



Mangroves and dependent communities: dynamics

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Abstract

Despite the fast strides of economic development, there are stakeholders who still depend on the traditional knowledge for their livelihood options. The mangroves, which are reported to be declining at a very fast rate, are a natural ecosystem which provides life support to dependent population along the coastal lines. This paper analyses the level of dependence of the marginalized communities on the mangrove ecosystem and its livelihood support level. Kerala coast, covering 10 per cent of the country's coastal line has only less than one per cent of India's total mangrove ecosystem. Majority of mangroves in Kerala are mainly seen in Kannur (44%) followed by Ernakulam (24%). Hence the study was undertaken in these districts. The respondents in this study were those living close to mangroves and depending on mangrove related livelihood options and mostly were residing within 100 m radius of mangrove areas. The mangrove vegetation was extensively used in the past for various purposes like fuel wood, building materials for constructing houses and poles for spreading nets or anchoring canoes in water. However, such dependence for these purposes is currently lesser. The life of all the respondents is closely linked with the nearby mangroves in one way or the other. Urgent measures are needed to preserve the valuable traditional knowledge associated with the mangroves in such a way that future generation can use and enjoy the coastal resource.

Key words: Mangroves, traditional knowledge, livelihood options

Introduction

Local communities dependent on natural resources for their livelihood needs are usually endowed with rich traditional wisdom associated with these resources. This knowledge, which is gained through generations of observation and accumulated experience, helps them in the sustainable management of the resources as well as supporting their lives.

Coastal resources such as coral reefs, mangroves and other wetlands are one among the richest store houses of biological diversity and primary productivity. The economic and ecological importance of mangroves were seriously discussed and gained increased attention of the public since

the tsunami of the year 2004, when they acted as buffers, preventing loss to life and property of coastal population. Globally numerous studies have identified that mangroves are vital for the existence of the coastal communities in its vicinity (Ruitenbeek, 1994). The studies by Dahdoudh-Guebas et al. (2000), Rasolofo (2000), Kovacs (1999) Kaplowitz (2001), Crona and Ronnback (2005) and Glaser (2006) confirmed the importance of mangrove's life supporting functions to local communities. Local communities depend on mangroves for wax, honey, firewood, poles, wood for furniture, traditional medicines etc. Even though indigenous knowledge about the mangroves has prime importance in its conservation and management, its contribution is often limited due to a general lack of understanding of what the

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indigenous knowledge actually is and how it can be explored.

Kerala with a coastal line of about 590 km, 35 to 120 km in width and 41 rivers emptying into the Arabian Sea, was once very rich in mangrove formations, perhaps next only to the Sunderbans. Kerala coast, covering 10 per cent of the country's coastal line has only less than one per cent of India's total mangrove ecosystem. In the state, mangroves are seen as narrow strips confined to the mud flats of delta, on the leeward faces of estuaries and also the embankments of the coast. Mangroves of the state are less complex in terms of tidal creek networks compared to the dense complex networks of mangrove ecosystems along the east coast of the country (Naskar and Mandal, 1999). This paper analyses the dependence of the stakeholders on mangroves and the indigenous knowledge associated with it.

Materials and Methods

The major shares of mangroves in Kerala are seen in Kannur (44%) followed by Ernakulam (24%). The four northern districts, Malappuram, Kozhikode, Kannur and Kasargode, account for more than 60 per cent of the mangrove area of the state, imparting higher heterogeneity in the ecosystem than the Southern part. This study was undertaken in Kannur (9 grama panchayats) and Ernakulam (8 grama panchayats) districts.

The study was initiated by holding informal discussions with local residents, officials of forest/agriculture/fisheries department, members of local self governments and elderly people in the locality and also by direct observations. Through this process, a stakeholder group who depended on the ecosystem directly was identified and categorized as 'residents'. These are people mostly residing within 100 m radius of mangrove areas and their population depending on mangrove related livelihood activities. The residents are thus living very close to mangroves or with mangroves as one

or more of the boundaries of their households. They are very poor people residing in highly fragmented lands, of average size of 0.04 ha and are highly vulnerable to flood and storm surges. Here, mangroves act as bio shield for the life and property. They also harvest fuel wood and small timber from the mangroves. In addition, these residents catch fish from the nearby water bodies for their household consumption. The poor sanitation and inadequate access to potable water are usually experienced in the area especially in Ernakulam. The primary data was gathered from 120 respondents who were selected randomly from these two districts. Data were collected through personal interviews using structured pretested interview schedule along with direct observation. The stakeholders' dependence on the products and services derived from the mangrove ecosystem viz. fuel wood, fodder, medicine, shoreline protection, buffer action against cyclonic/tsunami waves, biodiversity conservation etc were gathered in length through structured interview schedule. The location specific dependence was collected through direct observations and informal discussions. The data collection was conducted during the period of June 2012 to January 2013.

Results and discussion

Distribution of mangroves in Kerala

The species diversity of mangrove vegetation in the state is considered to be high. Unni (2004) and Khaleel (2009) reported 18 true mangrove species and 23 associates from the state. Anupama and Sivadasan (2004) reported only 15 true mangroves. But the mangrove associates were nearly three times, i.e. 49 in number belonging to nine genera and seven families. Madhusoodhanan and Vidyasagar (2012) also found 15 species but could locate only 33 associates. The important mangrove families commonly seen in Kerala are *Rhizophoraceae*, *Avicenniaceae* and *Sonneratiaceae*. *Avicennia officinalis*, *Avicennia marina*, *Bruguiera cylindrica*, *Excoecaria agallocha*,

Table 1. Distribution of respondent households according to proximity of mangroves

Sl No.	Distance (km)	No. of respondents		
		Ernakulam	Kannur	Overall
1	Mangroves as boundary of land property	32 (53)	18 (30)	50 (42)
2	Residence within 50 m away from mangroves	22 (37)	18 (30)	40 (33)
3	Mangroves 50 - 100 m away	6 (10)	10 (17)	16 (13)
4	Mangroves 100 m away	0	14 (23)	14 (12)
	Total	60 (100)	60 (100)	120 (100)

Figures in parentheses represent percentage to total

Kandelia candel, *Rhizophora mucronata* and *Sonneratia caseolaris* are the commonly seen mangrove species in Kerala. Two species *Derris trifoliata* and *Acrostichum* are also reported from the state, but scientific community is yet to make conclusions on these two.

Socio-economic status of the stakeholders: residents

The average age of the respondents in Ernakulam was 42 years while it was slightly higher in Kannur with an overall average age of 45 years. Most of the respondents in the two districts had attained secondary level of school education. The livelihood pattern of the stakeholders was clearly associated with the nearby water bodies. Nearly half of the respondents in Ernakulam were fishermen. The rest were engaged in casual wage labour and private jobs, in the nearby urban centres. Majority of the respondents in Kannur were casual wage labourers in agriculture or in construction sectors. Males outnumbered females among the respondents. The average annual income per person among the respondents in Ernakulam and Kannur was Rs. 1,65,078 and Rs. 1,66,450 respectively with overall average income per person being Rs. 1,65,764 per year.

The distribution of stakeholders according to the proximity to mangroves was presented in Table 1. In 42 per cent cases mangroves formed a fence in at least one of the boundaries of their land property. More than half of the respondents in Ernakulam belonged to this category especially in areas like Edavanakkad, Nayarambalam and Vypeen. In the case of one third respondents mangroves were seen

at a maximum of 50 m away from their residence, though it was not their boundary wall. For the rest 25 per cent of the respondents it was 100 m - 1 km.

The ownership status of mangroves in Kerala is reported as mainly private (Unni, 2003). However private owned mangroves are relatively lesser in Ernakulam. Mangroves in Ernakulam are spread across lands mainly owned by public enterprises and are extensively reclaimed for developmental projects of Cochin Port Trust, International Transshipment Container Terminal (ICTT) Vallarpadam and LNG Petronet, Puthuvypeen. The private ownership with highly fragmented lands is mainly observed in areas like Thanthonni Thruth, Edavanakkad, Vypeen, Mulavukad and Panambukad. On the contrary, in Kannur district, most of the mangrove spread is in agricultural lands/residential area, which are privately owned.

The study area in Ernakulam district is very close to the city of Cochin, hence the pressure on land for development/ construction activities is very high. According to Census, 2011, the per capita land availability in Kerala was reported as 0.13 ha and 94 per cent of people in the state were categorised as marginal land holders (< 1 ha). The average holding size of respondents was 0.04 ha and 0.16 ha in Ernakulam and Kannur respectively with an overall average of 0.1 ha (Table 2). A study by Ramachandran et al. (2005) confirmed that the average land holding size of coastal villages of Kerala was below 0.04 ha especially in Ernakulam district. Fifty per cent of the respondents possessed only less than 0.04 ha and their proportion was more

Table 2. Details of the landholding size of the residents

Sl No.	Size of land holdings (ha)	No. of respondents		
		Ernakulam	Kannur	Overall
1	< 0.04	37 (62)	27 (45)	64 (53)
2	0.04 - 0.2	23 (38)	11 (18)	34 (28)
3	0.2 – 0.4	0	13 (22)	13 (11)
4	0.4 – 1.2	0	9 (15)	9 (8)
	Total	60 (100)	60 (100)	120 (100)

Figures in parentheses represent percentage to total

in Ernakulam (62%). About 23 per cent possessed 0.04 to 0.2 ha with an average of 0.12 ha. None of the respondents in Ernakulam had larger land area of size greater than 0.2 ha. The land ownership in Kannur district was comparably more distributed than in Ernakulam. Majority (45%) belonged to the marginal group with less than 0.04 ha average holding. The land area between 0.2–0.4 ha was possessed by 22 per cent while 18 per cent have 0.04–0.2 ha.

About 20 per cent of the respondents in both districts owned mangrove lands; thus the average size of mangrove area equivalent per household (who possess mangroves as boundary) in Ernakulam and Kannur was calculated as 0.04 and 0.1 ha respectively. These households had mangrove areas within the total owned land and in most cases mangroves remain as one of the boundaries and these were estimated separately for calculating mangrove area equivalent.

Livelihood dependence on the mangroves

The intensity and the nature of dependence of mangroves have changed substantially over time among the stakeholder groups. The mangrove vegetation was extensively used in the past for various purposes like fuel wood, building materials for constructing houses and poles for spreading nets or anchoring canoes in water. Owing to the socio-economic changes and technological factors, the dependence for these purposes is less. The

stakeholders have more realistic perception towards mangrove ecosystem and hence the life supporting services rather than direct uses are given more emphasis often. The dependence on mangroves by the local communities of Kerala is limited compared to their counterparts in the Sunderbans (India and Bangladesh). It was estimated that in Bangladesh and India, around 9 million people are dependent on the mangroves for their livelihood (ICZM, 2004). The direct benefits from mangroves are detailed in Table 3. The lives of all the respondents are closely linked with the nearby mangroves in one way or the other. All the respondents in Ernakulam and 92 per cent in Kannur opined that they are receiving beneficial effects either direct or indirect from mangroves.

Mangroves were a major source of food, fodder, medicines and wood and many other goods for the local communities. Owing to the changes in the demand (social and economic behaviour) and the supply (depletion of mangroves) conditions, this dependence has been reducing substantially. Still there exists some level of dependence, for fuel wood, fodder and poles.

Traditionally the local population extracted wood products from mangroves, which included wood for construction purpose (poles) and fuel wood. Fuel wood collected from mangroves was considered to have high energy efficiency. Since, the source of household energy for cooking has got changed to LPG (Liquefied Petroleum Gas), the use of fuel

wood is limited now. A similar reduction in use of fuel wood was reported from Thailand by Sudtongkong and Webb (2008) as well. Further, the stringent forest laws restrict mangrove destruction and hence currently extraction is restricted to that of dried branches, twice or thrice a year. In Kannur the patrolling of forest officials and vigil of the environmental activist groups against mangrove destruction is intense. So the people are not daring to harvest even though they wanted to.

The respondents of Ernakulam (27%) and Kannur (37%), are depending on mangroves for their fuel wood requirements (Table 3). They spend average five hours/day for fuel wood collection, extracting an average of 15.5 kg for 20 days an year. Generally, *Rhizophora* sp., particularly its stilt roots are preferred as fuel wood. The species is preferred owing to its availability, easy accessibility, inflammability and easy drying nature. Even the fresh green wood is directly used as fuel wood. The roots of this species are normally collected during summer months (April and May) and kept along the river bank for drying. It is a regular practice in summer and they store it for the rainy season. To certain extent, *Sonneratia* sp. is also harvested for fuel wood. But hardness of its wood limits the harvesting.

Generally, fuel wood collection is the mandatory activity of rural females in India. Mostly the females collect the roots during summer months and store it for the lean rainy season. Unlike the fuel wood collectors in other parts of India especially North and East India, respondents in this case are collecting wood from the nearby places individually and hence the distance travelled for the fuel wood collection is practically negligible. If the purchase price of similar fuel wood species in the locality is applied, the average value of the collected fuel wood per person per year in both the districts was found to be Rs. 1,228.

Mangroves were a major source of fodder in traditional days. Elder generation of people

especially in Kannur recollects the dependence on mangroves for fodder in their earlier age. Mangrove leaves were used as fodder in coastal areas especially the species like *Avicennia marina* and *Sonneratia alba*. The most common species is *Avicennia* owing to its high palatability (salty in taste). In addition, the calcium content in the leaf is very high which directly increases the milk yield. The species became more acceptable among the local communities since 1990's following the confirmation of the local veterinary surgeon. The milk enhancing property of *Avicennia* was also reported from Gujarat and Pakistan (Baba et al., 2013).

The paddy cultivation was prevalent all over in Kerala till 1980's and correspondingly livestock was integral component of homesteads of the state. The availability of paddy straw in the state is very much reduced owing to the decline in paddy cultivation. Together with, the reduced accessibility of green fodder, practice of feeding the cattle with manufactured cattle feed is more common now.

Out of 120 respondents only 5 per cent were utilizing mangroves for fodder purpose. Presently, the fodder gathered was meeting one quarter of the fodder requirement per household. Based on the market price, it was valued at Rs. 2,560 per person per year. On an average 128 days equivalent was spent for the collection of the same, mainly by the womenfolk. The constant vigil of the environmental activist groups and Forest and Wildlife department officials limits the fodder collection from mangroves in Kannur. However, the fodder properties of mangrove species are not properly understood by the respondents in Ernakulam district and none of the sampled respondents were reported to be collecting fodder.

The poles from mangroves (*Rhizophora*, *Avicennia*, *Bruguiera*) were commonly used for constructing thatched houses. Currently most of the houses have concrete roofing and hence use of poles is limited. Some 10-20 per cent of the respondents had reported

Table 3. Level of dependence of mangroves

Sl No.	Particulars	Ernakulam			Kannur		
		No. of respondents	Quantity per person per year (Kg)	Value per person per year (Rs.)	No. of respondents	Quantity per person per year (Kg)	Value per person per year (Rs.)
1	Fire wood	16	306	1224	22	308	1232
2	Fodder	-	-	-	6	1024	2560
3	Poles	5	12 (No.)	720	11	15 (No.)	900

to be collecting poles of *Rhizophora* and *Bruguiera* which amounted to 12–15 numbers of poles worth Rs. 720-900 per year. Thus fuel wood, fodder and poles collected from mangroves were equivalent to 3 per cent of the annual household income, which otherwise should have been spent on these items.

The indigenous technical knowledge in traditional home remedies is closely linked with the local flora and fauna. The mangrove species, *Avicennia*, *Excoecaria*, *Bruguiera gymnorrhiza*, and *B. cylindrica* were used in home remedies. The fruit of *Avicennia* was used against rheumatism and also as cattle medicine. The woods of *Excoecaria agallocha* and *Bruguiera cylindrica* were mainly extracted for cork making and were traded in domestic and export market. Presently, none of the respondents were engaged in this activity. A village called Korom, near Payyannur in Kannur district was famous for this small cottage industry. The use of mud deposited in mangrove ecosystem as manure for coconut palms is also prevalent in Kannur. It is confirmed by the studies of Nambiar and Raveendran (2009).

Though the extent of extraction of goods from mangroves has shrunk over the years, the ecosystem services from them has been recognised and valued much. Mangroves act as green fence in areas like Nayarambalam, Edavannakkad and Narakkal of Ernakulam district. The mangrove species, *Bruguiera gymnorrhiza* (*Ezhuthani kandal*) is planted along the boundary of homesteads to prevent soil and embankment erosion in the fragile coastal areas. About 30 per cent of the respondents have planted them in the boundaries of household.

The green belt of mangroves offer protection against storm surges in the coastal area. The respondents in Edavannakkad of Ernakulam district had experienced the effect during Asian tsunami of the year 2004 and the regular annual cyclones. Hence mangroves offer protection to the life and property of coastal communities.

The respondents from Thazhe Kavu in Thekkumbad Island in Mattool grama panchayat of Kannur also mentioned the role played by mangroves in preventing the entry of saline water intrusion to the coconut farms. The island is characterised by the presence of a biodiversity rich coastal sacred grove namely Thazhekavu. This place along the Valapattanam estuary is rich in mangroves. It is also reported by Sreeja and Khaleel (2010). However the younger generation among the local communities has only limited knowledge about the use of mangroves. The prevailing traditional knowledge is slowly eroding along with the older generation.

The massive reduction in the mangrove area to about 2000 hectares in the state from 70,000 hectares as per historic records highlights the need of the development of a socially desirable management option for the conservation of mangroves in the state. One of the aims of any management option of natural resources is biodiversity conservation and enhancement (Sudtongkong and Webb, 2008). The Sunderbans mangrove was the first scientifically managed mangroves in the world (Kumar, 2000). In Kerala, an effective management strategy for mangroves is to be evolved in view of the rising pressure on land resources. An effective

management plan is mandatory for the conservation of mangroves especially in a land scarce state like Kerala. The plan would be effective and viable only with the participation of local communities around the mangrove ecosystem. The stakeholders emphasized the need of a management option for the effective management and conservation of the fragile ecosystem. The informal discussion with the stakeholders revealed their willingness to participate in conservation activities and hence community management can be introduced as a socially desirable management plan for the conservation of mangroves.

In the coastal state of Kerala, direct dependence on mangrove is very limited and the local communities give more importance to the ecological services of mangroves like coastal protection, storm abatement, prevention of soil erosion etc. The feasibility of mangrove as a viable option against highly expensive civil engineering structures along the coastal area like sea walls need to be further explored. Being resource and economically poor, local communities will find it difficult to offer any sorts of payment for the conservation of mangroves. This acts as major hindrance for the implementation of the community management unless there should be ample public funding. Local communities appreciated the ecotourism potential of mangrove habitat and resultant economic growth, which has positive influence on perception and attitude towards participating in the conservation initiatives of mangroves.

Community management refers to a system where a locally derived formal governance structure has been developed to manage, protect, and use of the resources (Sudtongkong and Webb, 2008). This arrangement requires the active participation of existing local communities and would allow them to express their opinion and make decisions regarding the management plan and regulations related to the utilization of mangrove resources. The community management of the mangrove ecosystem provides opportunity for the local

community to participate in management decision process. Through this, local community became aware of the importance of the conservation of the mangrove ecosystem and prevents further degradation and participates in the awareness campaign and encourages their neighbours to participate in conservation drives. Hence community management provides a socially desirable mechanism to achieve the goal of mangrove ecosystem conservation.

Community management of mangrove is found successful in Thailand, Indonesia while it has got mixed response from India, Philippines, Vietnam and Tanzania (Datta et al., 2012). However the community management of mangrove ecosystem will be successful only when more local dependence on mangroves, collective action and mutual agreement on regional and political arena are favourable (Sudtongkong and Webb, 2008). It is essential to motivate local communities to involve in income generating activities without the destruction of the mangrove ecosystem *per se*. The reforestation or replanting can find higher success rate with the use of appropriate species and suited planting sites based on the traditional knowledge of the locals.

Policy suggestions

Scientific attempts on realistic area estimation and mapping of the mangrove resources in the state are to be initiated. There should be attempts to identify and classify the species and document the traditional wisdom associated with them. The scientific validation of the same may also be undertaken. The stakeholders who live closest to the mangrove ecosystem attribute more importance to the ecological benefits. Hence, their role in conservation efforts should be appropriately utilized. The community management system can be implemented as the institutional form for mangrove management. Efforts should be in place for awareness creation programmes. There should be public funding for the conservation efforts.

Mangroves, even though are invaluable treasure of our biodiversity, its significance is slowly declining owing to ignorance and negligence by the society during the developmental strides. Still, there are local communities who depend on it for their livelihood needs. The communities who reside close to the wetland systems depend on the mangroves for their daily needs (extraction of fuel wood, fodder and poles). Moreover they are also aware of the indirect benefits of mangroves i.e. ecological service (storm protection, reduction of soil and embankment erosion) and hence protect and plant mangroves along the boundaries of their householdings. The traditional knowledge associated with the mangroves is closely interwoven with the local use pattern and this naturally supports their decision making on the protection and management of the ecosystem. Considering the social and ecological significance of this natural resource and associated knowledge resource, institutional and policy measures like community management are to be framed for its sustainable management.

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