION

Pichavaram is located 200 km south of Chennai in Tamil Nadu State. It is an important coastal wetland near the mouth of the Coleroon River. Covering some 1,400 ha, the mangrove forest of Pichavaram was declared as Reserve Forest (government owned) in 1897. Thirteen species of exclusive mangrove flora have been recorded in the mangrove wetland, but Avicennia marina alone constitutes 95% of the tree population. Other notable species present are Rhizophora apiculata, Rhizophora mucronata and a hybrid form of these two species.

MANAGEMENT HISTORY

The remote sensing data of 1986 indicated that nearly 60% of the mangroves were in a degraded state. The state Forest Department said it was because of cattle-grazing and tree-felling by villagers. MSSRF studies, however, showed that the clear-felling system of management practiced in Pichavaram between 1910 and the late 1960s was mainly responsible for the degradation. “Clear felling in coupes” is a system of forest management whereby trees are felled on a rotation basis every 20 or 30 years for revenue generation in coupes (plots) of about 10 to 15 ha. Studies indicated that coupe felling exposed large areas of mangrove wetland to sunlight and evaporation of soil water. As a result, soil in the coupe-felled areas shrank, changing the flat topography into a trough. Tidal water entered the trough-shaped portions and became stagnant. Evaporation of stagnant water increased soil salinity to a level lethal to mangroves. As a result, no regeneration of mangrove plants was seen in the coupe-felled areas, confirming this as the main cause of degradation.

THE LOCAL FISHER COMMUNITY

About 4,400 households living in four villages with 17 hamlets use the Pichavaram mangrove resources. There are almost 3,000 fishers, two-thirds of whom are the traditional fisher group belonging to the Periapattinavar community; the other non-traditional fisher group includes Irulars and landless wage labourers of the Vanniyar community. The mangroves are also used for fuelwood-collecting and for grazing livestock. The local communities have a rich understanding of the mangrove wetland

The Pichavaram mangroves support a wide variety of traditional subsistence fishing practices, including hand-collecting, or ‘groping’ of shrimp, trapping of crabs and catfishes, and fishing with cast nets, gill nets, and hooks and lines. The Irular community in particular practice the quite remarkable method of groping for shrimp by hand – this is a traditional occupation that is fascinating to watch. Mangrove oysters and other molluscs are also collected. There are also small numbers of other highly mangrove-dependent fishers who operate in small boats to catch fish and mud crabs; they commonly fish as a husband and wife team.

The reference study on mangrove fisheries in Pichavaram by MSSRF published in 2003 reported that 26 finfish species, seven shrimp species and four crab species are important to mangrove fishers, but significant declines in the catches of 80% of these species had occurred compared to 10-20 years earlier. Seasonal closure of the mouth of the estuary by a sand bar is one of the main factors blamed for the decline in catches, as this reduces the entry of juveniles from the sea into the mangroves.

JOINT MANGROVE MANAGEMENT

MSSRF developed a simple technology to restore degraded mangrove areas and demonstrated it in a 10 ha degraded plot. A canal system, consisting of main and feeder canals, was designed and dug in the degraded area. The main canals were connected to natural canals nearby. This enabled tidal water to flow freely in and out of the degraded area (instead of stagnating), thus decreasing soil salinity. This technique was demonstrated at Pichavaram between 1993 and 1996. After successful replication, a Joint Mangrove Management (JMM) programme was started to restore the entire degraded mangroves with the local community as the lead partner. A science based, people-centred and process-oriented approached followed in the JMM programme resulted in complete restoration of Pichavaram mangroves. This JMM model pilot tested in other mangroves of India also and currently it is being replicated in management of Indian mangroves

Currently MSSRF is also demonstrating an Integrated Mangrove Fishery Farming system in the region around Pichavaram mangroves, which has received project funding from MFF.

MANGROVE-BASED TOURISM

The Tourist Department of Tamil Nadu has established an eco-tourism center at Pichavaram ("The Boat House"). The Department of Forests, the Saradharam Hotel group and the local Panchayat are the other main stakeholders, together with local people employed as boatmen, etc. Large numbers of visitors (1000-2000 at weekends) are coming to the Boat House to take mangrove boat tours which are advertised at fixed prices (several different tours are available).

The Boat House also has an observation tower and a restaurant operated by the Saradharam Hotel, which also promotes the mangrove boat tours in its hotel in Chidambaram, the main town near Pichavaram. The tower offers a wonderful panoramic view over the mangrove wetland.

Apart from advertising that the Pichavaram mangroves as "a gift of Nature" the eco-tourism center and hotel need assistance to provide more information about the mangroves and to train local people as mangrove guides.

ABSTRACTS

STATUS OF MANGROVE PLANTATIONS IN THE LIVING DELTA: AN OVERVIEW OF THE COASTAL AFFORESTATION EXPERIENCE OF BANGLADESH

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Bangladesh is largely a deltaic country formed at the northern end of the Bay of Bengal and is located at the foot of the Himalayan Ganges. The country's terrain has a gentle slope towards the sea with less than 1.5 m to 0.2 m elevation above mean sea level. The coastal area of Bangladesh lies in the tropical zone between latitude 21°- 23°N and longitude 89°-93°E and is densely populated. The Bay of Bengal is one of the places on Earth most prone to the formation of tropical cyclones. About 10% of the world's tropical cyclones form in the Bay of Bengal. Countries surrounding the bay suffer most in terms of loss of life and property. More than 40% of all deaths worldwide from cyclones take place in Bangladesh alone. A significant proportion of the casualties is caused by storm surges associated with cyclones.

In order to address extreme climatic events in the coastal region of Bangladesh, a coastal afforestation programme has been established since 1960-1961. Bangladesh, especially the coastal zone, is a cyclone-prone region and has a serious need of protection from such calamities. The protective role of the natural mangroves, the Sundarbans, led the Forest Department to introduce mangrove plantations. Planting activities with mangrove species were initiated in the inter-tidal zone outside of the protective coastal embankment in 1966. Bangladesh is a pioneer in coastal afforestation in terms of the scale of the programme and also its positive outcome. A small-scale planting programme on unstable terrain showed success in many areas and it was a matter of encouragement to the foresters. The primary objective of raising mangrove plantations in the coastal areas was to mitigate the disastrous effects of cyclones and storm surges. The early success of the plantation programme resulted in setting of some additional objectives.

Four types of changes, namely rapid accretion, sand smothering, sediment winnowing and erosion adversely affect the mangrove plantations in Bangladesh. After independence to 1992, a total land area of 672.18 km2 was eroded; on the other hand 939.26 km2 were accreted, giving a net gain 13.38 km2 of new land. The mangrove afforestation programme was carried out on a very unstable environment; consequently, there was always the risk of some plantation loss during the time it takes for the trees to reach maturity. Bangladesh foresters pioneered in the field of mangrove afforestation by raising 1,773 km2 of mangrove plantation over the last five decades along the coast and on offshore areas, mostly in the central part of the coastal zone. From 1961 to 2010, 23% of this total plantation area was eroded, 10% was encroached, but 67% remained as sustainable plantations in the coastal area of Bangladesh.

Considerable variations in the level of salinity, inundation of the forest floor, rate of sedimentation and soil texture occur along the coastal belt of Bangladesh. These factors not only influence the growth of different mangrove species, but also their survival. Moreover, the different species have different silvicultural requirements. The peak season for mangrove seed/seedlings is June to October, except for Nypa fruticans (February to April).

With a view to using mangrove plantations as a prime weapon against the impact of climate change-induced sea level rise, the value of mangroves can hardly be underestimated, especially their role in protecting coastal areas against cyclones and storm surges. The long shoreline is virtually barren and exposed to wind and wave action, so there is a need to build a bio-shield of mangroves to save the coastal communities from extreme climatic events.

Keywords: mangroves, afforestation, cyclones, climate change, Bangladesh

MANGROVE REHABILITATION THROUGH COMMUNITY INVOLVEMENT: ESTABLISHING MANGROVE CONSERVATION AWARENESS AND EDUCATION

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Wildlife Clubs of Seychelles (WCS) is a non-governmental organisation (NGO), formed in 1994, to promote conservation in the Seychelles through environmental education. WCS has implemented a wetlands education and rehabilitation project funded by the Mangroves for the Future initiative from July 2009 to December 2010. Activities of the project were carried out at six different locations on the islands of Mahé, Praslin and within the Curieuse Marine National Park, in the Republic of Seychelles. The purpose of the project was to advocate for wetlands and mangrove ecosystems conservation, and to create capacity; and to understand value, restore and conserve wetlands through co-operative actions with children, the relevant national authorities and the local communities, for a sustainable future. In order to achieve this, school children, the general public and stakeholders were involved in mangrove planting and rehabilitation activities at these six locations. Four of the rehabilitated sites had 50-60% success rates in seedlings survival. The Curieuse Marine National Park site had only an 8% success rate and there was no survival at one of the rehabilitated sites.

Most success can be attributed to the location chosen, and advice received from mangrove experts in the country on the best sites for rehabilitation. At the same time, two locations had the participation of schoolchildren only, while the other locations benefitted from the participation of local communities, a private hotel, and conservation staffs. There was also an observed increase in the number of male wildlife Club members participating in mangrove rehabilitation activities, compared to previous attempts. Obviously, a lot of work still needs to be done in order to educate people about the importance and value of mangroves and wetlands habitats. There is still a need to increase awareness and provide training for youths as well as local communities in monitoring changes within wetland habitats. This is needed to facilitate the rehabilitation of wetlands and to ensure community engagement in their conservation.

Keywords: mangroves, wetlands, rehabilitation, conservation, environmental education, Seychelles

VALUATION, CARBON SEQUESTRATION AND RESTORATION OF MANGROVE ECOSYSTEMS IN INDIA

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Mangrove forests are among the world's most productive ecosystems and they are of great ecological significance and economic importance. Global mangrove cover stands at 15.2 million ha in 123 countries and territories. Mangroves in India cover a total area of 4,663 km2. About 34% of the mangrove cover in India is sparse, 36% is moderate and only 30% is very dense. The mangrove habitats continue to disappear globally at a rate of 0.66% per year. However, they are being well-maintained in India without any drastic change. This is because of effective conservation and restoration measures taken in the country. The present paper deals with valuation, carbon sequestration potential and restoration of mangrove forest ecosystems in India.

The monetary value of India's mangroves is USD 9,990 per ha per year, which is greater than that of coral reefs, continental shelves and/or the open sea. The protection value of one ha of intact mangroves in Orissa against a cyclone in 1999 was estimated to be about USD 8,700. At the time, one hectare of cleared land was fetching only USD 5,000. Similarly, the role of mangroves in coastal protection against the 2004 tsunami was remarkable. Besides coastal protection, mangroves also enhance fisheries and forestry production, and these benefits cannot be provided by concrete seawalls constructed for coastal protection. A study on the effect of mangroves on fisheries income has revealed that a mangrove-rich area provides as high as 70 times more catch and fisheries income, compared with a mangrove-poor area. In addition, many rural communities have used mangroves to produce honey, fodder and traditional medicines. Thus, a thorough economic valuation of the mangrove ecosystem is highly warranted.

The carbon sequestration potential of mangroves is 50 times greater than many other tropical forests. This is because of high levels of below ground biomass, plus a considerable storage of organic carbon in mangrove sediments. With 2,118 km2 of total mangrove forest cover, the Indian Sundarbans have soaked in 41.5 million tonnes of carbon dioxide daily, valued at around USD 79 billion in the international market. Mangrove deforestation generates around 10% of CO2 emissions from deforestation globally. Thus, failing to preserve mangrove forests could cause further considerable carbon emissions, and hence, mangrove restoration/rehabilitation can be a novel counter-measure against global warming.

In India, mangrove planting is carried out for three purposes: (i) coastal protection, (ii) fish production, and (iii) biodiversity enrichment. The plantations are made either directly with mangrove seeds/propagules, or nursery-derived seedlings, depending upon their availability in the planting sites. Different planting techniques are adopted in the country, depending upon the local conditions, especially tidal amplitude. In Gujarat, 'raised bed' is used for dibbling of Avicennia seeds. This avoids the problems of strong tidal currents and washing away of the seeds. In Karnataka, mangroves are planted in holes of the coconut fruits to ensure better rooting and establishment. In the eroded areas of Tamil Nadu, dead palmyra trees are used to strengthen the substratum; earthen pots planted with mangrove seedlings are also used. In the states of Andhra Pradesh and Tamil Nadu, a special technique of canal planting in a 'fish bone' design has proved successful in the saline blank areas where the tidal amplitude is low.

Keywords: mangroves, economic valuation, restoration, rehabilitation, carbon sequestration, India

CLAM SEED PRODUCTION AND BENEFIT-SHARING IN XUAN THUY NATIONAL PARK, VIET NAM

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Located in Viet Nam's Red River Delta, Xuan Thuy is a National Park covering 12,000 ha and a Ramsar Site. This coastal area is of high economic as well ecological importance: thousands of subsistence harvesters of aquatic products, as well as commercial shrimp farmers, clam seed collectors and producers, and clam growers depend on its mangroves and mud flats for their livelihoods. Since its designation as a Ramsar site in 1989, human pressure on Xuan Thuy's natural resources has led to the almost complete conversion of the original park perimeter to aquaculture, including extensive integrated mangrove and shrimp culture ponds, intensive shrimp farms and clam grow out beds. While the area under mangroves has largely recovered as a result of internationally supported mangrove planting projects on new mud flats, the park's core zone remains de facto an open access area. The park's management board can neither officially accept the presence of people in the core zone, nor can it strictly apply the national laws that forbid human use of the core zone.

In an effort to defuse conflict over the park's valuable natural resources, the management board has piloted a benefit-sharing agreement for 10 households involved in highly profitable collection of clam seed. The other signatories to this agreement are the local district and commune authorities, and the park management board. This pilot project has succeeded in establishing strong multi-stakeholder cooperation to achieve more equitable sharing of the benefits from clam seed production. According to the park's own analysis, the agreement has generated significant revenue for local welfare services and has reduced the scope for conflict. Resulting partly from this experience, the Prime Minister recently issued Decision 126 on piloting benefit-sharing in the management, protection, and sustainable development of protected areas. Xuan Thuy was chosen as one of two sites to implement the decision.

Keywords: mangroves, aquaculture, benefit-sharing, Ramsar Site, Xuan Thuy National Park, Viet Nam

TOWARDS COASTAL HEALTH ARCHIVE AND MONITORING NATIONAL PROGRAMMES (CHAMPS) FOR ASSESSING CHANGE, AND IDENTIFYING DRIVERS OF CHANGE, IN TIDAL WETLANDS AND COASTAL MARGINS

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There is ample evidence of diminishing mangrove and tidal wetland areas worldwide that provide fundamental and highly beneficial ecosystem services, like blue carbon capture and storage, shoreline stabilization, habitat/nursery function, and more. Despite such significant benefits across regional landscapes and in specific locations, missing from coastal assessment tools is a means to broadly evaluate, quantify and monitor changes to such critical coastal resources. Presented here is a standard and encompassing strategy. This can be used also for assessing and monitoring rehabilitation sites, and restoring resource benefits when damaged or lost.

Current global assessments focus primarily on declining area and increasing loss, along with serious threats to biodiversity. Each of these is extremely important, fuelling considerable current concern. But, the missing measures of habitat condition are arguably even more worrying. By all accounts, habitat condition and functionality continue to deteriorate despite important efforts to protect key areas – a situation exacerbated further by global climate change. There is an urgent need to identify and quantify key stressors, particularly anthropogenic ones. A broad-scale methodology is required for monitoring coastal ecosystems threatened by ever-increasing demands and pressures on these important areas

To achieve success with such a strategy, an agreed protocol and methodology must distinguish regional changes due to natural events from numerous human impacts, whether direct or indirect. Better targeting of particular stressors is needed to enhance the resilience of coastal ecosystems allowing them to better counter increasingly more frequent and damaging additional pressures. Such a scheme is proposed, coupled with an evaluation system that can be used to classify all drivers of change, and identify observed ecosystem responses. Recent innovative adoption of current technologies further demonstrates how local communities can participate with researchers, using the Shoreline Video Assessment Method to usefully monitor estuarine and coastal margins. Armed with such insights and evidence, managers of valuable coastal natural resources will be in a better position to optimize specific management regimes that effectively mitigate key impacts, allowing coastal ecosystems to more effectively respond and adapt – promoting their survival in an uncertain future.

Keywords: mangroves, wetlands, rehabilitation, climate change, ecosystem monitoring

ACTIVE VERSUS PASSIVE RESTORATION OF MANGROVES: DEVELOPING MODELS FOR SUSTAINABLE REJUVENATION OF MANGROVE ECOSYSTEMS USED FOR SHRIMP FARMING IN THE NORTH-WESTERN PROVINCE OF SRI LANKA

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A narrow coastal belt of 120 km in Puttalam District of Sri Lanka's North-western Province accounts for more than 90% of the shrimp farming, but the industry is increasingly constrained by disease and environment-related problems. As a result, a considerable number of farms are now abandoned. Most shrimp farms have been constructed by clearing prime mangrove and associated coastal ecosystems. The present study conducted during 2010, was aimed at assessing the current status of the shrimp culture industry in Puttalam District, and identifying sensitive areas for restoration; and finally developing models for each identified location for restoration. Information about the shrimp farms, such as their size, present status (functional or abandoned), current vegetation characteristics of the farm and the surrounding (density and diversity), type of vegetation prior to shrimp farm construction, distance to ecologically sensitive areas, type of ownership of land, as well as current mangrove restoration projects in the vicinity, was collected. This was done by visiting all farms and also by interviewing service providers to shrimp farms, office bearers of farm associations, community leaders and relevant government officials. Maps were prepared using Google Earth.

The results indicated that the total allocated area for shrimp farming in the project area is 2,799 ha. Out of the 814 farms identified, 290 are abandoned, accounting for 1,532 ha of the abandoned area. The highest percentages of abandoned farms are in Mundalama (78.1%) and Kalpitiya (78.1%), which are prominent mangrove areas in Sri Lanka. Results also revealed that most of the large scale farms are abandoned, while the majority of operational farms are small scale. The study also revealed that a gradual natural restoration of abandoned shrimp farms in close proximity to exiting mangrove patches is occurring, with Excoecaria agallocha and Sueda maritima as the dominant species in established secondary vegetation. Comparison of such areas with actively restored areas indicated a higher diversity in the former. However, long term land leases hinder restoration efforts of abandoned large scale shrimp farms, as well as a recent trend to convert them into salterns. Models developed for abandoned shrimp farms in ecologically sensitive areas are described; they recommend passive restoration with only active protection of the area from further encroachment, clearing and development. Since small scale farmers run most of the active shrimp farms today, involving them and their land in active restoration with mangrove planting, and transferring of rights of such restored areas to the local community, is vital.

Keywords: mangroves, restoration, shrimp farming, Sri Lanka

LESSON LEARNED FROM THE PROGRAMME LET'S PLANT MANGROVES: A CASE STUDY FROM VILLAGES IN BANTEN AND CENTRAL JAVA PROVINCES, INDONESIA

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Degradation of the mangrove ecosystem along the northern coastline of Java Island is very serious, more than 70% of the mangroves are in a severely damaged condition, or 4,826 ha out of a total mangrove area of 6,798 ha according to statistics of the Ministry of Marine Affairs and Fisheries (MMAF) in 2011. This condition has been caused by land use conversion, cutting of mangrove trees for milkfish/shrimp ponds, industrialization, oil pollution, and charcoal production. Degradation of mangroves can cause coastal erosion, seawater intrusion, and land subsidence. As one of the efforts to restore mangroves which have been degraded, the Directorate of Coastal and Marine Affairs of MMAF developed a programme for mangrove rehabilitation called Let's Plant Mangroves. This programme has been implemented since 2009 and 420,000 mangrove seedlings have been planted covering an area of 42 ha (in seven villages in four provinces).

Besides replanting mangroves, there were other activities like environmental education, a student competition in environment matters, training in alternative income generation and mangrove rehabilitation, integrated coastal management training, and a campaign on environmental awareness. A lot of benefits accrued to the local communities, and after two years of implementing the programme there were positive impacts from recovery of the mangrove ecosystem. They have practiced how to develop a seedling nursery to provide mangrove seedling needs for other programmes in different locations. By this activity, local community groups received some supplementary income. Members of the groups are increasing every year. A housewives group applied what they learned from the training and they can produce different mangrove products and milkfish postharvest processing. The younger generation is more aware of environmental rehabilitation; it is important to create this awareness at an early stage, so they can give advice to their parents and become involved in protecting the environment.

The methodology used in this study included (i) analysis of data, interviewing local community and local government; (ii) monitoring, learning and evaluation (MLE) regarding relevance and quality of design, efficiency and effectiveness of implementation to date, livelihoods and future impact, potential for sustainability, weaknesses, and summary of key observations and recommendations; (iii) writing of lesson learned; and (iv) suggestions for replication of the programme. The information sources used were demographic data, livelihood and income data before and after the programme was implemented, a questionnaire, and MLE documents.

Based on evaluation of case studies in three villages, two of them, namely Depok village and Mangunharjo village, were considered successful in bringing benefits to the local communities. They were able to increase their income from processing mangrove products and post-harvest processing, develop a nursery for mangrove seedlings and establish an environmental inspection group. In addition, after the mangrove seedlings grow up, nursery ground can be recovered and the coastline can be protected from wave attack. Conversely, the results were not so successful in Tanjung Pasir village, because too many seedlings died. Both the failures and successes should be used as lessons learned to help replicate the programme in other locations. For example, soil type and hydrological conditions must be considered when planting mangroves.

Keywords: mangroves, degradation, rehabilitation, alternative livelihoods, Indonesia

AN OVERVIEW OF MANGROVE RESTORATION EFFORTS IN PAKISTAN

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Mangrove ecosystems exist in the transition zone between land and sea characterized by tidal inundation and low oxygen that necessitates morphological and physiological adaptations by the species that survive in this zone. Globally, 92 species of mangrove plants have been reported, out of which 50 species occur in South Asia.

Mangroves are highly productive ecosystems in the tropics and subtropics, as they provide multiple goods and services of a provisioning, regulating, supporting and cultural nature, such as, production of woody plants, food, spawning grounds, habitat for marine and terrestrial animals and protection of shorelines form coastal disasters.

In coastal areas of Pakistan, the Indus Delta is the main habitat of 97% of the mangroves found in Pakistan, whereas, the remaining 3% are found in scattered patches along the Balochistan coast. Mangroves are a highly dynamic and fragile ecosystem. They are depleting at an alarming rate due to natural and anthropogenic factors. The severest stress which the mangroves are facing in Pakistan is the reduction of inflows of freshwater from the River Indus which may undermine their long-term sustainability.

In Pakistan, mangrove cover has witnessed a rapid decline during last few decades, reportedly decreasing from 600,000 ha in 1932 to 86,000 ha in 2005. The most recent estimates, based on a GIS based study by Sindh Forest Department, indicate a slight positive trend in mangrove cover, reaching approximately 100,000 ha. This trend seems to be due to increase in awareness, rehabilitation of degraded mangrove areas and advocacy on the importance of mangroves by governmental and non-governmental organizations at the various levels. The increasing level of attention to this important ecosystem appears to have resulted in supportive legislative reform and advocacy, and an increase in investment by government and donor agencies towards the conservation of this important ecosystem.

This paper analyses trends in the management of mangroves in Pakistan and focuses on the key lessons learned from Pakistan' experiences with mangrove rehabilitation and management. It also highlights livelihood linkages and mangrove conservation in Pakistan, with particular focus on the coastal economy, food security and coastal protection.

Keywords: mangroves, ecosystem services, conservation, rehabilitation, Pakistan

NAVIGATING MANGROVE RESILIENCE THROUGH THE ECOSYSTEM-BASED ADAPTATION APPROACH: LESSONS FROM BANGLADESH

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Mangroves are significant resources in coastal ecosystems contributing multiple ecological and social services across the globe. Bangladesh has a history of planting mangroves to stabilize newly accreted Char lands and transforming them into protective and productive ecosystems for the benefit of coastal communities. But due to unequal access to land and weakly defined institutional arrangements, livelihood pressures are creating challenges to mangrove management in the form of deforestation and encroachment. Climate change related stress, with rapid and sudden cyclonic wind and sea level rise induced storms and high inundation heights, are aggravating the existing threats to the critical social and ecological functions of the mangrove.

The 'Community-Based Adaptation to Climate Change through Coastal Afforestation Project' has focused on community-based livelihood development through coastal land restoration and integrating social roles in mangrove plantation development and management. This paper highlights findings from this project with respect to the ecosystem-based adaptation approach and its potential application for integrated mangrove ecosystem management. It has been observed that community-based restoration of coastal land is a productive resource regime for adaptation and sustaining mangrove functions in Bangladesh. Supported by the project, the local community restored fallow, periodically inundated and salinity-affected mangrove lands into a collective natural resource management system with agriculture, fisheries and forestry for multi-scale livelihood practices in two coastal districts of Bangladesh. An innovative land use model locally known as FFF (Forest, Fish, Fruit) is contributing to community ownership on livelihoods and socially inclusive resource governance, whereby coastal communities are participating in mangrove nursery establishment, plantation management and guarding from illegal human interventions. The study highlights that mangrove policies should avoid narrow protection and ecological goals and controlling social variables when climate change shapes certain degree of threats as a whole and to manage opportunities within the most desirable social context. Finally, it has been argued to promote an ecosystem-based approach through shifting from a conventional protection approach to an integrated socio-ecological system that provides renewal opportunities for mangroves and communities to adapt to climatic shocks and build resilience in the long-run.

Keywords: mangroves, climate change, afforestation, adaptation, livelihoods, Bangladesh

AFFORESTATION OF COASTAL MUDFLATS IN GUJARAT, INDIA

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India registered an increase of about 24 km2 in its mangrove cover during the years 2009-11. The highest increase (12 km2) was reported from Gujarat which is attributed to this state's strong mangrove conservation and afforestation efforts. Gujarat has 66% of the country's coastal wetlands which suggests that the state has extensive potential areas where mangrove plantations can be raised. This calls for a long term afforestation strategy. In view if this, an ambitious mangrove afforestation programme of raising about 100 to 120 km2 of mangroves every year has been launched in the state since 2010. In addition, recognizing that a holistic approach is required for their long term conservation, a number of area specific research and other studies pertaining to mangroves, namely reproductive and pollination biology of mangroves, status of natural regeneration of mangroves, substratum and inundation conditions preferred by different mangrove species for their natural regeneration, have been conducted, . It has also been established that mangrove associates and faunal components of the ecosystem play a very important role in the overall functioning of the ecosystem.

Based on these findings, instead of raising mangrove plantations, mangrove habitat development plan has been developed for the mangrove habitats of South Gujarat. This plan has the objective of factoring in the substratum conditions, inundation conditions, natural zoning of mangroves in the area and existing mangrove species. The plan also includes an inventory ofs all the potential mudflats measuring more than 1.0 km2. Each potential mudflat has been given a permanent identity. Mudflat specific treatment plans have also been developed suggesting the mangrove species and mangrove associates which may be taken up in different zone/subzones of each mudflat. This will promote biodiversity in the area, while location specific permanent identification numbers will facilitate long term monitoring of each mudflat. Accordingly, with these objectives, mangrove habitat development plans have been developed for 70 mudflats, covering about 810 km2 area and spread over seven coastal district of the state. The implementation of the plan has been taken up since 2011-12.

Keywords: mangroves, afforestation, mudflats, substratum, inundation, Gujarat.

ECOLOGICAL MANGROVE RESTORATION: RE-ESTABLISHING A MORE BIO-DIVERSE AND RESILIENT COASTAL ECOSYSTEM WITH COMMUNITY PARTICIPATION

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Mangrove forests are vital for healthy coastal ecosystems in many regions of the world. They support an immense variety of sea life, and are prime nesting and feeding sites for hundreds of migratory bird species. Healthy mangrove forests purify water flowing through them to the sea, and form a natural coastline protection shield against floods, storms or other natural disasters such as hurricanes and tsunamis. And mangroves can sequester far more carbon per hectare than tropical rainforests. Beyond these irreplaceable ecosystem services, mangroves provide important socio-economic benefits to coastal communities. In regions where the forest has been destroyed, local coastal communities face serious problems of diminished wild fisheries and threatened traditional livelihoods. But in spite of those important functions, more than 50% of the global mangrove forests have been destroyed over the last 100 years, mainly by human development.

Reforestation programs in these areas would therefore rebuild mangrove forest ecosystems and increase the potential for sustainable development. However, there are relatively few examples of successful, long-term mangrove rehabilitation, partly because most attempts have not corrected the problem(s) which caused the mangrove loss in the first place. Moreover, the great majority of mangrove restoration attempts are merely hand planting of a single species- Rhizophora, or red mangrove - forming monoculture plantations rather than truly restoring vibrant and bio-diverse multi-species mangrove wetlands. Many plantings are not restoration, but rather attempts at ecosystem conversion of natural mudflats to mangroves.

In search of a compromise between assigned economic worth and biodiversity, the Mangrove Action Project (MAP) promotes the concept and practice of Community-based Ecological Mangrove Restoration (CBEMR). This holistic approach to mangrove restoration views the proposed plant and animal communities to be restored as part of a larger ecosystem, connected with other ecological communities that also have functions to be protected or restored. Mangrove forests can self-repair, or successfully undergo secondary succession, if the normal tidal hydrology is restored and if there is a ready source of mangrove seedlings or propagules from nearby stands that are accessible to re-seed an area. CBEMR focuses on re-establishing the hydrology which will facilitate this natural regeneration process. CBEMR also engages local communities in the restoration process, empowering them to be stewards of their environment, and enabling them to regain the livelihoods destroyed when the mangroves were destroyed. Three-day intensive workshops train local people to do CBEMR, and community management plans ensure project sustainability.

Working with local communities and NGOs, MAP has been piloting small successful CBEMR projects in El Salvador, Indonesia and Thailand. However, many challenges remain, such as the need for more a robust monitoring and evaluation model with internationally recognized outcome indicators; issues of land tenancy and site availability; restrictions imposed by funders; carbon offset planting that encourages ecosystem conversion rather than true mangrove restoration; and securing government permits and approvals. MAP plans to continue its CBEMR work with new projects in SE Asia and Latin America, gradually brought to greater scale, and in the process learn to overcome current challenges and further refine the CBEMR model.

Keywords: mangroves, restoration, biodiversity, community-based management, carbon sequestration

MANGROVE RESTORATION EFFORTS IN SRI LANKA

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In Sri Lanka, mangroves are associated with 22 brackish water bodies and the mangrove vegetation is estimated to cover between 4,000 to 12,000 ha. It is scattered in different climatic zones with rare species and types of plant associations. Mangroves provide many benefits to coastal populations in terms of economic goods and ecological services, such as fishery production, provision of building materials, aquaculture source, medicinal usage, as a natural wastewater treatment system, habitat for birds and mammals and eco-tourism value.

The main reasons for loss and degradation of mangroves have been identified as extraction for timber, conversion for agriculture, aquaculture and salterns, coastal industrialization and urbanization and. After the tsunami in 2004, the central government and some NGOs realized the significance of this mangrove cover as it acts as a natural barrier against storm waves. They initiated projects for restoration and re-planting at identified locations.

A study was conducted to evaluate the sustainability of these mangrove restoration projects and the achievements of their expected goals. The study involved a literature survey on mangroves rehabilitation efforts taken by various organizations, reports on mangrove restoration projects and research papers and presentations made by various experts. The study was also extended to the field level by on-site observations, questionnaires and interviews with community and discussions with project leaders.

Six project sites were studied at Rekawa, Negombo, Puttalam lagoons and in the Madu Ganga area. It was possible to observe both successful and unsuccessful results from these restoration/re-planting attempts. In Rekawa Lagoon, re-planting started in 2007 with 15,000 seedlings, but failed because the natural environmental conditions did not support seedling survival; at present only about 200 plants are remaining. The attempts made at Negombo Lagoon, in the form of projects started in 2005 and 2007 with 125,000 seedlings, were 70% successful and the mangroves there now provide many benefits both to the environment and to the community; presently about 85,000 plants remain. In Puttalam Lagoon, planting started in 2005 and 2010 with 160,000 seedlings of Rhizophora sp., covering 15 ha. This project has been 65% successful and the plants are currently about 3-4 m in height. In Madu Ganga, planting started in 2005, but presently there are only about 50-70 plants remaining out of 10,000 seedlings planted. The main reasons for this failure were identified as low salinity conditions and a high growth of sea weeds.

Almost all the villagers in the successful mangrove plantation sites are engaged in fishery activities and most of them are now aware of the significance of mangroves. There is a very good trend in conserving these mangroves for future generations. Here the mangrove vegetation is acting as an alternative means of erosion control along the shoreline and it also traps sediments.

The results indicated that the failure of these projects were due to unfavourable natural environment conditions, poor habitat selection, poor planting methods (e.g. planting at inappropriate shore levels) and lack of monitoring after planting. The lack of knowledge/enthusiasm on the ecological role of the mangroves among decision–makers was a further indirect cause of the failures. Recommendations for further improvement and conservation of the mangrove cover include: building awareness among people - school children and government/NGO officials; improving coordination among institutions; introducing a system to share knowledge and data; carrying out more research on mangrove habitats; and providing small grants for community-based mangrove rehabilitation projects.

Keywords: mangroves, degradation, restoration, rehabilitation, Sri Lanka

A COLLABORATIVE APPROACH BETWEEN TOURISM AND COASTAL COMMUNITIES: A PRESENT-DAY NEED AND OPPORTUNITY FOR MANGROVE MANAGEMENT AND CONSERVATION IN SRI LANKA

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Conservation of mangroves is a primary responsibility of mankind as a contribution to society, the environment and related ecosystems. In Sri Lanka, many initiatives have been taken in this regard, with restoration of mangroves affected by the 2004 tsunami in lagoons located in the East, West and South of the Island as a leading example. In the process, the involvement of communities, experts and non-governmental organisations was commendable. But due to lack of an independent system with continuous economic benefits to the neighbouring community, the sustainability of mangrove rehabilitation in many areas has been challenged in the longer run. Over a period of time, these areas demand external intervention and resources for conservation and restoration of the same flora. Considering current trends, introduction of tourism with visitor facilities for research, study and ecotourism activities will be an opportunity to generate additional or alternative income for its stakeholders. When they use mangroves as a resource base for tourism, which generates many economic benefits such as income from operating eco-lodges, conducting mangrove tours and other mangrove ecotourism activities, the stakeholders will start protecting their own resource base while using it sustainably.

In a study area in Kalpitiya, tourism was the primary source of income for 51.8% of the community and a secondary source of income for 28.5%, which was associated with mangrove environments most of the time. The study also revealed that mangrove areas generate many non-economic benefits, such as providing an environment and nesting sites for birds, enabling wetland ecosystems existence and their continuity, and protection of rare, site-specific faunal species. Further protection against coastal hazards such as erosion, tsunami and the existence of green cover were also noted. Moreover, due to the high tourism demand and visitor interest in nature and related ecosystems, an independent system will be developed capable of generating continuous economic benefits to the community through tourist facilitation which will be sustainable. Thus, in turn, the sensitive and important mangrove habitats that are mostly found in lagoons, estuaries and wetlands can be protected sustainably by an independent tourism-centered system and its neighbouring stakeholders.

Keywords: mangroves, conservation, ecotourism, economic benefits, Sri Lanka

RESTORATION OF DETERIORATED WETLANDS OF YALA EAST NATIONAL PARK, SRI LANKA: A PILOT PROJECT ON MANGROVE RESTORATION

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Yala East National Park (Kumana NP) lies on the south-east coast of Sri Lanka's Eastern Province. It is reputed for its avifaunal richness and abundance, and has been commissioned as a Ramsar wetland site of international importance. Kumana NP harbours large flocks of migratory waterfowl and waders that utilize the area for food, shelter and roosting sites. In addition, it is a potential breeding site for more than 33 species of resident aquatic birds that breed regularly among these wetlands.

During recent years, the numbers of waders, waterfowl and other aquatic birds in the Kumana wetlands have fallen slightly. Recent observations have shown that there is an increased competition for nesting and roosting sites during their breeding and migration seasons, suggesting that the mangrove vegetation is a limiting resource. The tsunami that hit the Eastern coast in 2004 caused physical damage and changed the hydrological conditions, resulting in significant damage to the mangroves of Kumana NP. Therefore, it is timely to take action to restore the affected areas with suitable species of mangroves.

A preliminary project was carried out to assess the success of restoration of mangroves among reputed feeding, roosting and breeding sites of avifauna in the park, namely the Bagura and Kumana wetlands, both of which are fringed by mangrove vegetation. Two trial plots of mangroves were established in the selected wetlands during early September 2011. Two species, namely 'Mangrove Apple' Sonneratia caseolaris (low salinity species) and 'Large-leafed Mangrove' Rhizophora mucronata (high salinity species) were selected for planting. Healthy plants were transferred from a nursery run by a Community-based Organization (CBO) associated with the Department of Wildlife Conservation.

A total of 2,048 Rhizophora mucronata seedlings were established in 30 cm x 30 cm pits with the involvement of the local community. A trial plot in 'Bagura' wetland was assessed after six months (March 2012). Depicting the success of the restoration activity during the preliminary stage, 1,889 plants were found surviving, indicating 92.2% survival and 7.8% mortality. Interestingly, 53.5% of the plants were well established without any signs of damage. This figure is quite high for a dynamic habitat where severe conditions prevail, especially the immense herbivore pressure. A total of 793 plants showed signs of damage, of which 59.5% was due to herbivore attack as indicated by visual signs. Direct observations indicated that wild buffalo are the major cause of the herbivore damage. However, out of the 472 herbivore damaged plants over 90% were found to be regenerating. After six months, the average height of the intact plants at Bagura had increased from 12.0 to 19.6 cm.

Preliminary data collection at Kumana on Sonneratia caseolaris indicated that mortality is less than 10%. The growth rate of Sonneratia is much higher than Rhizophora at the initial stage; however, continuous valuation of population dynamics of the plots will be necessary to confirm the absolute success of the current restoration programme, which is novel to the Department of Wildlife Conservation. The results to date show that it is possible to restore ecosystem characters that help birds, which are the primary attraction in Kumana NP. There is high potential for nature-based tourism and ecotourism in the park; thus, it is important that further management strategies should be taken towards restoring deteriorated wetland ecosystems to help the park's avifauna.

Keywords: mangroves, restoration, rehabilitation, Yala East National Park, Ramsar Site, Sri Lanka

MANGROVE RESTORATION AND PLANTING IN MICRO-TIDAL BARRIER-BUILT ESTUARIES AND LAGOONS IN ASIA - IDEOLOGY VERSUS SUSTAINABLE ECOSYSTEM SCIENCE?

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This paper provides a preliminary synthesis of information on mangrove restoration and planting for some micro-tidal (tidal amplitude less than 2.0 m) barrier-built estuaries and lagoons in Sri Lanka, Indonesia and India. The material addresses some impacts across 30 years since the mid-1980s when mangrove planting became 'fashionable' and provides an opportunity for integrated re-thinking. Micro-tidal, barrier-built estuaries, which are among the most sensitive among tidal wetlands, support the livelihoods of a large population in tropical Asia. Activities relating to mangrove restoration are compared and analyzed on the basis of the hypothesis: Mangrove restoration and planting (as bio-shields), cause long-term changes in micro-tidal barrier-built estuaries and lagoons that undermine their functional integrity as social-ecological systems by diminishing their fishery value - mainly through accelerated sediment entrapment'. The hypothesis could be falsified by appropriate measurement of sedimentation rates and fishery yield. However, since these entities are complex systems, subject to many land use impacts, attribution of fishery diminishment to a single cause (mangrove restoration and planting) is inadequate. A broadened perspective, which includes quantification of the role of eutrophication, anoxic conditions, increased turbidity, and of overfishing among others, require consideration. The purpose of this paper was to determine if mangrove restoration and planting, as practiced now, appear to support the hypothesis in a logical manner, while recognizing that these other parameters should not be ignored.

The results reveal: (i) mangroves and misplaced bio-shields are implicated in accelerated sedimentation and diminishment of the fishery in Rekawa Lagoon, Sri Lanka; (ii) mangrove restoration and planting that accelerated in Negombo Lagoon under the UNDP/UNESCO Regional Mangrove Project in the 1980s, and gathered momentum under subsequent funding arrangements, contributed substantially to the acceleration of the sedimentation trend; (iii) heavy sedimentation and stabilization by mangroves in Segara Anakan, as demonstrated by historical records dating back to 1903, may have resulted in the diminishment of the fishery habitat by 50%. Major investment in restoration of the ecosystem appears to be failing since, among others, integration between hydrological interventions and rehabilitation of mangroves did not occur; (iv) mangrove restoration and planting, as well as misplaced and technically incorrect bio-shields, appear to have contributed to acceleration of sedimentation in Batticaloa Lagoon, Sri Lanka; (v) Chilka Lagoon restoration since the 1990s under Chilka Development Authority has been successful in enhancing fisheries and dependent livelihoods. Restoration was based on a hydrodynamic model, and did not include any interventions in relation to mangrove restoration, although historical records of degraded mangroves exist.

A large technical literature is available on mangrove restoration, planting and bio-shields. Some relate to these activities in micro-tidal barrier-built estuaries and lagoons. Mangrove restoration and planting appears to be done at present as a 'project' activity isolated from the diversity and complexity of the social-ecological relationships that have driven, and continue today to drive, long-term change in these systems. Therefore it could be prudent to consider the activity as an additional land use one within an integrated coastal management framework (ICM) which incorporates customary management, the ecosystem approach to fisheries and the precautionary principle. This transition in approach requires inter-disciplinary discourse at a regional level to produce a set of good practice guidelines, which may be adaptable to particular sites with particular attention to hydromorphology.

Keywords: mangroves, restoration, barrier-built estuaries, hydrology, micro-tidal, sedimentation

MANGROVE PLANTING, COMMUNITY PARTICIPATION AND INTEGRATED MANAGEMENT IN SOC TRANG PROVINCE, VIET NAM

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The highly dynamic coastline of Soc Trang Province in the Mekong Delta of Viet Nam is in most parts protected from erosion, storms and flooding by a narrow belt of mangroves. This protection function is threatened by the unsustainable use of natural resources in the coastal zone. This situation will be exacerbated by the impacts of climate change, particularly by the increased intensity and frequency of storms, floods and rising sea levels.

The GIZ (Deutsche Gesellschaft für Internationale Zusammenarbeit) project 'Management of Natural Resources in the Coastal Zone of Soc Trang Province, Viet Nam' makes a contribution to addressing this issue by protecting and sustainably utilising the coastal wetlands for the benefit of the local population through mangrove rehabilitation and management, with emphasis on resilience to climate change. Lessons learned from five years of mangrove planting, protection and management can be summarised in five statements.

1. Planting mangroves alone is of little use. Newly planted mangroves must be protected from human impacts such as destructive fishing or resource collection methods. This has been achieved by participatory involvement of local communities through co-management. Co-management is an effective way of maintaining and enhancing the protection function of the mangrove forest belt and, at the same time, providing livelihood for poor local people. Payment for ecosystem services from a clam cooperative on the sandbanks in front of the mangrove forest contributes to sustainability of co-management.
2. Site specific and appropriate solutions are needed. This requires selection of suitable species, site selection for the planting of different species, appropriate planting techniques and selection of the best planting times. Testing of new planting techniques which mimic successful natural regeneration contributes to address uncertainties associated with the impacts of climate change. Mangroves can only be planted in erosion sites after fences and wave breakers have reduced the erosion and stimulated sedimentation. The impact of wave breakers on shoreline dynamics must be predicted using numeric current and erosion modelling.
3. Looking at the status quo is not enough. Historic information contributes to a better understanding of coastal dynamics. It also enables the selection of species for rehabilitation which grew naturally in a given site before human interventions.
4. Integrated coastal area management is needed. Parts of the coastal zone cannot be effectively managed in an isolated, sectoral approach. Mangrove planting, protection and management, therefore, must be part of an integrated approach.
5. Awareness raising of and communication with all stakeholders is a prerequisite for successful mangrove and integrated coastal area management.

Keywords: mangroves, rehabilitation, co-management, payment for ecosystem services, climate change adaptation, Viet Nam

GENESIS AND PRESENT STATUS OF RESTORATION PRACTICES IN SALINE BLANKS

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Unvegetated areas, or saline blanks, are one of the common features in mangrove wetlands of arid and semi-arid regions. The mangroves of Tamil Nadu and Andhra Pradesh are characterised by saline blanks, but the reasons for this are not clearly understood and, as a result, many attempts to restore these areas have yielded limited results.

The participatory research conducted by M S Swaminathan Research Foundation (MSSRF) showed for the first time that the clear-felling system of mangrove management followed from the early 20th century to late 1970s, which involved cutting of mangrove trees in coupes, was the main cause of degradation. This clear-felling system of management exposed large areas of mangrove wetland to sunlight, which caused evaporation of water from these mangrove areas; it has been documented that nearly 80% of the water is lost, with the result that the soil bulk density in the clear-felled area increased, changing the flat topography into its current trough shape condition. Tidal water that entered the trough-shaped portions during the high tides remained stagnant and evaporation of this stagnant water increased the soil salinity to a level lethal to mangroves. As a result, no regeneration of mangrove plants was seen in the clear-felled area and attempts to restore these blank areas by planting also failed.

On the basis of the above findings, a simple and cost-effective restoration technique was developed and demonstrated with the participation of stakeholders including the State Forest Department and local community. This technique involved a canal system with supply and feeder canals that allowed tidal water to freely move in and out of the degraded area and thereby avoiding stagnation of saline water. This free and energy-neutral flushing by tidal water reduced soil and water salinity, and increased moisture of the degraded areas, making them biophysically suitable to support mangroves. MSSRF and State Forest Department of Tamil Nadu demonstrated this technique in Pichavaram in about 10 ha area. At the end of the demonstration, stakeholders raised three important questions: i) who will maintain the artificial canals created for tidal flushing; ii) how to upscale mangrove restoration activities; and iii) how can social pressures such as felling of trees for livelihood and grazing of animals be managed?

Answers to these questions led to development of a Joint Mangrove Management (JMM) Programme, which was pilot tested in seven mangrove wetlands located in the states of Tamil Nadu, Andhra Pradesh, Orissa and West Bengal by MSSRF, jointly with State Forest Departments and the local communities. A total number of 33 villages in the four states and about 5,200 families participated in this pilot testing along with MSSRF and State Forest Departments; more than 1,500 ha of mangroves were restored by planting 6.8 million mangrove saplings. This pilot testing was done during 1996 to 2004. The Ministry of Environment Forests, Government of India formed a Sub-Committee to review the restoration protocol and JMM approach and declared that it is the best approach available and included it in the National Mangrove Action Plan. Currently, State Forest Departments on the east coast of India, and Gujarat, follow this canal technique to restore degraded mangrove wetlands in appropriate areas.

Keywords: mangroves, saline blanks, restoration, Pichavaram, India

RESTORATION AND RETURN OF MANGROVES AND FISHERIES IN ABANDONED AQUACULTURE FARMS

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More than 92% of global aquaculture production in 2007 (56.7 million tonnes) was produced in Asia. Aquaculture in Asia, including that of India, is characterized by small-scale, family-operated farms and constitutes one of the important sources of income and employment for rural coastal communities. However, in recent years, coastal aquaculture has suffered setbacks in terms of production, value and acreage. For example, in India shrimp production which was around 1.06 million tonnes in 2007-08 has come down to 0.76 million tonnes in 2008-09. Monoculture, disease, poor seed quality, excessive use of artificial feed, increased input costs and decreased market value are considered as important factors accounting for such decline in aquaculture production. Above all, poor environmental management and lack of different activities to diversify livelihoods within aquaculture farming are also responsible for the current status of coastal aquaculture in India; and the social impact of decline in prawn farming has been enormous. Many of the farmers, who converted their agriculture land into aquaculture farms, are currently getting no income either from agriculture or from aquaculture; many of these families now migrate either temporarily or permanently in search of employment and livelihood to nearby urban areas. In this situation, the projected Integrated Mangrove Fishery Farming System (IMFFS), wherein cultivation of mangroves, halophytes and culture of fish, crabs and prawns is integrated, provides tangible solutions to make coastal aquaculture sustainable and also strengthen resilience of coastal communities. This also provides opportunity to integrate livelihoods with mangrove bio-shields and to promote ecologically sensitive alternative land use practices.

In IMFFS, which has been demonstrated with the participation of the local community, government agencies and shrimp farmers, aquaculture ponds are designed in such a way to provide space for growing saline-tolerant vegetations including mangroves and halophytes. Space for planting is created by constructing bunds inside the pond in a zigzag manner, or as small mounds (mitochondrial in shape). These bunds and mounds are created by digging the soil from the bottom of the pond. This makes the pond deeper and below the tidal level. As a result, tidal water fills the pond by gravitation during high tide and drains out during low tide. The tidal inlet and outlet are designed in such a way that nearly one metre of water remains in the pond as standing water. The ponds are designed in such a way that nearly 30 to 35% of the space is left for planting mangroves and halophytes, while the remaining 65 to 70% is left for holding seawater for fish culture. Three species of mangroves and two halophytes are planted along the inner bunds, mounds and outer bunds of the ponds. The survival and growth rate of mangroves and halophytes are almost equal to observed growth in natural condition. Regarding fish culture, experiments conducted to culture sea bass in these ponds indicated that this can generate an income of about USD 1,500 in a period of eight months from a one hectare pond. Further experiments are ongoing to utilise this system for polyculture of mullets and prawns. The IMFFS is also a good farming system for culturing mud crabs since the well-developed root system of mangroves provides these crabs with a refuge, while detritus generated from mangrove litter-fall provides them with food.

Keywords: mangroves, halophytes, aquaculture, polyculture, shrimp farming, India

MONITORING FRAMEWORK FOR REPLANTED MANGROVE AREAS – SHARING THE EXPERIENCES FROM PAKISTAN

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Almost 97 % of the mangroves in Pakistan exist in estuarine areas within the intertwining creek system formed in the deltaic areas of the River Indus. The historical distribution of mangroves in the Indus Delta has been altered greatly by anthropogenic as well as natural factors. Deforestation and animal grazing, coupled with changes in hydrological regimes in the River Indus, are believed to be the most obvious causes of mangrove ecosystem degradation in the Indus Delta.

Over time, realization about the values of the mangrove ecosystem and their contribution to the coastal economy and to coastal protection has grown globally. This realization has enhanced local and regional responses by governmental and non-governmental agencies towards mangrove conservation in various parts of the world. Human-induced rehabilitation of the degraded mangrove ecosystem in Pakistan, which started about three decades ago, has gained momentum during recent years with multiple agencies now working on mangrove rehabilitation.

Monitoring and evaluation of restored mangrove areas has been a daunting task for the resource managers, as the restored areas fall in intertidal creek zone where the accurate assessment of restored areas is hampered by the tidal characteristics of the area, limited access and lack of surveyed reference points. As such, the transparent and accountable monitoring and evaluation in mangrove rehabilitation work has been a matter of great criticism in Pakistan, with remarks in certain quarters that such restoration work is like, 'draining money into the sea'. The recent applications of remote sensing and GIS have greatly facilitated the task of mangrove mapping, but such measures are highly costly, and require experienced GIS analysts and high resolution data to undertake accurate assessments.

Under the Sindh Coastal Community Development Project (SCCDP) being implemented in coastal areas of Pakistan with financial assistance from the Asian Development Bank, IUCN Pakistan has been tasked with third-party monitoring and evaluation of replanted mangroves. IUCN Pakistan has successfully developed and implemented a simplified framework for physical monitoring and evaluation of replanted mangrove areas in the Indus Delta under SCCDP. The assessment methodology entails guidelines and indicators identified in the overall monitoring framework developed for the purpose. This monitoring and evaluation tool has been received and highly appreciated by the respective agencies. The resulting feedback has helped the resource managers in implementing adaptive measures related to selection of sites for mangrove planting, choice of species, accurate estimation of planted areas and effective management of field staff.

This paper explains of the methodology applied for monitoring and evaluation of newly-planted mangrove areas in terms of assessment of survival rate, species composition and plant growth. Based on learning during its implementation, the developed methodology has been under constant improvement. Thus, the practical experience gained from its application may be useful for monitoring and evaluation of other similar estuarine mangrove areas.

Keywords: mangroves, rehabilitation, monitoring and evaluation, Indus Delta, Pakistan

INDONESIAN MANGROVES: CRITICAL CHALLENGES AND STRATEGIES FOR THEIR SUSTAINABLE MANAGEMENT AFTER THE 26 DECEMBER 2004 TSUNAMI

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With an area of mangroves estimated to be 9.7 million ha (State Forest Area, SFA: 3.9 million ha and Non-state Forest Area, NFA: 5.8 million ha), Indonesia is home to some of the world's most valuable natural resources. Unfortunately, the mangroves designated for conservation – with biodiversity and fish habitat values as well as value as reducers of salt-water intrusion and flooding – have been completely destroyed in many locations, or considerably degraded due to human activities. Other human activities contributing to the destruction of marine and coastal resources include large scale illegal fishing operations, fishing techniques using explosives and cyanide, coral harvesting and mining operations. The total area of damaged mangroves (both SFA and NFA) amounted to 5.3 million ha (SFA: 1.6 million ha, NFA: 3.7 million ha), or more than 50% of the total area of mangroves in Indonesia.

The mangroves of Indonesia are reasonably well documented floristically and ecologically, albeit in a widely scattered literature. Indonesia mangroves are common properties. Therefore, political, social, and economic and culture sectors have different perception at all levels of mangrove functions, and consequently produce a debate with no ending resulting finally in conflicts. This is making the position of mangrove ecosystems uncertain and the degradation is continuing unabated. The National Strategy for Mangrove Ecosystem Management in Indonesia 2006 (NSMEMI2006) is justified to put these systems into a national perspective and thus to provide a basis for a provincial and district (Kabupaten) developments. Moreover, apart from the intrinsic interest in such an ecosystem, questions on the underlying causes of this impoverishment should provide some insights into the general understanding of mangrove ecosystems, their values, uses, and conservation and management strategies.

Keywords: mangroves, conservation, management, tsunami, Indonesia

ADAPTING TO NATURAL DISASTERS AND CONTRIBUTING TO CLIMATE CHANGE MITIGATION: MANGROVE COMMUNITY FORESTRY IN VIET NAM

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Da Loc Commune in Thanh Hoa Province is vulnerable to increasing extreme weather events. The damage caused by Typhoon Damrey in 2005 was a pivotal moment for the commune, leading to mangrove reforestation initiatives for disaster risk management. Involving local communities as direct partners led to this project's success compared to earlier less participatory initiatives. In the interim years required for the mangroves to reach maturity, a number of secondary benefits have resulted. In addition to the income benefits from enhanced aquaculture, mangroves also serve as powerful carbon sinks. Thus, while originally designed as an adaptation measure, the project is an example of strong synergies with significant mitigation benefits, including carbon sequestration.

It has also shed light on a number of other important issues:

1. Official recognition of community management rights over the mangroves has been critical in ensuring the sustainability and commitment of local communities. However, currently these rights are short term (five years). The sustainable management of the mangroves is contingent on establishing longer-term community rights.
2. Trade-offs have emerged that may threaten the project. The income potential of aquaculture practices that are destructive to the mangroves is proving a strong temptation. Careful analysis on costs and benefits of both adaptation and mitigation actions is needed.
3. Unless equitable benefit-sharing mechanisms are ensured and participatory decision-making processes are incorporated for the well-being of vulnerable community members, there is a risk that the success of the project will be compromised.
4. Pre-existing, locally adapted knowledge can be highly beneficial to projects. Understanding and incorporation of local knowledge may lead to innovations that enhance effectiveness and improve uptake by local communities.

Keywords mangroves, community forestry, climate change, carbon sequestration, disaster risk management, Viet Nam

LOCAL KNOWLEDGE MANAGEMENT FOR MANGROVE MANAGEMENT

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A variety of threats affecting the coastal areas in southern Thailand, particular the mangrove concessions (during 1968-1991) and the devastating tsunami in 2004, have become key drivers to stimulate all coastal communities to rehabilitate the damaged mangroves. Launching with their local knowledge merged with external knowledge, community participation in mangrove rehabilitation has also dissolved conflicts and created fairness within the society of Thailand's coastal communities, including how to answer the question on what benefits should be gained by communities from mangrove rehabilitation?

From the study and analysis of community knowledge processes and their local knowledge management on mangrove rehabilitation and management in southern Thailand, it was found that coastal communities have based their knowledge management on searching, collecting, learning, applying and disseminating their local knowledge. Evidence of this was shown through selection of tree species, knowledge on seedlings and saplings, cultivation and nurturing as a combination of their existing local and external knowledge through a self-learning process from their occupations and know-how transfer from local gurus in the communities.

Key factors that affect a community's knowledge management are local communication efficiency within the community, characteristics of their involved occupations and capacity of community leaders. Furthermore, the national policy and implementation of supportive organizations represent other contributory factors. However, the communities also want to develop their own capacities for collecting, editing and presenting their systematic local knowledge, as well as developing young-generation leaders to maintain the sustainability of the community's local knowledge and its use for efficient mangrove management.

Keywords: mangroves, rehabilitation, knowledge management, tsunami, Thailand

DISASTER RISK REDUCTION THROUGH MANGROVE CONSERVATION AND REHABILITATION: A CASE STUDY IN AYEYARWADY DELTA OF MYANMAR

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In May 2008, Cyclone Nargis devastated virtually all of the Ayeyarwady Delta of Myanmar, an area that had never experienced such a tremendous disaster in its history. According to the Post Nargis Joint Assessment (PONJA) report, some 17,000 ha of natural forest and 21,000 ha of forest plantations were damaged, at an estimated cost of Kyat 14 billion (USD 14 million, approximately). Thus, restoration of mangrove forests in the delta became a huge task for both the government and civil society organizations.

Most of the leading NGOs working in the field of disaster risk reduction realized that collective action was crucial to respond to other disasters that are highly likely to take place in the coastal area of Myanmar in future. Therefore, networking of local NGOs was considered to be essential for assisting the programme "Promoting Community-led Disaster Risk Reduction" in the Ayeyarwady Delta. As a result, the Mangrove and Environmental Rehabilitation Network (MERN), comprising 17 local NGOs, was officially formed in August of 2009 to jointly work for Disaster Risk Reduction (DRR) through mangrove restoration in the post-Nargis period in Myanmar. MERN is undertaking mangrove conservation and rehabilitation, plus improvement of livelihood activities, by providing small grants to each member, and supporting joint project management in which some member organizations are working together. All the activities are being undertaken through Community-based Organizations formed by the project (e.g. Forest User Groups).

A total of 41 villages comprising 6,460 households were supported to establish mangrove plantations and to develop improvement of livelihood activities, awareness- raising and capacity-building for community led DRR across the delta. In total, about 340,000 mangrove and non-mangrove trees were grown for the purpose of DRR. In order to reduce the consumption of fuel wood, 600 energy efficient stoves were distributed to villagers. For livelihood improvement, 4,000 ducks, 25,000 fishes and other cash crops for home garden were provided to poor families participating in mangrove rehabilitation. A total of 800 villagers were trained to improve their technical and managerial skill for mangrove conservation and rehabilitation. The mangrove species planted were mainly Avicennia officinalis, Sonneratia apetala and Bruguiera gymnorrhiza. The survival rate was more than 80%; attack by crabs and rodents, plus uncontrolled grazing in some plantations, were the main causes of damage and mortality.

As networking experiences were previously lacking among the local NGOs, management was not much synchronized in the early days of MERN. Understanding among the member organizations could be enhanced through learning and sharing mechanisms throughout implementation of projects. MERN is also conducting policy advocacy in relation to revision of the forest law and community forestry instructions that can promote empowerment of local communities in sustainable forest management. However, other challenges remain, such as improper land use planning, poverty, lack of alternative energy sources and inadequate funds for mangrove conservation and rehabilitation in the Ayeyarwady Delta.

Keywords: mangroves, rehabilitation, Cyclone Nargis, Disaster Risk Reduction, Myanmar

MANGROVE CONSERVATION AND RESTORATION IN THE INDIAN SUNDARBANS

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Supported by the world's largest delta, the mighty Sundarbans is shared between India (approximately 37%) and Bangladesh (approximately 63%). The Indian Sundarbans lies between 21°13' to 22° 40' N and 88° 03' to 89° 07' E and occupies 9,630 km2, of which 4,200 km2 is exclusively mangrove forest, with significant faunal and floral diversity. The Indian Sundarbans has earned multiple national and international accolades and has been declared a World Heritage Site and Biosphere Reserve by UNESCO. It supports the first national Tiger Reserve and is segregated into a National Park and three Wildlife Sanctuaries.

The Sundarbans delta experienced a neo-tectonic shift in 16th century which resulted in unequal fresh water flows to its different regions, with a greater portion of fresh water flowing to its eastern part (currently in Bangladesh). This has greatly influenced mangrove distribution, growth and regeneration in the Sundarbans. The delta was first colonized, when the Britishers began clearing of large tracts of mangroves, primarily to earn revenue. First regular human settlements occurred from 1830 onwards. At present, population along the fringes of the Indian Sundarban exceeds 4.2 million resulting in immense anthropogenic pressures on the mangroves. Most recently, climate change, the alteration of fresh water (non-saline) flows, illicit mangrove felling, poaching, unplanned embankments for human settlements have been identified as the most severe threats facing Sundarbans. Additionally, the Central Indian Sundarbans receives limited fresh water due to heavy siltation and clogging of the Bidyadhari channel in the late 15th century; there are no longer rivers in these parts and sea water incursion has adversely affected the growth of some of the mangrove species, particularly the Sundari tree Heritiera fomes after which the Sundarbans has been named. The understudied influences of salinity and climate change may have caused the invasion of alien species in some parts of Sundarbans, additionally adding a complicated dimension to the human tiger conflicts.

Current mangrove restoration efforts are largely led by the West Bengal State Forest Department. These include large-scale mangrove afforestation programmes along mud flats, degraded mangroves areas and embankments. In addition to increasing the mangrove cover in the Sundarbans, restoration activities and nurseries have contributed significantly to strengthening local community resilience to climate change and sea level rise (embankments), in involving local communities in the management of these areas and in building a trust between stakeholders and the Forest Department. In the last decade, over 14,000 ha of mangrove area and 4,000 ha of non-mangrove area have been restored. Several of these activities have been supported by improved relationships with local communities through the formation of Joint Forest Management Committees (JFMCs which include Forest Protection Committees and Eco-development Committees).

Restoration efforts in the Indian Sundarbans have adopted an all-encompassing approach to include local community involvement, increased environmental and biological security and the provision of alternate and sustainable livelihoods. This paper explores associated issues to this approach and dwells on future solutions.

Keywords: mud flats, mangroves, afforestation, restoration, Sundarbans, India

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Mangroves for the Future
INVESTING IN COASTAL ECOSYSTEMS

About Mangroves for the Future

Mangroves for the Future (MFF) is a unique partner-led initiative to promote investment in coastal ecosystem conservation for sustainable development. It provides a collaborative platform among the many different agencies, sectors and countries who are addressing challenges to coastal ecosystem and livelihood issues, to work towards a common goal.

MFF builds on a history of coastal management interventions before and after the 2004 Indian Ocean tsunami, especially the call to continue the momentum and partnerships generated by the immediate post-tsunami response. It initially focused on the countries worst-affected by the tsunami; India, Indonesia, Maldives, Seychelles, Sri Lanka, and Thailand. MFF has recently expanded to include Pakistan and Viet Nam. MFF will continue to reach out other countries of the region that face similar issues, with an overall aim to promote an integrated ocean wide approach to coastal zone management.

The initiative uses mangroves as a flagship ecosystem, but MFF is inclusive of all coastal ecosystems, including coral reefs, estuaries, lagoons, sandy beaches, sea grasses and wetlands. Its long-term management strategy is based on identified needs and priorities for long-term sustainable coastal ecosystem management. These priorities emerged from extensive consultations with over 200 individuals and 160 institutions involved in coastal management.

MFF seeks to achieve demonstrable results in influencing regional cooperation, national programme support, private sector engagement and community action. This will be achieved using a strategy of generating knowledge, empowering institutions and individuals to promote good governance in coastal ecosystem management.

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