



The environmental challenges of declining mangroves: an analytical survey in Puttalam District in Sri Lanka

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ABSTRACT

This study under the title of “the environmental challenges of declining mangroves: a study based on Puttalam District in Sri Lanka” was undertaken to attain the primary objective ‘to identify the factors for the declining of the mangroves in the study area’ and the secondary objectives ‘identify the environmental challenges due to the mangroves declining in the study area and to suggest ways to control the decline and to provide awareness of this problem among the inhabitants’. Both, primary and secondary data were collected for this study. As primary data, questionnaire survey, direct observation and constructed discussion were used. As secondary data, statistic reports, previous researches, books and magazines were employed. According to the analysis, major environmental challenges were encountered. These included ‘land fragmentation, biodiversity destruction, decreasing endemism in mangrove, loss of herbs and coastal soil erosion’. To overcome these challenges, many recommendations were put forward.

Keywords: mangrove, environment, land fragmentation, biodiversity

1. INTRODUCTION

More than 1/3 world mangroves have been destructed in last 2 decades. Some countries have lost 80 percent of mangroves. Annually, 3.6 percent of the mangrove species accounts for the destruction.

Mangrove forests are distributed in the inter-tidal region between the sea and the land in the tropical and subtropical regions of the world between approximately 30° N and 30° S latitude (Global Ecology and Biogeography, 2010). Almost 40% of the world's mangroves are concentrated in Asia. In Sri Lanka many statements have been recoded about the types of the mangroves.

However, 24 species of mangroves from 12 families available in Sri Lanka. Jaffna, Kilinochchi, Mullaitivu, Trincomalee, Batticaloa, Amparai, Hambantota, Matara, Galle, Kalutara, Colombo, Gampaha, Puttalam and Mannar such 14 districts deserve the availability of the mangrove in Sri Lanka. According to the report of the coast conservation Department in 1986, total land occupied by mangrove is 12,189 hectares. The recent activities caused the declining of mangrove occurrence. In 2002, the total amount of the mangrove occupied land 6000 hectares.

In the coastal area of Puttalam District, mangroves play vital role and they are considered as the most valuable coastal ecosystem in the coastal region. They protect the coastal regions and also, mangroves protect from the impact of climate change such as coastal erosion and sea level rise. Human get benefitted from mangroves in many ways, for the fish, crab and shrimp farm industry, providing accommodation, protection and food for all kind of species, conserve corals, nourish sea grass, extracted juice for coloring the fishing nets to reduce decaying, for constructing houses and erecting for fences and wood pillars, for herbs, food and beverages, for the honey attracting the bees, for tourism and providing protection from strong wind, tsunami and soil erosion.

Inversely, agricultural activities, housing scheme for settlement, industrial activities, expansion of shrimp farms, intrusion of the freshwater, coastal erosion, formation of playground and natural phenomenon such as Tsunami reduce the occurrence of mangrove in Puttalam area.

Mangroves in Sri Lanka are composed of 20 species of true mangroves and 24 species of mangrove associates which is 1/3 of all mangrove species in world. Most of the mangroves occur in the Puttalam – Kalpitiya area and the estuaries of the Eastern Province. Due to the destruction of the mangrove many environmental problems have been triggered.

There are 16 genuine mangrove varieties and 12 other plants belong to the mangrove community around the lagoon. The Puttalam lagoon is the second largest lagoon in Sri Lanka and its environmental productivity is very high compared to the other lagoons.

2. STUDY AREA

The Puttalam District, which is a capital of Northwest Province, situated in the North latitude 8.229377 to East longitude 79.812579. The extent of this area is 3013 km². This District has 16 Divisional Secretariats with 548 GN Divisions.

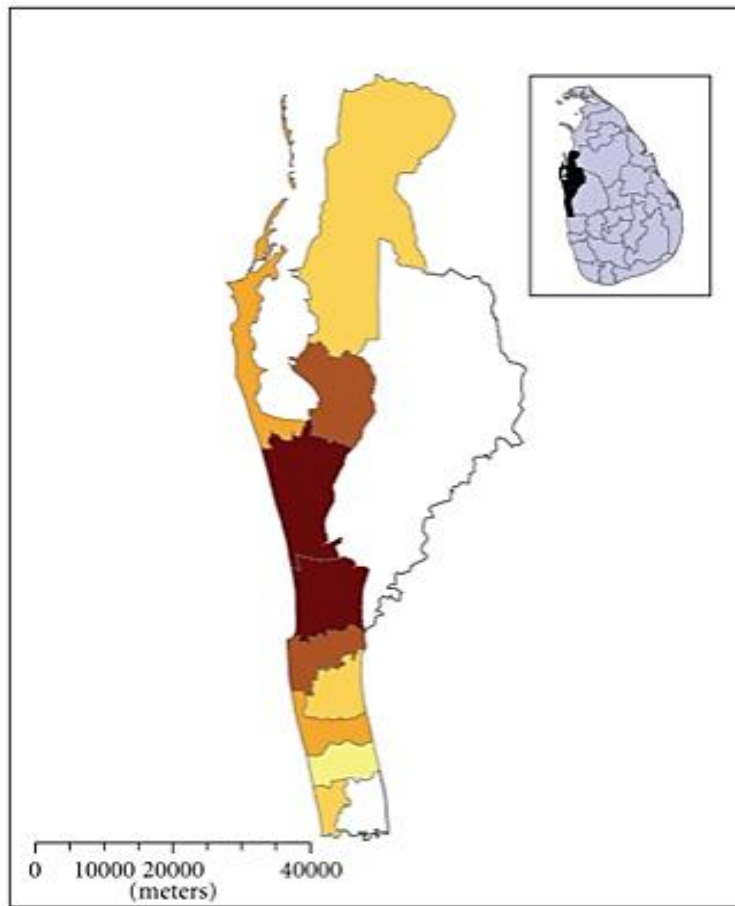


Figure 1. Study area

3. OBJECTIVES

Primary objectives

- To identify the factors for declining of the mangroves in the study area.

Secondary objectives

- Identify the environmental challenges due to the mangroves declining in the study area.
- To suggest to control the decline of the mangroves and providing awareness among people.

4. MATERIALS AND METHODS

Both primary and secondary data were used to conduct this study. Questionnaire survey as simple random sampling system among 100 of which 20 officers from Coastal

conservation department, people who live in the 100m margin area 20 others, living in 200 m coastline area. Fishermen 20, owners of coastline hotels. The photographs were captured to show the exact situation of the mangrove destruction of the study area. For the map making process, Arc GIS 10.5 software was used.

5. RESULT AND DISCUSSION

Human gets benefited from mangrove in many ways such as herbal for the medical purposes and the timbers and wood for many purposes. In the global context, 35 percent mangrove and mangrove associates have been declined in last decade. In the study area, 38 percent of mangroves have been declined due to the shrimp growing.

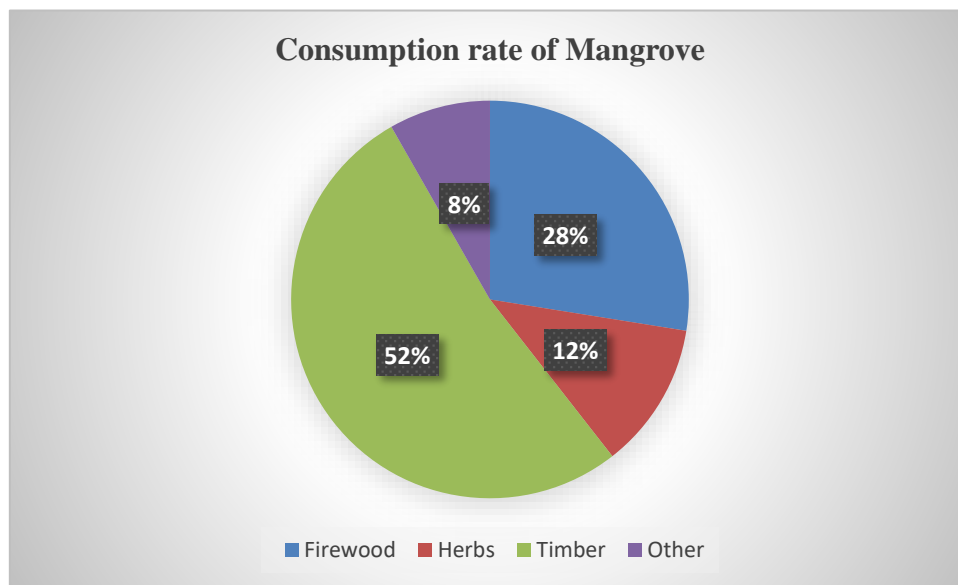


Figure 2. Factors for the mangroves declining in the study area

According to this figure, 52 percent of the mangroves are felled for the timber purposes. In small scale carpentry work, they are used for the fence making to conserve the cropland from animals, shrimp farm making. Some people in the study area, chop the mangroves for the tree-house and normal makeshift homes for the temporary survival.

Further, 12 percent of the mangroves are chopped for the herbs. Herbal material for the indigenous medical purposes is extracted from the mangroves in the study area. Due to the fact that, the mangroves have been reducing. 28 percent of the mangroves have been destroyed for the firewood purposes. The people around the coastal area, fell the mangroves for the firewood which meets the needs of the study area people. For the food making, industrial purposes such selling the firewood in the town area people. And 8 percent of the mangrove have been destroyed for the other purposes such as, making fish traps, fishing rods, stilt making, and so on.

Factors for the mangroves destruction

Over consumption

Over consumption of the mangroves lead to the environmental threats. In earlier, it was believed that, the mangroves are useless. But the significant of the mangroves have been understood. In Puttalam area, the consumption of the mangroves is very high. People consume the mangroves for many purposes such as, herbal, firewood, timber and industrial purposes. These activities cause the environmental challenges such as, biodiversity fragmentation and loss of nature scene of the area.

Sand mining

Sand mining from the coastal area causes the destruction of the mangroves. The higher constructions occur the greater amount of the sand is needed. Due to the fact that, the amount of the mangroves have been decreasing. Even though, mangroves have mechanisms to survive in the submerged area, the sand mining makes the serious condition of the declining of mangroves.

Fire wood

People from the nearby places log the mangroves for the firewood and other purposes. This activity takes place mainly night times. The surrounding area people always try to log in this region.

Agricultural activities

In some area, the land is encroached for the agricultural activities mainly for chilly cultivation. Thus, many kind of mangroves have been felled for the fence.

Playground expansion

Mangroves in Puttalam, Kurinchipitti, Thillaiyadi and Vettala, area have been affected due to the expansion of the playground. For the playground large area of land has been acquired and undergone to the development activities.

Illegal fishing

Mangroves house to too much amount of fish species. Fishers who fish in illegal way remove the mangroves dramatically. The fish shelter in to the root of mangroves arranged as the protective bores.

Shrimp farms

For the shrimp farming processes, vast area of land have been prepared to room for the shrimps. Small water basins are prepared to grow the shrimps in the coastal areas of puttalam. Therefore, mangrove area happen to face destruction in these areas.

Unprecedented growth of tourism sector

The advent of national and international tourists have been emerged as a big challenge in Puttlam district. For the construction of hotels and beach resorts large coastal area has been occupied both government and private sectors. This triggers to clear the mangroves in the coastal areas of Puttlam mainly in the Puttlam lagoon area.

Formation of the salterns in the lagoon area

Today the Puttlam Salt plant occupies 815 acres at the edge of a lagoon and supplies about a third of the country's salt. The salt coming from Puttlam Salt Limited does not just add flavor to millions of family meals, it provides vital protection to children, saving them from life-long mental retardation.



Figure 3. Saltern in Puttlam

Challenges by the mangroves declining

Loss of herbs



Figure 3. Shrimp farm expansion in Puttlam area

Significant amount of herbs have been destroyed due to the mangroves destruction in the study area.

Decreasing endemism in mangrove

In yearly comparison, due to the severe destruction the mangroves species are dwindling. The endemic mangroves of Sri Lanka has the possibility to dwindle.

Coastal soil erosion

Due to the destruction of mangroves, the coastal erosion is triggered. Many mangroves destructed areas' coastal lands have been eroded pathetically. Mangroves are acting as a buffers to protect the coastal area from tides and runoff.

Planting the mangroves saplings in the destructed area.

In Puttalam District due to the many factors mangroves are affected. Therefore, taking steps to reforest the mangroves in the coastal area of Puttalam District. For this activity, using the air layering methods to propagate the mangroves in the area allied with the respective organizations. And take measures to conserve the mangroves associates in the study area.

Ecological impacts

Mangrove ecosystems suffer constant exposure to conditions of high salinity, low oxygen, strong winds, and high light intensity. Although the mangrove ecosystem is exposed to the hostile environmental conditions, it is one of the most productive wetland ecosystems in Sri Lanka. In order to survive in these harsh conditions, mangroves have developed remarkable adaptations to survive, and provide shelter for other mangrove associate organisms. Some of these adaptations are: the aerial roots for absorbing atmospheric oxygen; prop; buttress; and knee root system to anchor in soft soil, and "viviparity" of seed germinations. Viviparous plants have a unique adaptation to allow seeds to grow until young roots and shoots are formed while attached to the parent plant.

Biodiversity fragmentation

Mangroves serves as a natural habitat for the living organisms such as fish, amphibians, tortoise and birds. This mangrove environment is rich for the biodiversity. Due to the fragmentation and encroachment of the mangroves and land, the biodiversity fragmentation has been triggered in the study area. After the Tsunami, it is rare to find the endemic species often roaming in the mangroves area of the study area. According to the fishermen's remarks, Mangroves houses for the mating of the fish and crab species but the destruction of the mangroves reduced the fish harvesting in some particular places.

Coastal degradation

Mangroves serves as a barrier to protect the coastal erosion. In Sri Lanka. It is evident that; the purpose of the coastal conservation has been successfully gained by mangroves than the artificial construction in the study area. People did not understand the exact importance of the mangroves.

Tourisms sector

The arrival of local and international tourist have been reducing due to the loss of mangroves in the area. Many come to see and visit the mangroves and some international tourists have rest under the shade of the mangroves having swum in the shallow area.

6. CONCLUSION

In this study, many environmental challenges were identified. Land fragmentation. Biodiversity destruction, decreasing endemism in mangrove, loss of herbs, deforestation and the Coastal soil erosion were the major challenges, due to the declining of the mangroves. As a whole, the primary objective has been attained. Secondary objectives have also been attained by the identified challenges and many remedial measures have been suggested to overcome the challenges in the recommendation part.

Recommendations

- Regulating to monitoring the state or NGOs assistance
- Assigning environmental officers to report about the mangrove declining.
- Getting assistance from police department to control the declination of the mangrove
- Restrict the boundaries to the human activities considering the mangrove propagation.
- Developing tourism sector not to harm the mangroves population
- Making awareness among the people in the study area.
- Previous management measures to conserve the declining mangrove
- Replantation activities considering the coastal plant conservation
- Research on coastal resources and mangroves.
- Coast conservation Mangroves able to withstand the tidal current and wind speed.
- Providing energy efficient stoves for the nearby families to reduce the logging of the mangroves.
- Stakeholder participation to conserve the mangroves.

References

- [1] Giri, C., E. Ochieng, L. L. Tieszen, Z. Zhu, A. Singh, T. Loveland, J. Masek, and N. Duke. 2010. Status and Distribution of Mangrove Forests of the World Using Earth Observation Satellite Data. *Global Ecology and Biogeography: A Journal of Macroecology* 20(1): 154-159
- [2] Ghosh S., Bakshi M., Bhattacharyya S., Nath B. and Chaudhuri P. (2015). A Review of Threats and Vulnerabilities to Mangrove Habitats: With Special Emphasis on East Coast of India. *Journal of Earth Science & Climatic Change* 6 (4), 1-9
- [3] L. P. Jayatissa, S. Hettiarachi, F. Dahdouh-Guebas. An attempt to recover economic losses from decadal changes in two lagoon systems of Sri Lanka through a newly patented mangrove product. *Environment, Development and Sustainability*. November 2006, Volume 8, Issue 4, pp 585–595

- [4] Ferdinando V, Tunesi L, Agardy T (2000.) Zoning marine protected areas through spatial multiple criteria analysis: the case of Asinara Island, National Marine Reserve of Italy. *Conserv Biol* 16: 515–526
- [5] Janssen R, Padilla JE (1999) Preservation or conservation valuation and evaluation of a mangrove forest in the Philippines. *Environ Resour Econ* 14: 297–331
- [6] Theresa E. Burns, Joy Wade, Craig Stephen, Lorraine Toews. A Scoping Analysis of Peer-Reviewed Literature About Linkages Between Aquaculture and Determinants of Human Health, *EcoHealth*, June 2014, Volume 11, Issue 2, pp 227–240
- [7] Akther P, Khan MA, Mannan MA (2004) Adequacy, utilization, repayment and profitability of pond fish credit in Mymensingh district. *Bangladesh Journal of Training and Development* 17: 65–73
- [8] Bergquist DA (2007) Sustainability and local people's participation in coastal aquaculture: regional differences and historical experiences in Sri Lanka and the Philippines. *Environmental Management* 40: 787–802;
- [9] Bhat MG, Ramachandra B (2004) Considering aquacultural externality in coastal land allocation decisions in India. *Environmental and Resource Economics* 29: 1–20;
- [10] Dewalt BR, Vergne P, Hardin M (1996) Shrimp aquaculture development and the environment: people, mangroves and fisheries on the Gulf of Fonseca, Honduras. *World Development* (Oxford) 24: 1193–1208
- [11] Garcia SM, Rosenberg AA (2010) Food security and marine capture fisheries: characteristics, trends, drivers and future perspectives. *Philosophical Transactions of the Royal Society of London—Series B: Biological Sciences* 365: 2869–2880
- [12] Godfray HCJ, Beddington JR, Crute IR, Haddad L, Lawrence D, Muir JF, Pretty J, Robinson S, Thomas SM, Toulmin C (2010) Food security: the challenge of feeding 9 billion people. *Science* 327: 812–818
- [13] Gunawardena M, Rowan JS (2005) Economic valuation of a mangrove ecosystem threatened by shrimp aquaculture in Sri Lanka. *Environmental Management* 36: 535–550
- [14] Hall D (2003) The international political ecology of industrial shrimp aquaculture and industrial plantation forestry in Southeast Asia. (Special section: Localising and globalising patterns in natural resource use in Southeast Asia). *Journal of Southeast Asian Studies* 34: 251–264
- [15] Kusakabe K (2003) Women's involvement in small-scale aquaculture in Northeast Thailand. *Development in Practice* 13: 333–345
- [16] Murshed-e-Jahan K, Ahmed M, Belton B (2010) The impacts of aquaculture development on food security: lessons from Bangladesh. *Aquaculture Research* 41: 481–495
- [17] Nathan D, Apu NA (1998) Women's independent access to productive resources: fish ponds in the Oxbow Lakes Project, Bangladesh. *Gender, Technology & Development* 2: 397–413

- [18] Tipraqsa P, Craswell ET, Noble AD, Schmidt-Vogt D (2007) Resource integration for multiple benefits: multifunctionality of integrated farming systems in Northeast Thailand. *Agricultural Systems* 94: 694–703
- [19] Deegan, L. A. *et al.* Coastal eutrophication as a driver of marsh loss. *Nature* 490, 388-392 (2012).
- [20] Howes, N. C. *etal.* Hurricane-Induced failure of low salinity wetlands. *Proc. Natl Acad. Sei. USA* 107, 14014-14019 (2010).
- [21] Gedan, K. B., Silliman, B. R. & Bertness, M. D. Centuries of human-driven change in salt marsh ecosystems. *Annu. Rev. Mar. Sei.* 1, 117-141 (2009).

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