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Conservation of Kerala Mangroves: Economic and Environmental Relations

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Abstract

Purpose: Research is the systematic investigation into and study of materials and sources to establish facts and reach new conclusions. This study aims to analyze mangrove forests' socio-economic and ecological systems and their linkages for their conservation and identify important mangrove ecosystem values.

Methodology: This investigation aims to utilize a Descriptive Research design, relying on secondary information sources. The secondary data is obtained from books, journals, newspapers, articles, and government websites.

Findings: Extreme scientific information is lacking regarding the utilization of mangroves as a natural nursery for migrating fishes and other species. An absolutely necessary research.It's clear that native inhabitants have relied on mangrove ecosystems for a number of products made from animals and plants, and that this practice continues today. Preserving and managing the remaining mangrove stretches in the manner that guarantees their ability to produce, is essential if these activities are to continue. Further research might investigate the usefulness and significance of managing numerous purposes as a means to boost efficiency.There is a dearth of research that provides foundational understanding of mangrove settlements, including their demographics, economic status, and how they use resources. This makes it harder to put a strategy in place to protect this ecological system effectively. Because of this, thorough investigation into mangrove communities is required, as these people rely on the mangrove for their survival.The valuation of goods and services offered by this ecological system is necessary for greater preservation of mangroves because of the numerous advantages they offer. Conserving them to the fullest extent possible is important because of the many ways in which they contribute to society, including economically, ecologically, scientifically, and culturally both for the current and subsequent generations. Therefore, in order to inform public discussions and incorporate these values into policy and decision-making processes, further data regarding the values of mangroves and the interplay with one another is required. In order to comprehend its significance, it is necessary to compare the expenses and advantages of preservation of mangroves with those associated with other potential uses. It is possible to conduct research into the monetary worth of mangrove advantages and the expenses associated with replacing the ecological services provided by forests of mangroves

Keywords:- conservation of mangroves, natural nursery, ecosystem, economic valuation.

I. INTRODUCTION

Mangroves are bushes or trees that thrive in salty or brackish water along the coast. The word is also applied to describe coastline habitat in tropical regions that consists of these kinds of plants. Convergent evolution in multiple plant families is responsible for the taxonomic diversity of mangroves (Giri et al., 2011). Mangroves are halophytes, or trees that can tolerate high levels of salt, that have evolved to withstand the extreme conditions found along the coast. To withstand exposure to saltwater and the effects of waves, they have an intricate salinity filtering mechanism and an equally intricate root mechanism. Even though they've accustomed to life in waterlogged mud, where oxygen is scarce, they'll have the best chance of success in the upper intertidal zone (Flowers & Colmer, 2015). There is interest in mangrove restoration for several reasons. Mangroves

support sustainable coastal and marine ecosystems. They protect nearby areas from tsunamis and extreme weather events. Mangrove forests are also effective at carbon sequestration and storage and mitigate climate change.

Mangrove ecosystems are thought to assist local ecosystems in adapting to and surviving climate change-related changes, such as increased frequency and intensity of extreme weather events and greater levels of seawater (Friess et al., 2019).

The meeting of rivers, backwaters, and the sea forms an ecosystem where these distinct species of plants thrive. Their abundant underlying and aerial rhizomorphs make them an excellent geotextile for soil bonding. The plants are able to resist the waves because of the extremely strong anchoring provided by this. Protecting mangrove forests is critical because they are home to a wide variety of plant and animal species, play an important role in maintaining coastal stability and financial stability, and are particularly vulnerable in light of the dire predictions of future climate change and increases in sea levels (Barbier, 2012).

II. REVIEW OF LITERATURE

In the event of severe weather, such as a hurricane, mangroves absorb the impacts of storm wave action and prevent erosion, thus protecting nearby populated areas. They play an essential role in the ecosystem as well. Binding and building soils are assisted by their thick roots. All around the globe, mangroves play an important role in coastline populations' well-being, food security, and defense. From 2004 to 2022, the words "conservation of mangrove's," "natural nursery," "ecosystem," and "economic valuation" are employed to describe the impacts of mangroves on these two fronts.

Table 1**:** This table reviews the various works of literature on a Conservation of Kerala Mangroves: Economic and Environmental Relations

Sl. No.	Area	Contribution	Authors
1.	Mangroves of Kerala	The study reports 15 true mangrove and 49 mangrove associate species from Kerala coast. Developmental and anthropogenic activities, grazing and widespread prawn farming are the major threats to Kerala mangroves.	C. Anupama & M. Sivadasan
2.	Mangroves of Kerala	This paper observed that the mangroves of mangroves of Kerala were degraded and grew in isolated patches.	A. S Khan, A Ramachandran, N. Usha, I. A Aram & V. Selvam
3.	Ecological linkages of mangrove	This study focused on identifying mangroves and their associated species in the Kannur district of Kerala, along with their monetary and biological connections. Mangroves offer numerous ecological, environmental, and socioeconomic advantages to humanity. The mangroves in the region face unparalleled devastation due to economic exploiting of resources, land reclaiming for aquaculture, farming, and construction of dwellings.	M. Vaiga & S. Joseph
4.	Mangrove forest	This investigation analyzes the present condition of mangrove vegetation throughout the Kerala coastline, the factors contributing to the decline of mangroves, conserving strategies implemented, and the prospective outlook. Scientific data regarding the mangrove regions in numerous districts of this southern Indian state remains insufficient.	S. Sreelekshmi, B. K Veettil, S. B Nandan & M. Harikrishnan
5.	Carbon stock and mangrove ecosystem	With their high rates of carbon storage and sequestration and their ability to become significant sources of greenhouse gases when disturbed by land-use change, mangrove ecosystems are of great significance for climatic shifts adapting and minimizing strategies. This research shows that gaining insight into the amount of carbon stocks in Keralan mangroves, along with other ecosystem services they provide, emphasizes their importance in developing preservation, rehabilitation, and prevention plans for the country.	S Sreelekshmi, M Harikrishnan, S. B Nandan, V. S Kaimal & N. R Hershey

Source: Compiled by the author

Many social, economic, and environmentally beneficial benefits accrue to humanity as a result of mangroves. Around the world, mangrove ecosystems, which are rich in biodiversity, are rapidly disappearing. Despite an estimated size of around 1,670 hectares, the current size of unspoiled mangroves in Kerala is only 150 hectares, spread out mostly among the districts of Ernakulum, Kannur, and Kozhikode. The plant life in Kerala is now considered vulnerable due to its severely decreased extent (Muraleedharan et al., 2009).

III. RESEARCH GAP

Many scholars and government officials have conducted the studies about mangroves of Kerala, mangrove forest, ecological linkages of mangrove, carbon stock and mangrove ecosystem. However, none of the studies have looked into the effects of the mangrove ecosystem on the environment or the economy.

IV. RESEARCH AGENDA

- How do mangroves contribute to the environment?
- To what extent does the mangrove ecosystem contribute to the economy?
- How does the mangrove ecosystem function economically and ecologically?

V. OBJECTIVES

- To learn about mangroves' role in the environment.
- To know how much money is involved in mangrove ecosystems.
- To understand environmental and monetary connections to the mangrove ecology.

VI. STUDY AREA AND METHODOLOGY

Kerala possessed dense mangrove vegetation, especially around the coast. One estimate indicates that Kerala once sustained approximately 700 km² of mangroves throughout its coastline. The expanse of mangrove habitat has diminished considerably. The Kerala Forest Department estimates that mangrove coverage spans approx 17 km² across the coastlines of 10 districts in fragmented portions.

A descriptive approach, which relies on secondary sources of information, was employed in this investigation. Books, newspapers, magazines, articles, and official government websites are examples of publications from which secondary data is culled. We found this information by searching for "conservation of mangrove's," "natural nursery," "ecosystem, and economic valuation" on Sci-Hub and Google Scholar. The required materials were located through online searches and subsequently examined by hand.

VII. RESULTS OF THE STUDY

7.1. Mangroves and Their Role in Ecosystems

7.1.1. Shoreline Stabilisation

The growth of mangroves slows or stops the coast from being eroded. This is accomplished by means of sediment trapping, stabilizing the soil through plant roots and deposition of vegetal substance, while sediments are trapped and erosional forces like wind and waves are minimized. Cutting down mangroves increases the risk of coastal flooding and soil loss (Dale et al., 2014).

7.1.2. Groundwater Recharge

When surface water rushes into the underground water flow system, it is known as groundwater recharge. After flowing out of the mangroves and into an aquifer, the water has two possible destinations: either the shallow groundwater system, which supplies water to nearby areas and keeps the water table stable, or the deep groundwater system, that supplies water for the foreseeable future. Industries as well as neighbourhoods that use water from moderate or deep wells will find this useful (Dale et al., 2014).

7.1.3. Groundwater Discharge

The Flow from underground aquifers into aboveground bodies of water (like springs) is known as groundwater flow. The groundwater discharge functions of mangroves are usually average or unclear (Rönnbäck, 1999).

7.1.4. Flood and Flow Control

When large quantities of water enter a mangrove, they can be preserved or held back on their way downhill, a process known as flood and flow control (Rönnbäck, 1999). This can happen during periods with extensive rainfall or heavy flow rates of rivers.

7.1.5. Sediment and Nutrient Retention

There is a general trend for the physical characteristics of mangroves, such as their proportions, plant life, and the level of water, to reduce the rate of water flow. As a result, sediments can be more easily accumulated. Due to the binding nature of toxicants and nutrients to sediment particles, their effective elimination is closely associated with this accumulation. It is possible to deposit nutrients alongside sediments because of their common association (Aye et al., 2019).

7.1.6. Habitat Protection and Biodiversity

Some organisms' habitats serve as both food sources and protective covers. Many species of plants and animals rely on mangroves as part of their lifespan cycle. Few species, especially plants, can acquire all the nutrition they require from a single mangrove. Many aquatic animals, like fish and prawns, rely on mangrove regions for breeding and growth of younger ones, and other species may rely on the region of mangroves for component of a more complicated phases of life cycle.

It is necessary to conduct an international assessment of the mangrove's significance in cases where migratory bird species depend on its resources as part of their entire life span, such as when they stop to rest or feed while migrating (Aye et al., 2019).

7.1.7. Biomass and Productivity

Ecological system biomass constitutes the foundation of the food chain and is therefore a crucial indicator for assessing the overall functionality of the framework.

The 'natural capital' of the system is the stock of plant biomass, which is maintained, increased, and sustained by the combination of water, nutrients, and light. This biomass is then utilized for growing newer biomass, which is used to support the remaining parts of the chain of food. An additional significant abiotic aspect of landscapes is plant biomass, which serves as an underlying structural element. It has both physical and biological uses, such as gathering sediment and providing a spot for animals to nest (Aye et al., 2019).

7.1.8. Gene Bank

Numerous mangrove regions harbor wild species that possess the ability to provide biological resource for the enhancement of commercially viable species. The genes from wild species can enhance the flavor and growing rates of produce from agriculture while decreasing their vulnerability to illness (Krauss et al., 2022).

Recreation and Tourism**:** Mangrove regions can be utilized for leisure and tourist activities. Locations more appropriate for leisure and tourist activity are those with adequate amenities or a possibility for creating such facilities (Moslehi, 2018).

7.1.9. Hunting and Fishing

The term "hunting and fishing" describes the human practice of taking wildlife that rely on mangroves for food and profit (Moslehi, 2018).

7.1.10. Forestry Products

The ecology of mangroves is an abundant supply of power, energy and building materials. Charcoal and wood for fuel are two examples of energy-producing materials (Lee, 1999).

7.1.11. Water Transport

Waterways in a mangrove ecosystem can facilitate the transportation of passengers as well as products to the nearby markets. Maritime transport may be an extremely effective and ecologically friendly mode of transportation. In some cases, it may represent the sole viable mode of conveyance.

7.2. The Economics of Mangrove Eco-System

Mangroves serve as an essential supplier of firewood for the nearby rural populace and for charcoal production intended for sale in urban regions. Additionally, mangrove regions offer a diverse array of fisheries, including shrimp, fish, mud crabs, sand extraction, coir soaking, boat operations, mussel farming, and various aquatic and botanical products. (Rizal et al., 2018)

7.2.1. Shrimp Farming

Many marine organisms rely on mangrove swamps for their survival, including shrimp and fish, and the nutrients they contain are carried in and out by the tides. Both the location of fishing and the volume of shrimp that breed alongshore determine the shrimp productivity (Ministry of Forest, Government of Kerala, 2022). Since pelagic larvae find their way to lagoons, wetlands made up of mangroves play an important role as hatching grounds. It is commonly believed that the region of mangroves directly correlates to the yield of shrimp. An aggregate of 140 shrimp ponds covering 524.4 hectares were recorded in Kannur. Back in 2007, it barely covered 251.5 hectares. About 60.6% of the land was used for conventional cultivation of shrimp, while 36.9% was used for more unconventional methods. Ezhome, Dharmadam, and Cherukunnu are home to more shrimp farms than any other areas (Rizal et al., 2018).

7.2.2. Fish Farming

The ideal habitat for brackishwater fish farming is typically lowland estuarine regions, such as mangrove wetlands. Some of the species that are grown in captivity include Penaeus monodon, Chanos, Mugil cephalus, Liza parsia, and Fenneropenaeus indicus (Lal, 2003).

7.2.3. Natural Nursery

The fishes lay their eggs in tangled roots of mangrove trees and later hatch and grow with needed nutrients available. Thus, mangroves act as natural nursery grounds. Mangroves offer shelter to the juveniles of a wide variety of marine organisms, notable among them being certain species of penaeid shrimps (Novizantara et al., 2022). A linear relationship exists between shrimp production and the size of the mangrove forest area. Mangroves give recreation to hunters, fishermen, bird-watchers, photographers and others who treasure natural areas (Krauss et al., 2022).

7.2.4. Commercial Exploration

The wood from mangrove trees is a popular material for making furniture and other home furnishings. Throughout history, mangrove trees have served as a reliable source of fuelwood. Rhizophora mucronata, Bruguiera gymnorrhiza, and Ceriops tagal are three mangrove species whose layers of bark are used for obtaining tannin (Moslehi, 2018). The tannin

content of the bark of Indian mangrove trees is 35%, which is higher than that of trees from other nations. The nets used for fishing undergo dyeing and made more durable using extracts from mangrove bark (Lee, 1999). A lucrative enterprise could be the gathering of honey from mangrove swamps. Aegicera corniculatum and Derris heterophylla are utilized as a mild fish poison, derived from their bark and roots, respectively. Human beings and livestock both benefit from the usage of Avicennia spp., Phoenix paludosa, and Sonneratia caseolaris. The nypa fruticans plant is used to make a type of alcohol (Aquafind, 2022).

VIII. CONCLUSIONS

Theoretically, mangrove diversification has been around for a while, and for good reason: it boosts ecosystem's efficiency and stabilization. To better understand mangroves, one must be aware of the ways in which they contribute to coastline ecological equilibrium and yield. Mangroves are vital to the survival of fishery and the livelihoods of fishers because of the crucial role they play as nests for juvenile aquatic creatures. Ecological systems are highly beneficial and diverse, and they play an important role in the coastline by acting as protection against eroding, waves from storms, and tsunamis that occur. In order to restore the coastal environment to its former perfect state, massive reforestation of mangrove areas is the top priority right now.

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