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Conservation Benefits of Mangroves

Overview

Mangrove biodiversity and conservation has received significant importance in the recent past as research has increased the understanding of values, functions and attributes of mangrove ecosystems and the role they play in providing important ecological services and livelihoods for the mangrove associated communities.

Mangroves are unique ecosystems occurring along the sheltered inter-tidal coastlines, mudflats, riverbanks in association with the brackish water margin between land and sea in tropical and subtropical areas. They sustain diverse flora and fauna species in large proportion and provide many ecosystem services such as coastal protection from storm, reduction of shoreline and riverbank erosion, stabilizing sediments and absorption of pollutants.

In all, about 10,000 ha of mangrove vegetation was present in the country prior to the tsunami and there have been no further estimates in quantifying the damage to the mangroves from the tsunami. Coastal areas of Sri Lanka have experienced losses of mangroves due to various reasons predating the Asian Tsunami. Many mangrove ecosystems in Sri Lanka have been, and to a large extent are, indiscriminately exploited for commercial, aquacultural, agricultural, residential, tourism, mining and industrial development. They are also being used as dumping grounds for domestic, agricultural and industrial waste thus posing as imminent threats to the mangrove habitats. Studies conducted to evaluate the loss by the tsunami have found that the areas with dense mangrove forests have reduced the damage to properties by absorbing the tidal waves.

The destruction of mangrove ecosystems is caused mainly because of the conservation benefits of mangroves not receiving importance and the little understanding of the role mangroves play for sustenance of other economic systems. This has led to mangroves being considered as wastelands with little use, and no value.

This project attempted to generate information to realize the value of mangrove in monetary terms through a rapid mangrove valuation study undertaken in the southeastern coast of Sri Lanka and synthesis of information obtained from previous studies on mangrove valuation in Sri Lanka.



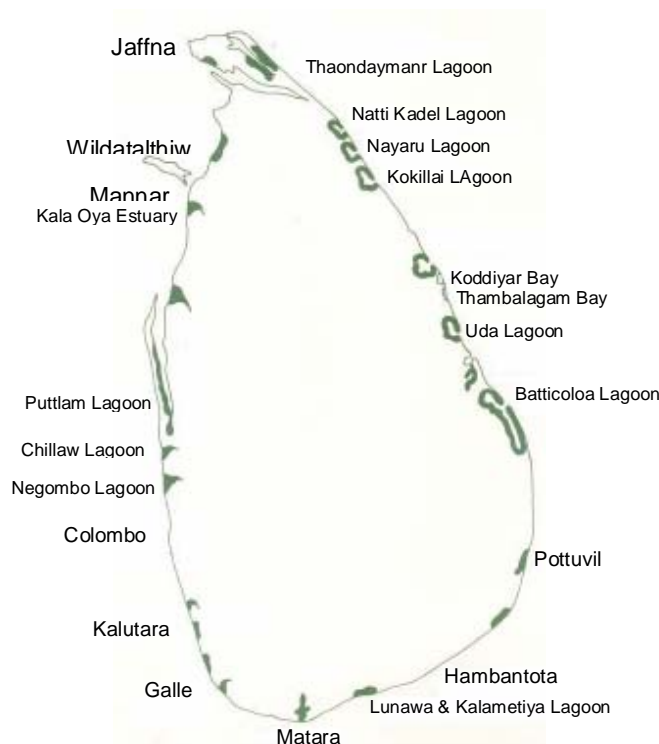
Mangrove ecosystem in Panama lagoon

Issues facing policy makers

- 1) What are the direct values of different mangrove goods (e.g. fuel wood, shrimp and fish)?
- 2) What are the indirect values of different mangrove ecosystem services (e.g. coastal protection and breeding grounds)?
- 3) What would be the economic and livelihood impact over time of continued mangrove loss?
- 4) How, overall, are the economic and financial benefits of different mangrove goods and services distributed between different beneficiaries (e.g. Local communities, Provincial economy, National economy, Global community)?
- 5) What is the overall economic efficiency of various competing uses of mangroves?
- 6) What is the economic rationale for mangrove rehabilitation and management?
- 7) How to allocate mangrove resources to improve human welfare?



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The distribution of mangrove eco-system in Sri Lanka

(Source: Mangroves in Sri Lanka, CCD)

Mangrove Biodiversity

Mangroves represent a rich and high diverse natural resource. Mangroves are home to many uniquely adapted biodiversity. The mangrove ecosystem plays a key role by providing the link between marine and terrestrial ecosystems. This link will provide and maintain the stability, not only to the mangrove habitats itself, but also to the other related coastal ecosystems, such as sea grass beds, coral reefs. This ecosystem plays a significant role in replenishing various fish populations for the coastal and lagoon fish industry. The nutrients given to the lagoon as a detritus from the mangrove ecosystem is carried in to the coastal waters by the tidal currents. They become food for marine micro-organisms, which is the first step of the marine food chain. The shallow inter-tidal reaches that characterize the mangrove wetlands offer refuge and nursery grounds for juvenile fish, crabs, shrimps, and mollusks. Mangroves are also prime nesting and migratory sites for hundreds of bird species. Additionally, manatees, monkeys, fishing cats,

monitor lizards, sea turtles, and mud-skipper fish use the mangrove wetlands as their habitat.

This unique ecosystem is home for over 29 true mangrove species in Sri Lanka. The major genera that represent these species are *Avicennia*, *Rhizophora*, *Bruguiera*, and *Sonneratia*. According to mangrove abundance and distribution, they can be categorized as very common, common, and rare; the very common species of Sri Lankan mangroves are *Avicennia marina*, *Bruguiera gymnorhiza*, *Excoecaria aggalocha*, *Lumnitzera racemosa*, *Rhizophora mucronata*, *Rhizophora apiculata*, and *Sonneratia caseolaris*. These species grow under a wide range of soil and hydrological conditions, and are widely distributed in Sri Lanka. The common category of mangrove species include *Aegiceras corniculatum*, *Avicennia officinalis*, *Bruguiera cylindrica*, *Bruguiera sexangula*, *Ceriops tagal*, *Heritiera littoralis*, *Pemphis acidula*, *Sonneratia alba*, *Nypa fruticans*. Although these species are widely distributed in Sri Lanka, they are low in abundance. Rare species of mangroves that are few in numbers restricted to a few locations include *Lumnitzera littorea*, *Xylocarpus granatum*, and *Scyphiphora hydrophyllaceae* in Sri Lanka.

Mangroves and Poverty

The coastal zone accounts for 33% of the population of Sri Lanka, possessing 24% of the total land area. Rural poverty persists in coastal areas and the majority of the coastal communities depend on fishing and agriculture for their livelihoods. Many mangrove resources are harvested for subsistence purposes. These include fuel-wood, aquatic products for food, shellfish species and fish species, medicinal herbs, vegetables, poles for fences, and posts. Most people are engaged in commercial activities like fishing, shrimp farming, collecting timber, vines for handicrafts, production of masks (*Cerebera manghas*), bark for tannin (traditionally in curing fishnets) and small ornaments using 'kaduru' wood. On the west coast of Sri Lanka, twigs and branches, mainly of *Rhizophora mucronata*, *R. apiculata* and *Lumnitzera racemosa*, are used to form "brush piles" or "brush parks" in a specially devised fishing method (AIMS, 2005).



Location of the Study Area-Panama

The study was undertaken in Panama village situated on the banks of the mouth of the Wila Oya River adjacent to the Kumana National Park. It falls under the administrative jurisdiction of Lahugala Pradeshiya Sabha situated on the eastern coast in Ampara District. The Lahugala Divisional Secretariat has 5 G.N. divisions comprising 1395 families.

The tsunami catastrophe had de-stabilised the economy with the majority of the population being engaged in agriculture and fishing that were badly affected sectors. During the tsunami, 70 small boats and 45 traditional crafts were wrecked while approximately 500 acres of paddy lands were damaged by the salt water and marine sediment intrusion. A key prominent feature is mangroves and sand dunes have acted as buffer to tsunami. The casualties and damages were minimised due to buffering effect of the ecosystem.

In the study, a questionnaire survey and focus group discussions were used for collection of data. Household questionnaire survey involved 109 households from the four GN Divisions in Panama.

Study Area

Valuing of Mangroves: The approach

By providing a means for measuring and comparing various benefits of ecosystems, economic valuation is a powerful tool to aid and improve wise use and management of those. The environmental valuation techniques adopt total economic value (TEV) framework and measure the incremental change in an individual's well being resulting from an incremental change in environmental quality.

The direct use value of the mangrove based on local use was assessed from the gross income generated by community, from the mangrove in terms of shellfish, fish, timber & poles, herbs and vegetables, fuelwood and other products. Market prices were used to calculate the gross income generated.

The indirect use values considered in this study include value in terms of coastline protection and stabilization and value in terms of providing breeding ground for fish.

Direct use values-Market valuation

Based on the results, the collective mangrove products represent a total gross value of US\$ 1,171/household/year, for a household that collect mangrove products. As far as the dependence of different income groups are concerned, the total mangrove dependence/household/year is US\$ 1,577 for poor, 1,431 and 806 for medium and rich groups respectively.

Out of the total value generated from mangroves, contribution of mangrove products to the income of poor income category is estimated at 42% using the market value. Of this total, 37% benefits were derived by medium income communities and, the benefit to rich community is 21%. Hence, the poor communities in the coastal zone are more dependent on mangroves than the rich.

The results also showed that, the poor income group depends on wide range of mangrove products and the communities on average are highly dependent on income from fish followed by shellfish irrespective of the income categories.

Mangrove Products	Average Quantity Collected per Household
Godaya (fish)	292.64kg
Reththala (fish)	295.3kg
Japan korali (fish)	181.8kg
Angulu (fish)	36.42kg
Shrimp (Kirissa)	45.1kg
Shrimp (Walissa)	20.25kg
Shrimp (Kara aduissa)	8.08kg
Crabs (Kakuluwa)	28.25kg
Parava (fish)	6.24kg
Fuel wood	454.2kg
Timber	5kg
Wooden poles(fences)	4.74Poles
Vegetables	40.91kg
Karankoku	0.07kg
Lunuvilla	0.21kg
Coir industry	1.24Bundle
Coconut leaves industry	265.36Leaves

Table 1. The use of mangrove products

Mangrove products-Community valuation

Fuel wood, herbs and wooden poles are derived from mangrove forests by the communities only for their subsistence use. Since the cash based techniques are not applicable for valuing the subsistence products, the participatory environmental valuation (PEV) technique was used to allow local communities to express the value within the context of their own perceptions, needs and priorities.

Indirect Values:

(a) Near shore fisheries

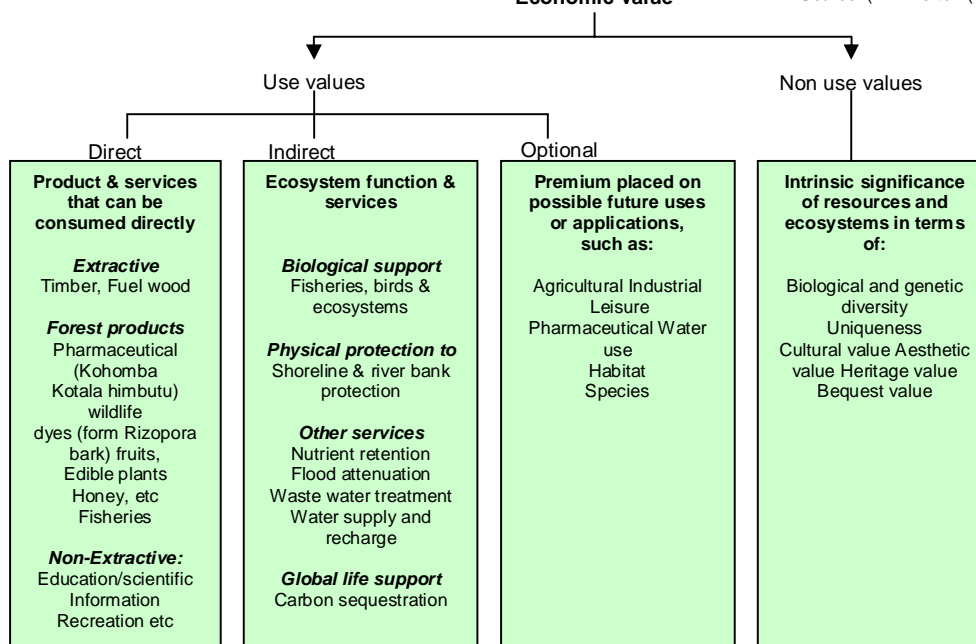
Indirect use value is determined by the contribution of resources in terms of their environmental and ecological services to support current production and consumption.

One important ecological service of mangroves is the support to off-shore fisheries by serving as a breeding ground.



Economic value

Source: (L. Emerton (ed), 2005)



Source: (IUCN 2003)

Assuming the dependence of these fish catches on the south-eastern coast mangroves of Sri Lanka is between 30% to 80%, (average) and based on there being 70ha of mangroves accessible to the community, the approximate net benefit value of coastal fisheries would be in the range between US\$ 177.9 to US\$ 474.3 per hectare of mangroves per year. The estimates are based on the measures of changes in net returns of fishery as indicators of change in social welfare.

(b) Shoreline protection

Another important ecological function of mangroves is to serve as a windbreak and shoreline stabilizer.

It has been experienced that the damage due to tidal surges and storms is much less with the presence of mangroves. This was evident during the Indian Ocean Tsunami where mangroves acted as barriers to reduce the force of the waves in some locations.

Based on this assumption, the study is using actual damage estimates on properties and livelihoods including tourism related hotel and cost of injuries as a measure of storm protection benefits of mangroves.

The value of the shoreline protection function of mangroves as revealed in this study is US\$ 392.5 per hectare of mangrove. The estimated value of mangroves in terms of coastal protection in this study could be an over estimation since the coastal protection benefits could be a combined effect of sand barrier and the mangrove forest present in the area.



The figure shows the destruction of Panama lagoon due to tsunami, whereas the interior mangroves were unaffected

Policy implications

Due to the fundamental issue of difficulty in measuring ecological benefits of mangrove ecosystems, the value of mangroves is always undermined. Moreover, the results from the analysis indicate that when coastal fisheries are well managed by local communities, the foregone benefits of mangrove in terms of support for coastal fisheries will be even greater.



Fishing activity

Under the locally-managed coastal fishery regime, converting mangrove forests into other options such as commercial shrimp farms is not economically viable. True value of mangroves in terms of ecological services and coastal fisheries are much greater than that of short term economical gain from shrimp farming.

Mangroves play a significant role as windbreak and shoreline stabilizer and acting as a buffer in the context of the extreme weather phenomena. Due to the complexity of nature, however, it is not very obvious on how mangroves act as a protective barrier in an incident of Tsunami affected human welfare.

Based on the study of Panama village on the south eastern coast of Sri Lanka, there is also a problem of "income distribution" with respect to conversion of mangrove forest in to any other options. Even though the venture is financially viable, the next logical question is "For whom?"

In this case, the local people tend to experience loss in terms of the net foregone benefits of mangroves such as fish and other mangrove products use for income and subsistence and

damage costs associated with those options. The gainers could be mainly outsiders who can afford the high initial investment requirement.

The results from the participatory valuation method show that although mangroves create enormous private benefits for those who subsist on these mangrove ecosystems, the market values rarely represent the true value of mangroves to the community considering the importance of mangrove products to the local community for their subsistence use.

According to the results, there also seems to be an incentive for the local villagers to protect mangrove forests. If it is likely that from society's point of view, the conversion of important mangrove forests into commercial activity is not economically feasible, the policy should encourage the participation of local people in the conservation of mangroves especially where a well managed coastal fishery is established in associated with mangroves.

Restoration

Restoration or rehabilitation may be recommended when a system has been altered to such an extent that it cannot self-correct or self-renew. Being a sensitive ecosystem this technique should be practiced with well planned system while taking the site specific conditions. Community based restoration approach has been widely used and considered common in restoring mangroves.



Mangrove nursery in Panama

IUCN has launched a mangrove restoration program and mangrove nurseries have been successfully raised in the Kumana buffer zone village-Panama. Members of Panama

Abesinghapura Small Fisheries Society have raised about 45,000 mangrove plants for replanting. In all, 35,000 *Rhizophora mucronata*, and 10,000 *Avicinia marina* seedlings have been successfully raised in the nurseries and five hectares of land has been planted with mangroves in Panama lagoon.

Fishing communities located around the mangrove areas have been made aware of the importance and benefit of the mangroves for fish stock. Except finance and technical advice, the community held the responsibility for restoration activities.

Although the regulations to safeguard the coastal ecosystems are in place, the enforcement of such regulations is practically difficult and the cost for effective enforcement could be very high. In this context the local community can play a role in the effective management of open access coastal mangroves. Involvement of local communities in the management of coastal ecosystems needs to be considered in the long term management strategies for the rehabilitated mangroves or green belts.

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Contact details:
The World Conservation Union (IUCN)
Sri Lanka
53, Horton Place
Colombo 07.
Tel: 2682418, 2694094
Fax: 2682470
E-mail: iucn@iucnsl.org
Website: www.iucnsl.org