A Study on Interrelations between Mangrove Ecosystem and Local Community on Ecosystem Sustainability: A Case Study in Maduganga Mangrove Estuary, Sri Lanka.

Ellawala K.C. and Ariyaratne D.L.S.

1 Department of Civil and Environmental Engineering, University of Ruhuna
Hapugala, Galle
SRI LANKA

2 National Water Supply and Drainage Board, Matara
SRI LANKA

E-mail: ellawala@cee.ruh.ac.lk

Abstract: Mangrove ecosystems are ecologically important coastal ecosystems that occur in sheltered tropical and subtropical shores and estuaries. They are among the most threatened ecosystems today. The objective of this study is to investigate the interrelations between the ecosystem and local community, which subsequently has a greater influence on ecosystem sustainability. The study was carried out in Maduganga ecosystem; which is a complex coastal wetland ecosystem situated in Galle district of Southern Sri Lanka. Data collection was carried out by means of questionnaire surveys. The judgement of the local community on temporal changes in the mangrove plant community in terms of species availability and density of mangrove cover is not positive. Approximately 70% of participants claimed that they have interactions with the ecosystem and they listed the benefits they receive. Further, local community suggested that the recreational boat service is the most threatening activity on the ecosystem sustainability.

Keywords: Mangrove, Maduganga, Interrelations, Local Community, Sustainability

1 INTRODUCTION

Mangrove ecosystems are ecologically important coastal ecosystems that occur in sheltered tropical and subtropical shores and estuaries (Lewis III, 2005). Mangrove species have structural and physiological adaptations to grow in saline and muddy conditions (Bambaradeniya et al. 2002). Mangrove forests provide a number of ecological benefits including stabilizing shorelines, reducing wave and wind energy against shorelines, and thus protecting inland structures, supporting coastal fisheries for fish and shellfish through direct and indirect food support and provisions for habitat, and support of wildlife populations including a number of wading birds and sea birds (Lewis III, 2005). Mangrove forests are among the most threatened ecosystems today. As population increase, natural resource management involves conflicts between economical development and ecosystem protection. This becomes more complex when local population exists within or close to the sensitive or protected areas (Christensen et al. 2008).

Early approaches in ecosystem conservation planning basically developed by state authorities with their officers and ended up unsuccessful or unimplemented. Several factors affected in these failures; two major factors becoming officers had lack of experience on the particulars of that specific ecosystem and resistance by stakeholders (Glaser, 2003). Specially, many technically feasible ecosystem conservation plans failed due to lack of support by the local community (stakeholders). Later, the concept of sustainability, which addresses the ecological, economic and social aspects of the ecosystems, came into picture. In which, interrelations between local community, their livelihood and ecosystem was given due attention. Community participation was accepted in sustainable ecosystem conservation planning as a crucial component now (Human and Davies, 2010).

Maduganga estuary and mangrove islets are a complex coastal wetland ecosystem situated in Galle district of Southern Sri Lanka. The importance of this wetland in terms of its aesthetic, ecological and biological significance has been identified; detailed study on its biodiversity has been carried out by IUCN Sri Lanka (Bambaradeniya et al., 2002). The area has been designated as the third Ramsar wetland in Sri
Lanka, wetlands of international importance. Further, it has been recognized as a priority wetland for conservation by Central Environmental Authority (CEA), Sri Lanka. Recent research highlights that habitat degradation, direct exploitation of species, human population pressure and spread of invasive alien population is threatening this ecosystem by inducing considerable stress on its ecology and biodiversity (Bambaradeniya et al., 2002). In identifying threats to the ecosystem, some studies have selected stakeholder participation is important. However, interrelations between local community and their livelihood, their dependability on the ecosystem has been given less attention in almost all projects. Therefore the objective of this study is to investigate the interrelations between the ecosystem and local community, which subsequently has a greater influence on ecosystem sustainability.

2 MATERIALS AND METHODS

2.1 Study area

Maduganga estuary and mangrove islets system is located in Galle district of Sri Lanka was chosen for the study (6°18’ N, 80°03’ E) (Figure 1). The total area of the estuary is 915 ha, of which 770 ha consist of open water, while islands account for 145 ha. The area located within the South-Western lowland wet zone of Sri Lanka, hence experiences a perennially wet climate (CEA/Euroconsult, 1997; Bambaradeniya et al., 2002). Thick mangrove vegetation is prevalent along the northern and northwestern banks of Maduganga, at the lagoon mouth and on majority of the islands. Maduganga wetland consists of 10 major wetland vegetation types including 19 endemics and it is the habitat for 248 species of vertebrate fauna, in which 20 species being endemic (Bambaradeniya et al., 2002). Most of the lands in the study area including the large islets are privately owned.

![Figure 1: Maduganga mangrove estuary (Source: www.maps.google.com)](image)

2.2 Data collection

Data collection was carried out by means of questionnaire surveys. Number of household units within the mangrove islets is estimated be around 500 (personal communication with local people and local religious leaders). One hundred and fifty three individuals from seventy different household units were participated for two questionnaire surveys, which represents approximately 30% of the housing units available within the Maduganga ecosystem. Participants were selected randomly. In addition, information collected from the boat drivers, boat service operators who are operating the recreational boat service in the area.

The questionnaires were prepared to evaluate their awareness on the ecosystem, their relationship with the ecosystem and to gather information on deteriorating actions of the human population on the ecosystem and their suggestions for ecosystem conservation and management. In addition, dependability
of the livelihood of local community on ecosystem was studied. Individuals, who have an opinion on the species availability, their usage and significance of those species for them and the environment both, were considered as people who are aware on the ecosystem. Passive consultation technique was chosen for the study, where participants simply provide the information for the study and the study team gather the information and document (Reed, 2008).

3 RESULTS AND DISCUSSION

Participants for the current study were residents in Maduwa, Mahaladuwa and Galmanduwa mangrove islets located in Maduganaga estuary. It was found that 77% of participants were aware on the ecosystem, estimated based on their perception on flora and fauna available in the ecosystem. In addition, the judgement of the local community on temporal changes in the mangrove plant community in terms of species availability and density of mangrove cover was discussed. Most of them are aware that the plant community is decreasing though they are not sure of the degree of the impact (Table 1). They may not sure on the degree of the impact because of two main reasons. One is it is a qualitative measure depending on each person’s view. The other is the difference between their ages, because the baseline for comparison differs with the age of the person. However, all together 72% suggest it is decreasing; it gives us evidence that there is a threat to the ecosystem.

Table 1: Opinion of local community living in Maduganga ecosystem on current situation of mangrove plant availability and density compared to past

<table>
<thead>
<tr>
<th>Current situation</th>
<th>Percentage (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mangrove plant community Increased</td>
<td>1.2%</td>
</tr>
<tr>
<td>Mangrove plant community decreased, but restoring</td>
<td>22.9%</td>
</tr>
<tr>
<td>Mangrove plant community is decreasing gradually</td>
<td>37.3%</td>
</tr>
<tr>
<td>Mangrove plant community destroyed heavily</td>
<td>12.0%</td>
</tr>
<tr>
<td>No difference in mangrove plant community</td>
<td>12.0%</td>
</tr>
<tr>
<td>No opinion</td>
<td>14.5%</td>
</tr>
</tbody>
</table>

Among the participants, 70% respond that they have associations/interactions with the ecosystem and/or they receive benefits from the ecosystem (Table 2). However, 30% of participants considered they have no interaction or use from the ecosystem. Individuals, who considered that they have interactions, listed their economic activities, shoreline protection near their residences, food supply, household fuel supply and indigenous medicine supply as their interactions and benefits they received. However, the others who considered no interaction with ecosystem also received the benefit of shoreline protection near their residences, sometimes indirect economic activities, though they did not consider those as the benefits they receive from this ecosystem. It should be noted that a higher percentage (41%) claims that they have no associations while getting natural services from the ecosystem. In analysing this response in detail it can be noted that they evaluate the economical benefits from the ecosystem in the first place and when they have no direct economic benefits from the ecosystem then they assume that they have no associations/interactions with the ecosystem. This view should be improved by increasing their awareness and by motivating them to rethink and evaluate the ecosystem services such as shoreline protection.

The occupational structure of the local community was studied to identify the dependency of local community on the ecosystem for their livelihood. It was found that the dependency of the local community on the ecosystem for the livelihood is very low (Table 3). The occupation of 83.1% of the participants is not dependant on the ecosystem. Remaining 16.9% is directly or indirectly dependant on the ecosystem for their occupation. Among their economic activities lagoon fishing and prawn cultivation become prominent. Cinnamon cultivation is also identified as one of the main human activities with this ecosystem form earlier times (Bamaradeniya et al., 2002).
Participants for this survey highlighted three main human interactions affecting negatively on the ecosystem sustainability. Those are recreational boat service available in the area, clearing of vegetation for domestic and commercial construction, pesticide usage in cinnamon cultivation. All these activities are contributing to the habitat degradation. In current study no evidences were received for direct exploitation of species in the ecosystem, however some previous studies have identified that direct exploitation of species is negatively affecting on the the wildlife (Barnabaradeniya et al., 2002). In addition invasion of alien species is available in the area, however the percentage of the locals who are aware on that is very less.

48% of participants suggested that the recreational boat service has the highest negative impact on the ecosystem. Most of the other causes they highlighted as negative impacts on the ecosystem are their consequences. For example, bank erosion due to waves, destroying the breeding places for fish and shellfish, oil spills floating on the water, are the consequences of the recreational boat service. However, in analysing the occupational structure of local community the involvement in local community on recreational boat service is very less. The data gathered from participants as well as other sources confirmed that most of the people dependant on recreational boat service for their livelihood is not belonging to the local community living within the ecosystem. Collected information supported that community dependant on the boat service are belonging to the people living in the adjacent cities such as Balapitiya.

Qualitative and quantitative reduction of mangrove cover is a problem encountered worldwide (Christensan, 2008, Glaser, 2003, Iftekar and Islam, 2004). In comparing the data collected for Maduganaga ecosystem with the other mangrove ecosystems available in the world, the dependency of this local community is comparably less in Maduganaga ecosystem (Glaser, 2003). Since the local community is less dependent on the ecosystem for their economy, imposing restrictions on ecosystem deteriorating activities such as recreational boat service may become easier.
4 CONCLUSION

Human activities such as recreational boat service are adversely affecting on the species diversity and subsequently the sustainability of the ecosystem. However, interrelations between mangrove ecosystem and local community for livelihood are less in Maduganga mangrove ecosystem, compared to same systems in the world. Further, local community is aware that ecosystem is deteriorating, hence their willingness in participation in ecosystem protection activities may serve in ecosystem conservation planning if due attention is given.

5 ACKNOWLEDGEMENTS

This research was partially financially supported by the University of Ruhuna. The authors would like to thank to the local community in Maduwa, Galmawwa and Mahaladuwa area for their volunteer participation in the study. The support given by the technical staff, National water supply and drainage board, Matara and undergraduate students, Faculty of Engineering, University of Ruhuna is greatly appreciated.

6 REFERENCES


