

COMMUNITY AWARENESS AND SOCIO-ENVIRONMENTAL BARRIERS IN MANGROVE CONSERVATION IN KOLLAM, KERALA

MSW DISASTER MANAGEMENT

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ABSTRACT

Mangroves are vital coastal ecosystems that provide ecological, economic, and social benefits, including shoreline protection, biodiversity conservation, carbon sequestration, and livelihood support. Despite their importance, mangrove ecosystems in Kerala are increasingly threatened by human activities, urbanisation, pollution, land reclamation, and a lack of public awareness. This study aimed to assess the level of community awareness about mangroves and identify the socio-environmental barriers affecting mangrove conservation in Kollam district, Kerala. The study also examined the relationship between community awareness and willingness to participate in conservation activities. A quantitative cross-sectional research design was adopted, and primary data were collected from 60 respondents using an interview schedule. Descriptive statistics were employed to analyse the data. The findings revealed that while most respondents possessed moderate to good knowledge of mangroves and demonstrated positive attitudes toward their conservation, their conservation practices were comparatively limited. The study identified major socio-environmental barriers, including a lack of awareness programmes, inadequate community participation, weak enforcement of environmental regulations, pollution, and developmental pressures. A statistically significant relationship was found between awareness level and willingness to participate in mangrove conservation activities, indicating that individuals with higher awareness were more likely to support and engage in conservation efforts. The study concludes that enhancing environmental education, strengthening community-based conservation initiatives, promoting public participation, and improving policy implementation are essential for the long-term protection of mangrove ecosystems. The findings contribute to a better understanding of community perspectives on mangrove conservation and provide practical recommendations for policymakers, environmental organisations, local authorities, and social work professionals to develop effective conservation strategies in Kollam district.

Keywords: Mangrove Conservation, Community Awareness, Socio-Environmental Barriers, Community Participation.

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CHAPTER I: INTRODUCTION

1.1 Introduction

At the land-sea border, in tropical and subtropical regions, one of the types of coastal wetlands is mangrove ecosystems. Ecosystems that are composed of salt-tolerant trees and shrubs that grow in intertidal and estuarine habitats. The mangroves form an ecological zone that is a link between the terrestrial and oceanic environments and are inhabited by numerous plant and animal species. Due to their special nature and role, mangroves are considered one of the most productive and beneficial ecosystems in the world.

Mangrove, as an ecologically important plant, is very important for the environmental stability where it resides, especially in the coastal environment. They can be used to naturally reduce coastal erosion and storm surge, and prevent coastal flooding from tidal waves, to protect coastal communities and infrastructure. In addition, mangrove forests are also a habitat for numerous fish, crustaceans, molluscs and birds, and play an important role in the conservation of biodiversity and fisheries productivity. Mangroves also play an important role in carbon storage, nutrient cycling and climate regulation; these are all important ecosystems in the current environmental challenges such as climate change and biodiversity loss (Alongi, 2015).

Mangroves also have social and economic value, in addition to their ecological value. The mangrove ecosystem is one of the core components in the livelihood of many coastal communities engaged in different resource-based activities like fisheries and aquaculture, forest product harvesting and tourism. The ecosystem services provided by the mangroves benefit the local population in terms of their food production, livelihood generation and environmental sustainability. Therefore, mangrove conservation is a social development and an ecological issue.

Mangrove forest is vital, but have been increasingly at risk due to natural and anthropogenic factors. Mangroves in many places in the world are degraded and lost, because of urbanisation, industrialisation, land reclamation, pollution, unsustainable resource extraction and climate change. The biodiversity, ecological value in protecting coastal areas and human livelihoods is all affected by loss or degradation of mangrove habitats. Increasingly, governments, environmental groups and conservation organisations highlight the value of mangrove conservation and restoration efforts (Friess et al., 2019), as more people understand the risks.

However, in the past few decades, conservation has not only been about ecology but has also considered the involvement of the community in environmental management. The local people are often the users and beneficiaries of natural resources, and so have a significant role in the outcomes of conservation. However, conservation programmes will only be successful if they offer ecological interventions and if people inhabiting and living around environmentally sensitive areas are aware, attuned and involved. Communities with a positive attitude towards natural resources are more likely to support natural resource management and to be “green”.

Environmental awareness is an important element of conservation as it affects the perception and reaction of people to environmental problems and conservation. Awareness is a tool to learn about the socio-economic and ecological values of natural ecosystems and take action towards the environment responsibly. In parallel, socio-environmental factors such as economic, livelihood, institutional, existing developmental activities, and the unavailability of environmental information often limit conservation efforts. Awareness of these barriers is crucial for the development of a conservation programme which is socially acceptable, environmentally effective and sustainable in the long-term.

India has extensive coastal ecosystems with a diversity of mangrove habitats. Mangroves are found in Kerala in estuaries, backwaters, river mouths and coastal wetlands. Despite being relatively small in size, mangrove cover in the state is comparatively small compared to other coastal areas of India, and mangroves have significant ecological and socio-economic values. Rapid development activities and land use, coupled with environmental degradation in many parts of the State have caused much stress in mangroves (Bharathan et al., 2021).

Among the coastal districts, one of the important districts of Kerala is the Kollam district, which has been observed as 'networks of backwaters, wetlands, rivers and estuarine ecosystems'. Munroe Island is situated in an ecologically important area between the Ashtamudi Lake and the Kallada River. The area harbours wetland ecosystems very close to the livelihood and life of local communities. The environmental changes, degradation of habitat and increasing developmental pressures, however, have brought the long-term viability of these ecosystems into question and the need for good conservation action to the fore.

In this context, the levels of awareness of mangrove conservation in the community and the socio-environmental constraints to mangrove conservation are more important. Local communities are a key component of environmental management and have a significant influence on the effectiveness of conservation, depending on their knowledge, perceptions and involvement. This study attempts to understand the level of awareness and the socio-environmental barriers to mangrove conservation in the district of Kollam, Kerala, with particular emphasis on awareness as a facilitator for people to participate in conservation activities. The study is anticipated to help develop better informed, participatory and sustainable strategies for mangrove conservation in the area.

1.2 Statement of the problem

The ecosystem of mangroves is one of the most valuable coastal ecosystems because of its ecological, economic and social value. They offer various ecosystem services such as vegetation protection, protection of biodiversity, fisheries, carbon fixation and control, among others. These ecosystems contribute to the life-support of the coastal communities in the fisheries, tourism and other resource utilisation related areas. Mangroves continue to be degraded and lost in the face of urbanisation, land use change, pollution, climate change and unsustainable human activities, although these ecosystems are vital.

The coastal wetlands, estuaries, river mouths and backwaters are home to mangrove ecosystems in Kerala. While they are small in size, these ecosystems have important ecological roles to play and are vital to livelihoods in the local communities. However, the combined effects of high developmental pressures, environmental threat and alteration of land use have had a detrimental effect on mangrove habitats in most of the state. The entire wetland system and backwater system of the Kollam district is an important area where the mangrove system continues to be subjected to anthropogenic and environmental pressures.

It is now recognised that conservation in the long term should be done in a way that not only engages with the ecology but also with the policy of the government. Local communities are key to the success of these efforts as they are the ones most directly involved in the ecosystems and may benefit from and use mangrove resources. This is important because if the people are not aware, they have a negative attitude and perception and they are not involved in

conservation it can mean failure in the conservation. Generally, people who are well acquainted with the ecological and socio-economic values of mangroves are better disposed towards mangrove conservation and more proactive.

But, a number of socio-environmental barriers can affect the level of community involvement in conservation. Social characteristics like low awareness of the environment, poverty, dependence on natural resources for living, lack of opportunities for conservation, insufficient institutional capacity and competing developmental interests can impact the willingness and capacity of people to participate in conservation. Barriers can affect the efficiency of conservation programmes and may be a cause of the lack of sustainable management of the ecosystem.

While a number of studies have looked at the ecological significance of mangroves and conservation problems in specific areas, little research has been conducted on community awareness and the socio-environmental challenges encountered in mangrove conservation in the district of Kollam, Kerala. Additionally, very little has been paid attention to about individuals' awareness of the communities that they are willing to be involved in the conservation process in their local environment.

For this purpose, the level of community awareness towards conservation of mangroves should be measured, and socio-environmental problems faced by the community and the relation between the level of mangrove conservation awareness and the community's actions in conserving mangroves should be found. These factors need to be understood if effective and community-based conservation strategies are to be developed, which promote sustainability of the ecosystems and community involvement. Therefore, the present study aims at filling the gap by exploring the awareness and socio-environmental constraints in the conservation of mangroves in the district of Kollam, Kerala.

1.3 Background of the study

Mangrove ecosystems are among the most productive and ecologically important coastal ecosystems in the world. Found in tropical and subtropical regions, mangroves occur in intertidal zones where land and sea meet. These ecosystems support a wide range of ecological

functions, including shoreline stabilization, nutrient cycling, carbon sequestration, biodiversity conservation, and protection against coastal hazards. Over the past few decades, scientific understanding of mangrove ecosystems has increased significantly, leading to greater recognition of their role in maintaining coastal ecological balance and supporting human well-being (Alongi, 2015).

Historically, mangrove forests were often considered unproductive lands and were cleared for agriculture, aquaculture, urban development, and infrastructure expansion. As a result, substantial areas of mangrove habitat have been lost worldwide. The degradation of mangrove ecosystems has been linked to declining biodiversity, reduced fisheries productivity, increased coastal vulnerability, and loss of ecosystem services. In response to these concerns, mangrove conservation has emerged as a major priority within global environmental agendas, particularly in relation to biodiversity conservation, climate change mitigation, and sustainable coastal resource management (Friess et al., 2019).

Globally, conservation approaches have evolved from purely protection-oriented strategies to more participatory and community-centred approaches. Environmental scholars and conservation practitioners increasingly recognise that local communities play a crucial role in the management and sustainability of natural resources. Since communities living near mangrove ecosystems depend on these resources for livelihoods and daily needs, their involvement is considered essential for the long-term success of conservation initiatives. Consequently, community participation, environmental awareness, and stakeholder engagement have become important components of contemporary conservation programmes.

India possesses extensive coastal ecosystems that support diverse mangrove habitats. Mangrove forests are distributed across several coastal states and union territories, providing ecological and socio-economic benefits to millions of people. These ecosystems support fisheries, protect coastal regions from natural hazards, store significant amounts of carbon, and contribute to biodiversity conservation. Recognizing their importance, various conservation and restoration programmes have been implemented through national environmental policies, coastal zone management initiatives, and biodiversity conservation efforts.

Kerala, located along the southwestern coast of India, is characterized by an extensive network of rivers, estuaries, backwaters, wetlands, and coastal ecosystems. Although the state accounts for a relatively small proportion of India's total mangrove cover, its mangrove ecosystems are ecologically significant because they support rich biodiversity and contribute to coastal environmental stability. However, over the years, Kerala's mangroves have experienced considerable decline due to urbanization, land reclamation, infrastructure development, aquaculture expansion, and other anthropogenic pressures. These changes have raised concerns regarding the sustainability of coastal ecosystems and the need for effective conservation measures (Bharathan et al., 2021).

In response to increasing environmental challenges, conservation and restoration initiatives have been undertaken in different parts of Kerala through the involvement of government agencies, local self-government institutions, educational institutions, environmental organizations, and community groups. These efforts have emphasized not only ecological restoration but also public awareness and stakeholder participation. The growing emphasis on community involvement reflects the understanding that conservation outcomes are closely linked to people's knowledge, attitudes, perceptions, and willingness to engage in environmental protection activities. Conservation programmes are more likely to succeed when local communities recognize the importance of natural resources and actively participate in their management and protection (Hema & Indira Devi, 2020).

Kollam district represents one of Kerala's important coastal and wetland regions. The district is characterized by extensive backwater systems, estuaries, wetlands, rivers, and coastal habitats that support diverse ecological resources. Among these environmentally significant areas, Munroe Island occupies a unique position due to its location at the confluence of Ashtamudi Lake and the Kallada River. The island comprises a network of interconnected waterways, wetlands, and low-lying landforms that support both ecological diversity and traditional livelihoods. Local communities depend on the surrounding natural resources for fishing, agriculture, tourism, and other livelihood activities.

In recent years, Munroe Island and the surrounding areas have experienced various environmental challenges, including land subsidence, salinity intrusion, coastal erosion, habitat degradation, altered hydrological conditions, and increasing developmental pressures. These

environmental changes have affected both ecosystem health and community livelihoods, creating concerns regarding the long-term sustainability of the region. In such a context, mangrove ecosystems can play an important role in enhancing ecological resilience, protecting coastal environments, and supporting sustainable livelihoods.

The success of mangrove conservation efforts depends not only on ecological interventions but also on the active participation of local communities. Environmental awareness influences how individuals perceive environmental issues, understand ecosystem services, and respond to conservation initiatives. At the same time, conservation efforts may be constrained by various socio-environmental barriers, including economic limitations, livelihood dependence on natural resources, inadequate environmental education, institutional challenges, and competing developmental priorities. Understanding these factors is therefore essential for designing effective and socially acceptable conservation strategies.

Despite the increasing importance of mangrove conservation in Kerala, limited research has specifically examined community awareness and socio-environmental barriers affecting mangrove conservation in Kollam district. Furthermore, there is a need to understand how awareness influences community willingness to participate in conservation activities within the local context. Against this background, the present study seeks to assess community awareness regarding mangrove conservation, identify the socio-environmental barriers affecting conservation efforts, and examine the relationship between awareness and participation in conservation activities. The findings are expected to contribute to the development of community-oriented and sustainable approaches to mangrove conservation in Kollam district, Kerala.

1.4 Relevance and significance of the study

Mangrove ecosystems provide important ecological, economic, and social benefits to coastal communities. They contribute to biodiversity conservation, shoreline protection, fisheries productivity, climate regulation, and livelihood security. Despite their significance, mangrove ecosystems continue to face various threats arising from environmental degradation, developmental pressures, and unsustainable human activities. The conservation of these

ecosystems has therefore become an important environmental concern, particularly in coastal regions where communities are closely dependent on natural resources.

The relevance of the present study lies in its focus on the human dimensions of mangrove conservation. While considerable attention has been given to the ecological importance of mangroves, the success of conservation efforts largely depends on the awareness, attitudes, and participation of local communities. Understanding how people perceive mangrove ecosystems and identifying the factors that influence their involvement in conservation activities are essential for developing sustainable and community-based conservation strategies.

The study is particularly relevant to the Kollam district, Kerala, where mangrove ecosystems form an integral part of the coastal and wetland environment. Areas such as Munroe Island are experiencing increasing environmental challenges, including habitat degradation, changing ecological conditions, and growing developmental pressures. In such a context, understanding community awareness and the barriers affecting conservation efforts becomes important for promoting the long-term sustainability of local ecosystems.

The findings of this study are expected to contribute to environmental conservation initiatives by providing insights into the level of awareness among local residents and the socio-environmental challenges that influence conservation participation. Identifying these barriers can help policymakers, environmental organizations, local self-government institutions, and conservation practitioners design more effective awareness programmes, community engagement strategies, and conservation interventions that are responsive to local needs and realities.

The study is also relevant from a social work perspective. Environmental issues increasingly affect the livelihoods, health, well-being, and resilience of communities. Contemporary social work recognizes the interconnectedness between people and their environment and emphasizes community participation, empowerment, and sustainable development. By examining community awareness and participation in mangrove conservation, the study contributes to the growing field of environmental social work and highlights the role of community-based approaches in addressing environmental challenges.

Furthermore, the study contributes to the existing body of knowledge on mangrove conservation in Kerala by providing empirical evidence from Kollam district. Since limited research has specifically examined the relationship between community awareness, socio-environmental barriers, and participation in mangrove conservation within the local context, the findings may serve as a useful reference for future researchers, students, and practitioners interested in environmental conservation and community development.

1.5 Chapterisation

This research is organised into five chapters:

- CHAPTER 1: INTRODUCTION
- CHAPTER 2: REVIEW OF LITERATURE
- CHAPTER 3: RESEARCH METHODOLOGY
- CHAPTER 4: DATA ANALYSIS AND DISCUSSION
- CHAPTER 5: FINDINGS, SUGGESTIONS AND CONCLUSION

There will be a list of references and the annexures for comprehensive supplementary information.

CHAPTER II:

REVIEW OF LITERATURE

2.1 Introduction

Literature Review is a systematic and critical analysis of the existing knowledge on a research topic. It requires the identification, analysis and evaluation of information gained from past studies, scholarly articles, books, reports and other sources of information relevant to the topic. The purpose of the literature review is to understand what is actually known, to identify gaps in the knowledge, to analyse the theoretical and/or empirical developments, and to found the present study. Snyder (2019) said that a literature review is a process in which the researcher can summarise and critically analyse the current evidence and situate his research in a wider academic setting.

A literature review should be a key part of research writing as it gives the researcher insight into what has already been researched and what has not yet been explored. It supports the formulation of research aims, the formation of ideas and methods choices. Researchers can compare and contrast previous research, draw patterns and trends from the studies, and reinforce the academic base of their research by reading previous research (Snyder, 2019).

Literature review is an important component of environmental and conservation studies due to the fact that the environmental issues are affected by ecological, social, economic, cultural and institutional issues. To discuss these several aspects, it is necessary to look at the results of previous research and theories. Research on environmental awareness, community involvement, conservation actions, environmental attitudes and socio-environmental problems offers useful information to understand the conservation issues and for developing conservation designs.

In the present study the focus is on the awareness and socio-environmental barriers for conservation of mangroves in Kollam district in Kerala. Mangrove ecosystems are one of the most productive coastal eco-systems in the world, and contribute a wide range of ecological, economic and social services. These ecosystems host biodiversity, provide shoreline protection against erosion, carbon storage, improved fisheries productivity and adaptation to climate change. Even though they are very important, mangroves are still under threat from urbanisation, land use change, pollution, exploitation of resources, and climate change. Therefore, understanding community awareness, attitudes, participation and socio-

environmental barriers that affect the conservation efforts is important besides the ecological protection for effective conservation of mangroves.

In order to accomplish the aim of the present study, the literature review has been presented thematically. The first theme will focus on the mangrove ecosystem and ecological value, including mangrove ecological functions and ecosystem services. The second theme is a review of community awareness and knowledge regarding mangrove conservation, which is related to the level of understanding of the public regarding mangrove ecosystems and the problems of their conservation. The third theme addresses attitudes and perceptions towards mangrove conservation, focusing on how attitudes and perceptions are related to support for mangrove conservation. The fourth theme is on community practices and participation in mangrove conservation, which discusses community participation in conservation and restoration practices. The fifth theme looks at socio-environmental barriers to mangrove conservation, which covers social, economic, institutional and environmental factors. The sixth theme discusses the relationship between awareness and participation in conservation activities, studying the impact of environmental knowledge on conservation behaviour and intentions to participate in conservation activities.

The literature review of international, national and Kerala-specific sources gives an overall picture of the factors affecting the mangrove conservation and helps to develop the conceptual and empirical background for the present work. Besides, literature survey helps in identifying the gaps in the existing research and the need for exploring the level of awareness and socio-environmental challenges in the mangrove conservation in the context of Kollam district in Kerala.

2.2 Review of literature

2.2.1 Understanding Mangrove Ecosystems and Their Ecological Importance

Mangroves are specialised woody plant communities that grow in tropical and subtropical coastal regions where land and sea interact. These ecosystems are found along estuaries, river mouths, lagoons, mudflats, and sheltered coastlines that experience regular tidal inundation. Mangrove vegetation possesses unique physiological adaptations such as salt tolerance, aerial

roots, and viviparous seed germination, enabling survival in highly saline and waterlogged conditions (Maurya et al., 2021). Mangrove ecosystems are widely recognized as one of the most productive and biologically complex ecosystems in the world because they support diverse ecological processes and provide multiple environmental services essential for both nature and human communities (Alongi, 2012).

2.2.1.1 Ecological Characteristics of Mangrove Ecosystems

Mangroves occupy the transitional zone between terrestrial and marine ecosystems and perform important ecological functions. Their complex root systems stabilize shorelines, trap sediments, reduce erosion, and improve water quality by filtering pollutants and excess nutrients. Mangrove forests also serve as breeding, nursery, and feeding grounds for numerous species of fish, crustaceans, molluscs, birds, and reptiles, thereby supporting coastal biodiversity and fisheries productivity (Maurya et al., 2021).

Globally, mangrove ecosystems are increasingly recognised for their role in maintaining ecological balance and supporting sustainable coastal development. Despite covering a relatively small proportion of the Earth's surface, mangroves contribute significantly to nutrient cycling, carbon storage, and ecosystem resilience. However, rapid urbanization, industrial expansion, aquaculture, and climate change have accelerated mangrove degradation in many regions of the world (Alongi, 2012).

2.2.1.2 Mangroves and Climate Change Mitigation

Mangrove forests are often described as "blue carbon ecosystems" because of their exceptional ability to capture and store atmospheric carbon dioxide. Studies have shown that mangroves store substantial amounts of carbon in both vegetation biomass and underlying sediments, making them among the most carbon-rich ecosystems globally (Alongi, 2012). Their capacity for long-term carbon sequestration contributes significantly to climate change mitigation efforts and supports international environmental commitments aimed at reducing greenhouse gas emissions.

Recent global assessments have emphasized that mangrove conservation is crucial for enhancing climate resilience and reducing vulnerability to environmental hazards. In addition

to carbon sequestration, mangroves help buffer coastal communities against sea-level rise, cyclones, storm surges, and extreme weather events (IUCN, 2024). Consequently, mangrove restoration has become an important component of nature-based solutions for climate adaptation and sustainable coastal management.

2.2.1.3 Socio-Economic Importance of Mangroves

Beyond their ecological functions, mangrove ecosystems provide substantial socio-economic benefits to coastal populations. Local communities depend on mangroves for fisheries resources, fuelwood, medicinal products, honey collection, and other livelihood-related activities. The nursery function of mangroves supports fish populations that contribute directly to food security and income generation among fishing communities (Alongi, 2012).

Mangroves also contribute to disaster risk reduction by minimizing the impacts of coastal hazards. Their dense vegetation acts as a natural barrier that absorbs wave energy and reduces coastal flooding during storms and cyclones. As a result, healthy mangrove ecosystems are increasingly considered essential for protecting vulnerable coastal populations and sustaining local livelihoods (IUCN, 2024).

2.2.1.4 Status of Mangrove Ecosystems in India

India possesses one of the largest mangrove resources in Asia, distributed along the eastern and western coastlines and the Andaman and Nicobar Islands. Major mangrove ecosystems are found in the Sundarbans, Mahanadi Delta, Godavari Delta, Krishna Delta, Gulf of Kachchh, and several estuarine regions along the western coast. Indian mangroves support rich biodiversity and provide critical ecosystem services including coastal protection, fisheries support, and carbon sequestration (Forest Survey of India, 2021).

However, Indian mangroves face increasing pressure from urban development, industrialization, aquaculture expansion, land reclamation, and pollution. These anthropogenic activities have contributed to habitat fragmentation and ecological degradation in many coastal regions. Consequently, mangrove conservation has become an important priority within India's coastal ecosystem management strategies (FSI, 2021).

2.2.1.5 Mangrove Ecosystems in Kerala

Kerala possesses a unique network of estuaries, backwaters, rivers, and coastal wetlands that historically supported extensive mangrove vegetation. However, studies indicate that the state has experienced severe mangrove decline over recent decades due to land conversion, urban expansion, aquaculture, infrastructure development, and other human interventions (Bharathan et al., 2021).

According to Bharathan et al. (2021), Kerala has lost nearly 95 percent of its mangrove cover during the past few decades. Although mangrove forests are distributed across districts such as Kannur, Kozhikode, Ernakulam, Alappuzha, Kollam, and Thiruvananthapuram, many patches remain fragmented and vulnerable to environmental disturbances. The reduction of mangrove cover has negatively affected biodiversity conservation, coastal stability, and ecosystem functioning.

Research conducted in Kerala demonstrates that mangrove ecosystems contribute significantly to carbon storage and climate regulation. Harishma et al. (2020) estimated that mangrove ecosystems in Kerala contain substantial biomass and carbon stocks, highlighting their importance as regional carbon sinks. Their findings emphasise the need for sustainable management and restoration efforts to enhance ecological resilience and mitigate climate change impacts.

Studies from Kannur district further indicate that undisturbed mangrove ecosystems exhibit higher carbon sequestration potential than anthropogenically disturbed mangrove areas. Human activities such as land reclamation, industrialization, coastal development, and sand mining have been identified as major threats affecting ecosystem health and carbon storage capacity (Anusree et al., 2024).

2.2.1.6 Emerging Conservation Concerns in Kerala

Recent literature suggests that mangrove conservation in Kerala requires stronger institutional support, community participation, and public awareness. Hema and Indira Devi (2020) argue that sustainable mangrove management must incorporate local stakeholder involvement

because community-based conservation approaches improve acceptance and long-term environmental outcomes.

Furthermore, scientific assessments have reported continuous habitat fragmentation and loss of mangrove biodiversity along Kerala's coastline. These ecological changes threaten not only environmental sustainability but also the livelihoods of coastal communities dependent on ecosystem services provided by mangroves (Bharathan et al., 2021). Therefore, understanding community awareness and perceptions regarding mangrove conservation becomes increasingly important for designing effective conservation strategies and promoting sustainable coastal resource management.

2.2.2 Community Awareness and Knowledge About Mangrove Conservation

Community awareness plays a significant role in environmental conservation because public understanding of ecological systems often influences attitudes, behaviours, and participation in conservation activities. In the context of mangrove ecosystems, awareness refers to the extent to which individuals understand the ecological, economic, and social importance of mangroves, while knowledge includes information regarding ecosystem services, conservation practices, environmental threats, and restoration measures. Researchers increasingly recognize that successful mangrove conservation depends not only on governmental interventions but also on informed and active community participation (Sathiyamoorthy & Sakurai, 2024).

2.2.2.1 Concept of Environmental Awareness in Conservation

Environmental awareness refers to the understanding of environmental issues and the recognition of human responsibilities in protecting natural resources. Studies indicate that awareness serves as an important determinant of conservation behaviour because individuals with greater environmental knowledge are more likely to support sustainable resource management and environmental protection initiatives (Manalo, 2023).

In mangrove conservation, awareness includes understanding ecosystem services such as shoreline protection, biodiversity conservation, fisheries support, carbon sequestration, and climate regulation. Communities living near mangrove ecosystems often interact directly with

these resources, making environmental awareness a critical factor influencing conservation outcomes (Badola et al., 2012).

2.2.2.2 Community Knowledge of Mangrove Ecosystem Services

Research conducted in the East Godavari Delta of Andhra Pradesh documented extensive indigenous knowledge regarding mangrove species, fisheries resources, and ecosystem utilization among local populations. The study found that community members possessed detailed knowledge about mangrove-related livelihoods and ecosystem functions, although environmental degradation and socio-economic changes threatened the continuity of this traditional knowledge system (Dahdouh-Guebas et al., 2006). Similar findings suggest that local ecological knowledge can strengthen conservation planning when incorporated into environmental management strategies.

2.2.2.3 Awareness and Conservation Behaviour

Environmental awareness is frequently associated with positive conservation behaviour. Communities that understand the ecological importance of mangroves are generally more supportive of restoration programmes, environmental regulations, and conservation initiatives. Research from the Philippines found that higher levels of awareness were positively associated with favourable attitudes toward mangrove conservation and ecosystem protection (Manalo, 2023).

Similarly, studies from Sri Lanka demonstrated that community participation in mangrove restoration programmes improved when local residents understood the ecological and economic benefits of mangroves. Community-based conservation approaches were found to be more effective than centralized management systems because awareness and local involvement increased stakeholder commitment to restoration activities (Sathiyamoorthy & Sakurai, 2024).

These findings suggest that awareness functions not only as a cognitive factor but also as a motivating force that influences environmental participation and stewardship.

2.2.2.4 Public Perceptions and Understanding of Mangrove Conservation

Perception refers to how individuals interpret environmental issues and conservation needs based on their experiences, beliefs, and socio-cultural context. Studies indicate that local perceptions significantly influence conservation outcomes because community members often determine whether conservation initiatives receive support or resistance (Badola et al., 2012).

A study conducted in the Bhitarkanika Conservation Area on the east coast of India revealed that most respondents recognized the protective role of mangroves against cyclones and coastal hazards. Positive perceptions toward mangrove ecosystems were strongly associated with livelihood dependency, education level, and environmental awareness. The study emphasized that understanding community perceptions is essential for designing effective conservation programmes (Badola et al., 2012).

Research from the Indian Sundarbans similarly reported that local communities acknowledged the importance of mangroves for disaster protection, fisheries productivity, and livelihood security. However, socio-economic pressures often created conflicts between conservation priorities and livelihood needs (Ghosh et al., 2015).

2.2.2.5 Role of Environmental Education and Awareness Programmes

Environmental education is widely considered a key strategy for enhancing conservation awareness. Educational interventions increase knowledge regarding ecosystem services, environmental degradation, climate change, and sustainable resource use. Studies suggest that awareness campaigns, school-based environmental education, community workshops, and NGO-led programmes contribute significantly to public understanding of mangrove conservation (Manalo, 2023).

Researchers argue that environmental education should be adapted to local socio-cultural contexts to improve effectiveness. Community-centered awareness programmes that incorporate local experiences and traditional ecological knowledge tend to generate stronger conservation engagement than purely technical approaches (Sathiyamoorthy & Sakurai, 2024).

2.2.2.6 Community Awareness and Mangrove Conservation in India

In India, community awareness has become an important component of mangrove conservation policies because many mangrove ecosystems exist within densely populated coastal regions. Studies indicate that awareness levels vary significantly according to education, occupation, access to information, and dependency on ecosystem resources (Badola et al., 2012).

Research from Mumbai examining awareness and attitudes toward mangrove conservation found that most respondents recognized the environmental benefits of mangroves, particularly their role in flood mitigation and coastal protection. However, the study also reported knowledge gaps regarding long-term conservation practices and ecosystem management, indicating the need for broader environmental education programmes (Singh et al., 2025).

Studies from the Sundarbans have further demonstrated that conservation awareness is closely linked with disaster experiences. Communities exposed to cyclones and environmental hazards often exhibit greater appreciation for mangrove ecosystem services because of their direct protective benefits (Ghosh et al., 2015).

2.2.2.7 Community Awareness and Local Perceptions in Kerala

Research focusing on Kerala highlights increasing concern regarding declining mangrove ecosystems and limited public awareness about their ecological importance. Kerala's mangrove ecosystems have undergone significant degradation due to urbanisation, land reclamation, aquaculture expansion, infrastructure development, and pollution (Hema & Indira Devi, 2020).

A large-scale study conducted in Puthuvype Ernakulam district examined attitudes and perceptions toward mangrove conservation among local inhabitants. The findings revealed that 52.3 percent of respondents demonstrated positive attitudes toward mangrove conservation and acknowledged the ecological importance of mangrove ecosystems. The researchers emphasised that environmental awareness and education significantly influenced conservation-oriented perceptions among community members (Kaippilly et al., 2017).

Further studies from Kerala indicate that communities often recognize the livelihood benefits of mangroves but may possess limited understanding of ecosystem services such as carbon sequestration, biodiversity conservation, and climate regulation (Hema & Indira Devi, 2020).

This gap suggests the need for targeted awareness programmes that expand public knowledge beyond immediate economic benefits.

2.2.2.8 Factors Influencing Awareness Levels

Literature indicates that awareness regarding mangrove conservation is influenced by multiple socio-demographic and environmental factors. Education level is frequently identified as a strong predictor of environmental knowledge because educated individuals generally have greater access to environmental information and conservation discourse (Badola et al., 2012).

Occupation also influences awareness levels, particularly among fishing communities and individuals whose livelihoods depend directly on coastal ecosystems. Age, gender, media exposure, participation in environmental programmes, and proximity to mangrove ecosystems have similarly been identified as important determinants of awareness (Manalo, 2023).

Studies further suggest that awareness is strengthened when communities directly experience the ecological benefits of mangroves, such as protection from coastal erosion, flood reduction, and fisheries support. Therefore, experiential learning and community participation can enhance conservation awareness more effectively than information dissemination alone (Sathiyamoorthy & Sakurai, 2024).

2.2.3 Attitudes and Perceptions Toward Mangrove Conservation

Attitudes and perceptions are important psychological and social dimensions influencing environmental conservation. While awareness and knowledge relate to understanding environmental issues, attitudes reflect individuals' positive or negative evaluations of conservation efforts, and perceptions refer to how people interpret environmental conditions, ecological changes, and conservation needs. In the context of mangrove conservation, community attitudes and perceptions significantly influence support for conservation policies, participation in restoration programmes, and willingness to adopt sustainable environmental practices (Badola et al., 2012).

2.2.3.1. Understanding Environmental Attitudes in Conservation

Environmental attitudes are generally defined as beliefs, feelings, and predispositions that influence individuals' responses toward environmental protection and resource management. Positive environmental attitudes often encourage pro-conservation behaviour, whereas negative attitudes may lead to resistance against conservation interventions (Bennett, 2016).

Research suggests that attitudes toward conservation are shaped by multiple factors, including environmental knowledge, education, cultural values, livelihood dependence, previous experiences with environmental change, and perceived benefits from ecosystem services (Masud et al., 2015). Communities that recognize the ecological and economic value of mangroves are generally more likely to support conservation initiatives and participate in restoration activities.

In environmental management literature, positive attitudes are considered a critical prerequisite for sustainable conservation because community support often determines the long-term success of environmental programmes (Bennett, 2016).

2.2.3.2 Community Perceptions of Mangrove Ecosystems

Perceptions represent the ways individuals interpret and evaluate environmental conditions based on personal experiences and social contexts. Local perceptions are particularly important in mangrove conservation because communities interact directly with coastal ecosystems and experience their benefits and challenges firsthand.

International studies indicate that coastal communities generally perceive mangroves as valuable natural resources because they provide protection against coastal hazards, support fisheries, and contribute to livelihood security. However, perceptions vary according to socio-economic conditions, resource dependency, and exposure to environmental risks (Mukherjee et al., 2014).

A global review of ecosystem services provided by mangroves found that communities frequently associate mangrove ecosystems with shoreline protection, fisheries enhancement, biodiversity conservation, and disaster risk reduction. These perceived benefits often influence local willingness to support conservation efforts (Mukherjee et al., 2014).

2.2.3.3. Attitudes Toward Mangrove Conservation Programmes

Several studies have demonstrated that community attitudes significantly affect the implementation and effectiveness of conservation programmes. Positive attitudes increase cooperation with conservation authorities, participation in restoration projects, and compliance with environmental regulations (Bennett, 2016).

Research conducted in coastal Bangladesh found that residents who perceived direct benefits from mangroves exhibited stronger support for conservation initiatives than those who did not recognize ecosystem services. The study concluded that conservation programmes are more successful when communities perceive tangible environmental and economic benefits (Uddin et al., 2013).

Similarly, studies in Southeast Asia reported that local support for mangrove restoration was strongly associated with positive perceptions regarding ecosystem services and environmental sustainability. Communities that viewed mangroves as valuable assets were more willing to engage in conservation activities and environmental stewardship programmes (Datta et al., 2012).

2.2.3.4 Perceptions of Environmental Change and Mangrove Degradation

Environmental perceptions often develop through direct observations of ecological changes. Coastal communities frequently witness mangrove loss, shoreline erosion, declining fisheries, and increasing environmental degradation, which shape their attitudes toward conservation.

Studies conducted in the Indian Sundarbans revealed that local residents perceived significant environmental changes resulting from mangrove degradation, including increased vulnerability to cyclones, coastal erosion, salinity intrusion, and reduced fish availability (Ghosh et al., 2015). These experiences strengthened public recognition of the importance of mangrove conservation.

Similarly, research in Indonesia found that communities experiencing environmental degradation were more likely to support restoration programmes because they directly observed the negative consequences of ecosystem loss (Datta et al., 2012).

Such findings suggest that perceptions of environmental risks can serve as important motivators for conservation-oriented attitudes.

2.2.3.5 Attitudes Toward Mangrove Conservation in India

In India, several studies have explored community attitudes toward mangrove ecosystems and conservation initiatives. Research from the Bhitarkanika mangrove region of Odisha found that local communities generally held favourable attitudes toward mangrove conservation because they recognized its role in supporting fisheries, reducing cyclone impacts, and sustaining local livelihoods (Badola et al., 2012).

The study further demonstrated that positive attitudes were significantly associated with education, awareness levels, and dependence on ecosystem services. Respondents who possessed greater environmental knowledge were more likely to express support for conservation measures and environmental regulations (Badola et al., 2012).

Research conducted in the Sundarbans also found that local residents viewed mangroves as essential for disaster protection and livelihood security. However, socio-economic pressures occasionally created conflicting attitudes when conservation restrictions affected resource access and income generation (Ghosh et al., 2015).

These findings indicate that attitudes toward conservation are often influenced by the balance between environmental benefits and livelihood considerations.

2.2.3.6 Community Perceptions of Disaster Protection Functions

One of the most significant factors shaping attitudes toward mangrove conservation is the perception of disaster protection benefits. Scientific evidence demonstrates that mangrove forests reduce wave energy, minimize storm surge impacts, and protect coastal communities from cyclones and flooding (Alongi, 2012).

Following major disasters such as the 2004 Indian Ocean tsunami and subsequent cyclonic events, many coastal communities developed stronger appreciation for mangrove ecosystems. Studies reported increased public support for conservation after communities observed the

protective functions of mangroves during extreme weather events (Kathiresan & Rajendran, 2005).

In regions vulnerable to climate change and coastal hazards, positive perceptions regarding disaster risk reduction frequently strengthen conservation-oriented attitudes and support for restoration programmes.

2.2.3.7 Attitudes and Perceptions Toward Mangrove Conservation in Kerala

Kerala's coastal communities have increasingly experienced environmental challenges associated with coastal erosion, flooding, habitat degradation, and climate variability. These environmental experiences have contributed to growing public concern regarding mangrove conservation (Hema & Indira Devi, 2020).

A study conducted in Puduveypu, Ernakulam district, assessed local attitudes and perceptions toward mangrove ecosystems. The findings indicated that a majority of respondents recognized the ecological importance of mangroves and expressed positive attitudes toward conservation. The study reported that awareness and educational background significantly influenced conservation-oriented perceptions among community members (Kaippilly et al., 2017).

Research conducted by Hema and Indira Devi (2020) further emphasized that public acceptance is a critical component of successful mangrove management in Kerala. The authors argued that conservation programmes are more likely to succeed when local communities perceive conservation initiatives as beneficial, socially acceptable, and compatible with their livelihood needs.

Recent conservation efforts in Kerala have increasingly focused on community engagement and awareness generation because positive attitudes among residents are viewed as essential for long-term ecosystem protection and restoration (Hema & Indira Devi, 2020).

2.2.3.8 Socio-Demographic Factors Influencing Attitudes and Perceptions

Literature consistently identifies several socio-demographic variables influencing attitudes toward mangrove conservation. Education is among the most frequently cited predictors

because environmental knowledge often contributes to favourable conservation attitudes (Badola et al., 2012).

Age, occupation, income level, livelihood dependence, and participation in environmental programmes also affect conservation perceptions. Fishing communities and coastal residents who directly benefit from ecosystem services often demonstrate stronger appreciation for mangrove conservation than populations with limited interaction with coastal resources (Masud et al., 2015).

Researchers have also found that previous exposure to environmental hazards strengthens conservation attitudes because individuals become more aware of the protective functions of mangrove ecosystems (Kathiresan & Rajendran, 2005).

2.2.3.9 Implications for Community-Based Conservation

The literature suggests that positive attitudes and perceptions are fundamental for successful community-based conservation. Conservation programmes that consider local perceptions, address livelihood concerns, and promote community participation tend to achieve greater effectiveness and sustainability (Bennett, 2016).

Attitudes serve as an important link between awareness and behaviour because knowledgeable individuals do not always participate in conservation unless they also hold favourable perceptions regarding environmental protection. Therefore, understanding community attitudes provides valuable insights into the social dimensions of mangrove conservation and helps identify factors influencing public support for conservation initiatives.

2.2.4 Community Practices and Participation in Mangrove Conservation

Community participation is widely recognised as one of the most important components of successful environmental conservation. Conservation initiatives are often more effective when local communities actively engage in planning, implementation, monitoring, and management processes. In mangrove conservation, participation includes activities such as mangrove planting, habitat restoration, sustainable resource utilisation, environmental awareness

campaigns, community monitoring, and involvement in conservation decision-making (Datta et al., 2012).

Environmental practices refer to the actions and behaviours adopted by individuals and communities to protect and sustainably manage natural resources. In the context of mangrove conservation, practices may include avoiding mangrove destruction, participating in restoration activities, supporting conservation regulations, reducing pollution, and promoting sustainable livelihood activities (Sathiyamoorthy & Sakurai, 2024).

2.2.4.1 Importance of Community Participation in Mangrove Conservation

The concept of community participation emerged from the recognition that conservation efforts cannot be sustained through government interventions alone. Local communities often possess valuable ecological knowledge and maintain direct relationships with natural resources. Their involvement contributes to improved resource management, local ownership, and long-term sustainability of conservation initiatives (Datta et al., 2012).

International conservation frameworks increasingly advocate participatory approaches because conservation programmes that exclude local stakeholders frequently encounter resistance and implementation challenges. Community participation enhances environmental awareness, improves trust between stakeholders, and promotes collective responsibility for ecosystem protection (Friess et al., 2016).

Studies indicate that communities actively involved in conservation activities demonstrate stronger environmental stewardship and greater willingness to support restoration programmes compared to communities that remain passive beneficiaries of conservation policies (Sathiyamoorthy & Sakurai, 2024).

2.2.4.2 Community-Based Mangrove Management

Community-based mangrove management refers to conservation systems in which local residents participate directly in planning, protecting, and restoring mangrove ecosystems. Such approaches recognize communities as key stakeholders rather than merely resource users.

A review of community-based mangrove management initiatives across Asia reported that local participation significantly improved conservation outcomes by reducing illegal exploitation, enhancing restoration success, and promoting sustainable resource utilization (Datta et al., 2012). Community involvement was found to strengthen local accountability and encourage long-term ecosystem stewardship.

A global review of mangrove conservation and restoration initiatives reported that projects involving local communities generally achieved better ecological and social outcomes than those implemented through purely top-down approaches. Community participation contributed to improved monitoring, sustainable resource management, increased local stewardship, and long-term conservation success (Romañach et al., 2018). Similarly, research from northern Sri Lanka demonstrated that active community involvement enhanced restoration effectiveness, improved survival rates of planted mangroves, and strengthened local commitment to conservation activities (Sathiyamoorthy & Sakurai, 2024). These findings indicate that community participation is a critical component of sustainable mangrove management and ecosystem restoration.

2.2.4.3 Community Practices in Mangrove Restoration Activities

Mangrove restoration has become an important conservation strategy worldwide due to widespread habitat degradation. Restoration activities often involve mangrove planting, habitat rehabilitation, shoreline stabilization, and ecosystem monitoring.

Studies indicate that local participation substantially improves restoration success because community members contribute labour, local ecological knowledge, and long-term monitoring support (Friess et al., 2016). Restoration programmes that incorporate local stakeholders are more likely to achieve ecological sustainability and community acceptance.

A recent study from northern Sri Lanka found that community participation significantly increased restoration effectiveness by improving survival rates of planted mangroves and strengthening community commitment to conservation objectives. Participants also reported enhanced environmental awareness and stronger conservation attitudes following involvement in restoration activities (Sathiyamoorthy & Sakurai, 2024).

These findings demonstrate that participation can simultaneously contribute to ecological restoration and social empowerment.

2.2.4.4 Sustainable Resource Use Practices

Mangrove-dependent communities often rely on ecosystem resources for fisheries, fuelwood, fodder, honey collection, and other livelihood activities. Sustainable utilization practices are therefore essential for balancing livelihood needs with conservation objectives.

Sustainable resource use practices included regulated harvesting, community monitoring, and adherence to conservation guidelines.

Similarly, studies from the Sundarbans emphasized that community participation in resource management reduced environmental degradation and enhanced ecosystem resilience. Participatory resource management approaches encouraged responsible resource utilization while supporting local livelihoods (Ghosh et al., 2015).

2.2.4.5 Participation in Environmental Awareness and Conservation Programmes

Environmental awareness programmes often serve as entry points for community engagement in conservation activities. Participation in workshops, training programmes, awareness campaigns, and environmental education initiatives contributes to increased understanding of ecosystem services and conservation needs (Bennett, 2016).

Research indicates that communities exposed to awareness programmes are more likely to participate in restoration projects and environmental monitoring activities. Awareness programmes help strengthen conservation values and encourage environmentally responsible practices (Sathiyamoorthy & Sakurai, 2024).

Furthermore, participation in environmental activities can create opportunities for social learning, where community members exchange knowledge and collectively develop solutions to environmental challenges (Bennett, 2016).

2.2.4.6 Community Participation in Mangrove Conservation in India

In India, community participation has become increasingly important in mangrove conservation due to the extensive dependence of coastal populations on ecosystem resources. Several studies have highlighted the role of local communities in supporting mangrove restoration, environmental monitoring, and sustainable resource management.

Research conducted in the Bhitarkanika mangrove ecosystem found that communities actively involved in conservation activities demonstrated stronger support for mangrove protection measures. Participation was influenced by environmental awareness, livelihood dependency, and perceived ecosystem benefits (Badola et al., 2012).

Similarly, studies from the Indian Sundarbans reported that local involvement in conservation initiatives improved community acceptance of environmental regulations and strengthened collective action toward ecosystem protection (Ghosh et al., 2015). However, participation levels varied according to socio-economic conditions, education levels, and resource dependency.

These studies suggest that community participation is influenced by both ecological and social factors and must be supported through inclusive conservation strategies.

2.2.4.7 Community Practices and Participation in Kerala

Kerala has witnessed increasing efforts to promote community involvement in mangrove conservation through government agencies, local self-government institutions, fisheries organizations, educational institutions, and environmental groups. These initiatives recognize the importance of public participation in addressing mangrove degradation and habitat loss (Hema & Indira Devi, 2020).

Research conducted in Kerala emphasized that conservation programmes are more likely to succeed when local communities are involved in planning and implementation processes. Hema and Indira Devi (2020) argued that socially acceptable management plans require active stakeholder participation because local support determines the sustainability of conservation outcomes.

Studies also indicate that participation in conservation activities is influenced by awareness levels, environmental attitudes, and perceptions regarding ecosystem benefits. Individuals who understand the ecological and livelihood significance of mangroves are generally more willing to engage in conservation programmes (Kaippilly et al., 2017).

2.2.4.8 Factors Influencing Community Participation

The literature identifies several factors that influence participation in mangrove conservation activities. Environmental awareness is among the strongest predictors because individuals who understand ecosystem services are more likely to support conservation initiatives (Badola et al., 2012).

Education, livelihood dependence, income, social capital, trust in institutions, and previous conservation experience also affect participation levels (Bennett, 2016). Communities that perceive direct benefits from conservation efforts are generally more willing to contribute time, labour, and resources toward environmental protection.

Conversely, limited awareness, economic pressures, lack of incentives, weak institutional support, and livelihood conflicts may reduce participation and weaken conservation outcomes (Datta et al., 2012).

2.2.4.9 Community Participation and Conservation Outcomes

Evidence from international and national studies consistently demonstrates that community participation improves conservation effectiveness. Participatory conservation approaches contribute to enhanced ecosystem restoration, reduced resource conflicts, stronger environmental stewardship, and increased sustainability of conservation programmes (Friess et al., 2016).

Participation also strengthens social ownership of conservation initiatives by empowering communities to become active partners in environmental management. As a result, community-based conservation is increasingly regarded as an essential strategy for protecting mangrove ecosystems in socially and ecologically complex coastal regions (Sathiyamoorthy & Sakurai, 2024).

2.2.5 Socio-Environmental Barriers Affecting Mangrove Conservation

Mangrove ecosystems provide numerous ecological, economic, and social benefits; however, they continue to experience significant degradation worldwide. Despite growing recognition of their importance, conservation efforts often face multiple socio-environmental barriers that limit effective protection and restoration. These barriers arise from interactions among social, economic, cultural, environmental, institutional, and political factors. Researchers argue that understanding these barriers is essential for developing sustainable conservation strategies because environmental protection cannot be achieved without addressing the human dimensions of ecosystem management (Mukherjee et al., 2014).

2.2.5.1 Concept of Socio-Environmental Barriers

Socio-environmental barriers refer to social, economic, institutional, and environmental conditions that hinder conservation actions and sustainable resource management. In mangrove ecosystems, these barriers may include poverty, livelihood dependency, inadequate environmental awareness, weak governance, land-use conflicts, urbanization, climate change impacts, and insufficient community participation (Romañach et al., 2018).

The socio-ecological systems approach emphasizes that environmental problems are often linked to human behaviour, governance structures, and socio-economic pressures. Consequently, successful mangrove conservation requires addressing both ecological threats and social constraints that influence resource use and environmental decision-making (Friess et al., 2019).

2.2.5.2 Lack of Environmental Awareness and Knowledge

Limited environmental awareness is frequently identified as a major barrier to mangrove conservation. Communities with inadequate knowledge regarding ecosystem services may underestimate the ecological importance of mangroves and fail to support conservation initiatives (Badola et al., 2012).

Studies have shown that many coastal residents recognize direct livelihood benefits of mangroves but possess limited understanding of broader ecosystem services such as carbon

sequestration, biodiversity conservation, shoreline stabilization, and climate regulation (Mukherjee et al., 2014). This knowledge gap can reduce public support for conservation policies and weaken participation in restoration activities.

Research from India has similarly reported that insufficient environmental education contributes to unsustainable resource utilization and reduced conservation engagement among local communities (Badola et al., 2012).

2.2.5.3 Livelihood Dependency and Economic Pressures

Economic dependence on mangrove resources often creates challenges for conservation efforts. Many coastal communities rely on mangrove ecosystems for fisheries, fuelwood collection, aquaculture, grazing, and other livelihood activities. While these resources contribute to economic security, excessive exploitation can accelerate ecosystem degradation (Datta et al., 2012).

Studies from South and Southeast Asia indicate that poverty and livelihood insecurity frequently compel communities to prioritize immediate economic needs over long-term environmental sustainability (Romañach et al., 2018). As a result, conservation measures that restrict resource access may encounter resistance unless alternative livelihood opportunities are provided.

Research conducted in the Indian Sundarbans found that livelihood dependency created tensions between conservation objectives and economic survival, particularly among vulnerable households dependent on natural resources (Ghosh et al., 2015). Such conflicts often reduce community support for conservation regulations.

2.2.5.4 Urbanization and Land-Use Change

Urban expansion, industrial development, tourism infrastructure, and land reclamation are among the most significant drivers of mangrove loss worldwide. Rapid urbanization frequently results in the conversion of mangrove areas into residential, commercial, and industrial land uses (Friess et al., 2019).

Global assessments indicate that land-use change remains a major threat to mangrove ecosystems because it causes habitat fragmentation, biodiversity loss, and ecosystem degradation (Romañach et al., 2018). Coastal development projects often prioritize economic growth while neglecting ecological sustainability.

In India, urbanisation has contributed substantially to mangrove degradation in several coastal cities, including Mumbai, Chennai, Kochi, and other rapidly developing regions. Land conversion and encroachment continue to threaten the long-term survival of mangrove habitats (Mukherjee et al., 2014).

2.2.5.5 Pollution and Environmental Degradation

Pollution represents another significant environmental barrier affecting mangrove conservation. Industrial effluents, domestic sewage, agricultural runoff, plastic waste, and chemical contaminants negatively impact mangrove health and biodiversity (Friess et al., 2019).

Research suggests that pollution alters soil properties, reduces water quality, disrupts ecological processes, and affects species diversity within mangrove ecosystems (Alongi, 2015). The accumulation of pollutants can weaken ecosystem resilience and reduce the effectiveness of restoration efforts.

Studies from Indian coastal regions have reported increasing pollution pressures associated with urban growth, industrialization, and unsustainable waste disposal practices. These environmental challenges continue to undermine conservation outcomes despite ongoing restoration initiatives (Mukherjee et al., 2014).

2.2.5.6 Climate Change and Natural Environmental Stressors

Climate change has emerged as a major global threat to mangrove ecosystems. Rising sea levels, changing precipitation patterns, increased temperatures, coastal erosion, and extreme weather events significantly affect mangrove distribution and ecological functioning (Alongi, 2015).

Research demonstrates that climate-related hazards can alter hydrological conditions, increase salinity levels, and reduce ecosystem resilience. Although mangroves contribute to climate adaptation and disaster risk reduction, they are themselves vulnerable to climate-induced environmental changes (Friess et al., 2019).

In many coastal regions, climate change interacts with existing human pressures, creating complex conservation challenges that require integrated environmental management approaches.

2.2.5.7 Weak Institutional and Policy Support

Institutional barriers often limit the effectiveness of conservation initiatives. Weak policy implementation, inadequate enforcement mechanisms, insufficient funding, fragmented governance structures, and poor coordination among agencies can undermine mangrove protection efforts (Romañach et al., 2018).

Researchers have emphasized that conservation policies frequently fail when local communities are excluded from decision-making processes. Top-down management approaches may reduce public trust and weaken stakeholder engagement, resulting in limited conservation success (Datta et al., 2012).

Institutional weaknesses are particularly problematic in regions where multiple agencies share responsibility for coastal management, creating overlaps, conflicts, and administrative inefficiencies (Friess et al., 2019).

2.2.5.8 Limited Community Participation

Insufficient community participation is widely recognized as a major obstacle to successful conservation. Conservation programmes often struggle when local residents are not involved in planning, implementation, or monitoring activities (Sathiyamoorthy & Sakurai, 2024).

Studies indicate that lack of participation reduces local ownership of conservation initiatives and weakens long-term sustainability. Communities may become reluctant to support

conservation measures when they perceive limited benefits or exclusion from decision-making processes (Datta et al., 2012).

Recent evidence from Sri Lanka demonstrates that conservation initiatives incorporating community participation achieve better ecological and social outcomes than projects implemented without local involvement (Sathiyamoorthy & Sakurai, 2024).

2.2.5.9 Socio-Environmental Barriers in Kerala

Kerala's mangrove ecosystems have experienced substantial decline due to a combination of socio-economic and environmental pressures. Studies report that land reclamation, urban expansion, aquaculture development, infrastructure projects, and population growth have contributed significantly to mangrove degradation across the state (Bharathan et al., 2021).

Research conducted in Kerala identified habitat fragmentation, inadequate public awareness, weak conservation enforcement, and competing land-use demands as major challenges affecting mangrove protection efforts (Hema & Indira Devi, 2020). These factors have reduced the effectiveness of conservation initiatives and contributed to continued ecosystem loss.

Furthermore, community perceptions regarding economic development often conflict with conservation objectives. In some areas, immediate economic benefits associated with land conversion and commercial development are prioritized over long-term environmental sustainability (Bharathan et al., 2021).

Recent studies also highlight climate-related challenges such as coastal erosion, flooding, salinity changes, and biodiversity loss, which further threaten the resilience of Kerala's mangrove ecosystems (Harishma et al., 2020).

2.2.5.10 Implications for Community-Based Conservation

The literature demonstrates that socio-environmental barriers are interconnected and cannot be addressed through ecological interventions alone. Effective conservation requires integrated approaches that combine environmental education, livelihood support, participatory governance, policy enforcement, and community engagement (Friess et al., 2019).

Addressing barriers such as poverty, lack of awareness, institutional weaknesses, and environmental degradation can improve conservation outcomes and strengthen community participation. Researchers increasingly advocate community-centered conservation models that recognize local needs while promoting ecosystem sustainability (Sathiyamoorthy & Sakurai, 2024).

2.2.6 Relationship Between Awareness and Participation in Mangrove Conservation

Community participation is widely regarded as a fundamental requirement for the success of environmental conservation initiatives. However, participation does not occur automatically; it is influenced by several social, psychological, and environmental factors. Among these, environmental awareness has consistently been identified as a critical determinant of conservation behaviour. Researchers argue that individuals who possess greater knowledge and awareness about environmental issues are more likely to develop positive attitudes toward conservation and actively engage in environmental protection activities (Ardoin et al., 2020).

In mangrove conservation, awareness refers to an individual's understanding of the ecological, economic, and social importance of mangrove ecosystems, while participation involves active involvement in conservation-related activities such as restoration programmes, environmental monitoring, awareness campaigns, community decision-making, and sustainable resource management. Understanding the relationship between awareness and participation is therefore essential for designing effective community-based conservation strategies.

2.2.6.1 Theoretical Perspectives Linking Awareness and Participation

Environmental behaviour theories provide a useful framework for understanding how awareness influences participation. The Knowledge–Attitude–Practice (KAP) model suggests that environmental knowledge shapes attitudes, which subsequently influence behaviour and participation in conservation activities (Kaliyaperumal, 2004). According to this model, increased awareness enhances understanding of environmental issues, promotes positive attitudes toward conservation, and encourages individuals to adopt environmentally responsible practices.

Similarly, the Theory of Planned Behavior proposes that environmental behaviour is influenced by attitudes, social norms, and perceived behavioural control. Individuals who are aware of environmental problems and believe their actions can contribute to solutions are more likely to participate in conservation initiatives (Ajzen, 1991).

These theoretical perspectives indicate that awareness functions as an important precursor to conservation participation and environmental stewardship.

2.2.6.2 Environmental Awareness as a Predictor of Conservation Participation

Numerous studies have demonstrated a positive relationship between environmental awareness and participation in conservation activities. Individuals with higher levels of environmental knowledge tend to exhibit stronger conservation values, greater environmental responsibility, and increased willingness to engage in environmental protection efforts (Ardoin et al., 2020).

A global review of environmental education and conservation behaviour found that awareness programmes significantly improve public participation in conservation initiatives by enhancing ecological understanding and strengthening pro-environmental attitudes (Ardoin et al., 2020). Participants exposed to environmental education were more likely to support conservation policies, volunteer in restoration activities, and adopt sustainable environmental practices.

Researchers argue that awareness influences participation because individuals who understand ecosystem services are more likely to recognize the consequences of environmental degradation and the benefits of conservation interventions.

2.2.6.3 Awareness and Community Participation in Mangrove Conservation

In mangrove conservation, awareness has been identified as a key factor influencing community engagement. Communities that understand the ecological functions of mangroves and their contribution to fisheries, coastal protection, biodiversity conservation, and climate regulation are generally more supportive of conservation efforts (Mukherjee et al., 2014).

Studies conducted across Asia indicate that environmental awareness strengthens community willingness to participate in mangrove restoration programmes and resource management

initiatives. Increased knowledge regarding ecosystem services often leads to stronger conservation commitment and greater community involvement in environmental activities (Datta et al., 2012).

A review of community-based mangrove management initiatives reported that awareness-building activities improved participation rates by increasing public understanding of conservation benefits and promoting local stewardship of mangrove resources (Datta et al., 2012).

2.2.6.4 Evidence from International Studies

Several international studies have documented significant associations between environmental awareness and conservation participation. Research conducted in coastal communities of Southeast Asia found that environmental education programmes increased public involvement in mangrove restoration, community monitoring, and conservation planning activities (Romañach et al., 2018).

Similarly, a study from northern Sri Lanka demonstrated that awareness generated through community engagement and restoration programmes enhanced participation in mangrove conservation activities. Participants reported increased ecological knowledge, stronger environmental attitudes, and greater commitment to restoration efforts following involvement in conservation programmes (Sathiyamoorthy & Sakurai, 2024).

Research from Bangladesh also found that individuals with higher awareness regarding ecosystem services exhibited stronger support for conservation measures and were more willing to participate in community-based environmental management initiatives (Uddin et al., 2013).

These findings collectively suggest that awareness contributes significantly to conservation participation by strengthening environmental values and motivating community engagement.

2.2.6.5 Awareness and Participation in the Indian Context

In India, several studies have highlighted the role of environmental awareness in shaping conservation behaviour. Research conducted in the Bhitarkanika mangrove ecosystem found that respondents possessing greater environmental knowledge expressed stronger support for conservation measures and demonstrated higher levels of participation in environmental activities (Badola et al., 2012).

Similarly, studies from the Indian Sundarbans reported that awareness regarding the ecological and protective functions of mangroves positively influenced community support for conservation programmes. Communities that understood the role of mangroves in reducing cyclone impacts and supporting livelihoods were more willing to cooperate with conservation initiatives (Ghosh et al., 2015).

These findings suggest that awareness contributes not only to positive attitudes but also to practical engagement in conservation activities.

2.2.6.6 Awareness, Attitudes, and Participation

The literature indicates that attitudes often act as an intermediary factor linking awareness and participation. Environmental awareness alone may not always result in conservation behaviour unless individuals also develop favourable attitudes toward environmental protection (Ardoin et al., 2020).

Researchers have found that individuals who possess environmental knowledge and positive attitudes are more likely to participate in conservation programmes than those who possess knowledge but lack favourable perceptions regarding conservation benefits (Bennett, 2016). This relationship highlights the interconnected nature of awareness, attitudes, and participation.

Consequently, many conservation programmes combine awareness campaigns with community engagement strategies to strengthen both environmental knowledge and conservation attitudes.

2.2.6.7 Awareness and Participation in Kerala

Studies conducted in Kerala indicate that awareness plays an important role in shaping public support for mangrove conservation. Research by Kaippilly et al. (2017) found that individuals with greater awareness of mangrove ecosystem services demonstrated more favourable attitudes toward conservation and expressed stronger support for protection initiatives.

Similarly, Hema and Indira Devi (2020) emphasized that public awareness is essential for generating community participation in mangrove management programmes. The authors argued that conservation efforts are more likely to succeed when local residents understand the ecological significance of mangroves and perceive conservation as beneficial to community well-being.

Recent restoration initiatives in Kerala have increasingly incorporated environmental education and awareness programmes as mechanisms for encouraging public participation in mangrove planting, monitoring, and protection activities. These initiatives reflect growing recognition of the relationship between awareness and conservation engagement (Hema & Indira Devi, 2020).

2.2.6.8 Factors Moderating the Awareness–Participation Relationship

Although awareness generally promotes participation, several factors can influence the strength of this relationship. Education level, livelihood dependency, economic conditions, institutional support, social capital, and previous conservation experience may affect whether awareness translates into actual participation (Datta et al., 2012).

For example, individuals may possess high environmental awareness but remain unable to participate because of economic constraints, time limitations, or lack of opportunities for involvement. Conversely, supportive institutions and accessible conservation programmes can strengthen the relationship between awareness and participation by providing opportunities for engagement (Sathiyamoorthy & Sakurai, 2024).

Researchers, therefore, emphasise that awareness should be complemented by enabling social and institutional conditions to achieve effective conservation outcomes.

2.2.6.9 Implications for Community-Based Conservation

The literature consistently demonstrates that awareness is a key driver of community participation in conservation activities. Conservation programmes that prioritize environmental education, awareness campaigns, and public engagement tend to achieve greater community involvement and long-term sustainability (Ardoin et al., 2020).

Enhancing awareness can strengthen environmental stewardship, improve support for conservation policies, encourage participation in restoration activities, and promote sustainable resource management practices. Consequently, awareness-building initiatives are increasingly viewed as essential components of community-based conservation strategies.

2.3 Theoretical Framework

The present study is guided by the Theory of Planned Behaviour (TPB) proposed by Ajzen (1991). The theory explains that human behaviour is influenced by attitudes, perceived social influences, and perceived control over behaviour. According to the theory, individuals are more likely to engage in a particular behaviour when they possess positive attitudes towards that behaviour and perceive that they have the ability and opportunity to perform it.

In the context of mangrove conservation, the theory suggests that individuals who possess adequate knowledge and awareness regarding the ecological and socio-economic importance of mangroves are more likely to develop positive attitudes towards their conservation. These positive attitudes can increase their willingness to participate in conservation-related activities such as mangrove planting, restoration programmes, environmental awareness campaigns, and community-based conservation initiatives.

Participation in conservation activities may also be influenced by various socio-environmental barriers, including economic limitations, livelihood dependence on natural resources, lack of institutional support, inadequate environmental education, and developmental pressures. Such barriers may reduce an individual's ability or willingness to participate in conservation efforts even when awareness and attitudes are favourable.

Therefore, the Theory of Planned Behaviour provides an appropriate framework for understanding how community awareness influences participation in mangrove conservation and how socio-environmental barriers may affect this relationship. The theory supports the

objectives of the present study by explaining the connection between awareness, attitudes, socio-environmental barriers, and willingness to participate in mangrove conservation activities.

2.4 Research Gap Analysis

The review of literature indicates that considerable research has been conducted on the ecological importance of mangrove ecosystems, their role in biodiversity conservation, coastal protection, carbon sequestration, and livelihood support. Previous studies have also examined community awareness, attitudes, perceptions, participation, and various socio-environmental challenges associated with mangrove conservation in different national and international contexts.

However, the reviewed literature reveals several gaps. First, many studies have primarily focused on the ecological and environmental aspects of mangrove conservation, while comparatively less attention has been given to the human dimensions of conservation, particularly community awareness and participation. Second, although studies have explored socio-environmental barriers affecting mangrove conservation, these investigations have largely been conducted in regions outside Kerala or in other coastal areas of India.

Furthermore, limited research has specifically examined community awareness, attitudes, and participation in mangrove conservation within the context of Kollam district, Kerala. The literature also shows a lack of studies investigating the socio-environmental barriers perceived by local communities in this region. In addition, the relationship between community awareness and willingness to participate in mangrove conservation activities remains insufficiently explored in the local context.

Therefore, there is a need for a study that comprehensively examines community awareness, socio-environmental barriers, and participation in mangrove conservation within Kollam district. The present study seeks to address this gap by assessing knowledge, attitudes, and practices related to mangrove conservation, identifying socio-environmental barriers perceived by the community, and examining the relationship between awareness and willingness to participate in conservation activities.

CHAPTER III:

RESEARCH METHODOLOGY

3.1 Introduction

Research methodology refers to the systematic process adopted by the researcher to collect, analyse, and interpret data in order to achieve the objectives of the study. It provides a structured framework for conducting the research and ensures that the study is carried out in a scientific, logical, and ethical manner. The choice of an appropriate methodology is essential for obtaining reliable and valid findings.

This chapter describes the methodological framework adopted for the study titled "Community Awareness and Socio-Environmental Barriers in Mangrove Conservation in Kollam, Kerala." It presents the research design, pilot study, pre-test, universe and unit of study, sampling technique, inclusion and exclusion criteria, data collection process, sources of data, tool for data collection, data analysis, assumptions, limitations, and scope of the study. The chapter outlines the procedures followed throughout the research to ensure the systematic collection and analysis of data for achieving the objectives of the study.

3.2 Title of the study

Community Awareness and Socio-Environmental Barriers in Mangrove Conservation in Kollam, Kerala

3.3 Research Objective

GENERAL RESEARCH OBJECTIVE

- To understand the level of community awareness about mangroves and to identify the socio-environmental barriers affecting conservation in Kollam district.

SPECIFIC RESEARCH OBJECTIVE

- To assess knowledge, attitudes, and practices related to mangrove conservation among local residents.
- To understand the socio-environmental barriers perceived by the community.

- To examine the relationship between awareness level and willingness to participate in conservation activities.

3.4 Definition of concept

	TERM	CONCEPTUAL	OPERATIONAL
1	Mangrove Conservation	“The protection, restoration, and sustainable management of mangrove ecosystems to ensure their ecological and socio-economic benefits continue” (Kathiresan & Bingham, 2001).	Actions such as planting mangroves, protecting existing cover, avoiding clearance, and reducing pollution, as reported by participants and observed in Kollam, Kerala.
2	Community Awareness	“The knowledge, attitudes, and understanding of local people about the ecological roles, economic value, and threats to mangroves” (Launiala, 2009 – KAP Model).	what people know about mangrove functions, their attitudes toward conservation, and their everyday practices related to mangrove use and protection.
3	Socio-Environmental Barriers	“Social, economic, cultural, political, and environmental factors that hinder or restrict effective mangrove conservation” (Hema & Indira Devi, 2020).	Defined by issues like land use conflicts, livelihood dependence, pollution sources, policy gaps, lack of community participation, and institutional challenges, as identified through participant responses.

3.5 Pilot study

The pilot study helped the researcher assess whether the questions were easily understood and whether the research tool was appropriate for collecting data related to community awareness and socio-environmental barriers in mangrove conservation. During the pilot study, it was observed that some respondents found a few questions difficult to understand due to the use of technical terms related to mangroves. Therefore, the wording of these questions was simplified, and brief explanations were provided where necessary to improve clarity.

The pilot study also indicated that the order of a few questions could be improved to provide a smoother flow. As a result, the demographic questions were placed at the beginning of the research tool, followed by sections on knowledge, attitude, practices, socio-environmental barriers, and willingness to participate in mangrove conservation activities. This made it easier for respondents to answer the research tool systematically.

Based on the feedback received, minor modifications were made to a few knowledge and attitude statements to eliminate ambiguity. The response options for the question on threats to mangroves were also revised to allow respondents to identify multiple perceived threats, thereby providing a more comprehensive understanding of community perceptions. Instructions were clarified for a few questions to reduce confusion and improve the consistency of responses.

3.6 Pre-test

Before the main data collection, a pre-test of the interview schedule was conducted among members of the community in Munroe Island, Kollam district. The purpose of the pre-test was to assess the clarity, relevance, sequencing, and comprehensibility of the questions and to identify any difficulties that respondents might encounter during the interview.

The pre-test also helped the researcher assess the flow of the interview schedule and make the necessary modifications to ensure that the questions effectively captured the respondents' knowledge, attitudes, practices, perceived socio-environmental barriers, and willingness to participate in mangrove conservation activities. Based on the result of the pre-test, minor revisions were made to improve the wording of certain questions, simplify technical terms

related to mangroves, and enhance the overall sequence of the interview schedule. The revised interview schedule was subsequently used for the pilot study and the main data collection.

3.7 Research design

Research design is the overall plan or blueprint that guides the research process. It provides a systematic framework for collecting, measuring, and analysing data in order to answer the research questions and achieve the objectives of the study. A well-designed research design ensures that the research is conducted in a logical, valid, and reliable manner by specifying the procedures for data collection, sampling, measurement, and analysis (Creswell & Creswell, 2018). It serves as a roadmap that enables the researcher to address the research problem in a structured and scientific manner.

The present study adopted a cross-sectional research design. A cross-sectional research design is an observational research design in which data are collected from a defined population at a single point in time or over a short period to provide a "snapshot" of a phenomenon. It is widely used to assess the prevalence, characteristics, attitudes, knowledge, perceptions, and practices of a population and to examine relationships between variables without manipulating them (Bryman, 2016). Since information is collected only once from each participant, this design is efficient for describing the current status of the study variables but does not establish cause-and-effect relationships.

A cross-sectional research design was considered appropriate for the present study because the research aimed to assess the existing level of community awareness regarding mangrove conservation and identify the socio-environmental barriers affecting conservation in Kollam district. The study also sought to assess the knowledge, attitudes, and practices of local residents and examine the relationship between awareness levels and their willingness to participate in mangrove conservation activities. Since these objectives required information on the current status of the community rather than changes over time, collecting data at a single point in time was considered appropriate. Furthermore, the cross-sectional design was practical, cost-effective, and time-efficient, enabling the researcher to obtain data from a relatively large number of respondents within the study period while providing a comprehensive understanding of the existing situation.

3.8 Universe and unit of study

3.8.1 Universe of the study

The universe consisted of all residents living in the selected mangrove areas of Munroe Island, Kollam district, Kerala.

3.8.2 Unit of study

The unit of study was the individual resident residing in the selected mangrove areas of Munroe Island, Kollam district.

3.9 Sampling

Purposive sampling was considered appropriate for the present study because the research focused on assessing community awareness and identifying socio-environmental barriers related to mangrove conservation among residents of the selected mangrove areas in Munroe Island, Kollam district.

3.9.1 Inclusion criteria

- Residents aged 18 years and above residing in the Munroe Island, Kollam district.
- Residents who had been living in the study area for at least ten years, ensuring adequate familiarity with the local mangrove ecosystem and the environmental issues affecting the area.
- Individuals who were aware of the presence of mangroves in their locality, irrespective of their level of knowledge about mangrove conservation.
- Residents who were willing to participate voluntarily and provided informed consent.
- Individuals who were able to understand the questions and provide complete responses.

3.9.2 Exclusion criteria

- Individuals below 18 years of age.
- Temporary residents, tourists, migrant workers, or visitors who were not permanent residents of the study area.

- Residents who had lived in the study area for less than ten years.
- Individuals who declined to participate or withdrew their consent during the data collection process.

3.10 Data collection

The present study employed both primary and secondary sources of data to understand the level of community awareness regarding mangrove conservation and to identify the socio-environmental barriers affecting mangrove conservation in Kollam district

3.10.1 Sources of data

Primary Data: Primary data were collected directly from the respondents residing in the selected study area of Munroe Island, Kollam district. The researcher gathered the data through an interview schedule administered using a face-to-face survey method. The interview schedule collected information on the respondents' demographic profile, knowledge, attitudes, practices, perceived socio-environmental barriers, and willingness to participate in mangrove conservation activities.

Secondary Data: Secondary data were collected from various published and unpublished sources to provide a theoretical foundation and contextual understanding of the study. These sources included books, peer-reviewed journals, research articles, dissertations and theses, government reports, publications of national and international organisations, official websites, and other relevant documents related to mangrove conservation, community awareness, environmental management, and socio-environmental issues.

3.10.2 Tool for data collection

An interview Schedule was used as the primary tool for data collection in the present study. The researcher developed the questions based on the objectives of the study and an extensive review of relevant literature. It was designed to collect quantitative data from the respondents in a systematic and standardised manner.

3.11 Data analysis

Data analysis is the process of organising, coding, classifying, and interpreting the collected data to draw meaningful conclusions and achieve the objectives of the study. After the completion of data collection, the interview schedules were checked, coded, and entered into the Statistical Package for the Social Sciences (SPSS version 22) for analysis.

The collected data were analysed using both descriptive and inferential statistical techniques. Descriptive statistics, including frequencies and percentages, were used to summarise the demographic characteristics of the respondents and to analyse their level of knowledge, attitudes, practices, perceived socio-environmental barriers, and willingness to participate in mangrove conservation activities. The findings were presented using tables and figures for easy interpretation.

To examine the association between selected variables, cross-tabulation was performed. The analysed data were interpreted in accordance with the objectives of the study.

3.12 Assumptions, limitations and scope

3.12.1 Assumptions

- The respondents are aware of the presence of mangroves in their locality and were able to provide information related to mangrove conservation.
- The level of community awareness influences attitudes, practices, and willingness to participate in mangrove conservation activities.
- Socio-environmental factors such as economic conditions, community participation, institutional support, and environmental challenges influence mangrove conservation efforts in the study area.

3.12.2 Limitations

- The study was confined to the selected areas of Munroe Island, Kollam district; therefore, the findings cannot be generalised to all communities in Kollam district or other regions of Kerala.

- The study was conducted among 60 respondents selected through purposive sampling. As a non-probability sampling technique was used, the findings may not be representative of the entire population.
- The study focused primarily on community awareness, socio-environmental barriers, and willingness to participate in mangrove conservation. Other factors, such as ecological assessments, policy implementation, and scientific evaluation of mangrove ecosystems, were beyond the scope of the study.
- Time and resource constraints limited the geographical coverage and sample size of the study.

3.12.3 Scope

- The study provides an understanding of the existing level of community awareness regarding mangrove conservation among residents of the selected areas of Munroe Island, Kollam district.
- The study identifies the major socio-environmental barriers that influence community participation in mangrove conservation and highlights the challenges faced by local communities.
- The findings of the study assist government departments, local self-government institutions, and environmental organisations in formulating community-based mangrove conservation programmes and awareness initiatives.
- The study helps social workers, non-governmental organisations, and community-based organisations in planning interventions that encourage public participation in mangrove conservation and environmental protection.
- The findings serve as baseline information for researchers, academicians, and students interested in the fields of environmental conservation, disaster management, community development, and sustainable natural resource management.
- The study contributes to the existing body of knowledge on community awareness and socio-environmental aspects of mangrove conservation and provides direction for future research in similar ecological settings.

- The recommendations of the study support the development of policies and strategies that promote sustainable mangrove conservation through active community involvement.

CHAPTER IV: DATA ANALYSIS

4.1 Introduction

This chapter presents the analysis and interpretation of the data collected from 60 respondents for the study titled "Community Awareness and Socio-Environmental Barriers in Mangrove Conservation in Kollam, Kerala." The analysis was carried out using the Statistical Package for the Social Sciences (SPSS version 22). The findings are presented in the form of tables, cross-tabulations, figures, frequencies, percentages, and graphical representations to facilitate a clear understanding of the data.

The chapter is organised according to the objectives of the study. It begins with the demographic profile of the respondents, followed by the analysis of their knowledge regarding mangrove conservation, attitudes towards mangrove conservation, socio-environmental barriers affecting conservation, and willingness to participate in future mangrove conservation activities. Cross-tabulations are also presented to examine the relationship between demographic characteristics and key study variables, as well as the association between knowledge, attitude, and willingness to participate in conservation activities.

4.2 Demographic details

DEMOGRAPHIC DETAILS		FREQUENCY	PERCENTAGE
GENDER	Female	23	38.3
	Male	37	61.7
EDUCATIONAL QUALIFICATION	No formal education	1	1.7
	Primary Education	19	31.7
	High School	13	21.7
	Higher Secondary	12	20
	ITI/Diploma	2	3.3
	Graduation	12	20
	Post-Graduation and above	1	1.7
OCCUPATION	Fishing	4	6.7
	Agriculture	2	3.3

	Daily wage labour	16	26.7
	Private job	12	20
	Government job	2	3.3
	Self-employed	4	6.7
	Boating	5	8.3
	Housewife	13	21.7
	Student	2	3.3
TYPE OF RESIDENCE	Own house	51	85
	Rented	9	15

Table 1: Demographic Details

Table 1 presents the demographic characteristics of the respondents who participated in the study. Out of the total 60 respondents, 37 (61.7%) were male and 23 (38.3%) were female. This indicates that males constituted the majority of the study sample.

Analysis of educational attainment reveals that a considerable proportion of respondents (31.7%) had completed primary education, followed by those with high school education (21.7%). Respondents with higher secondary education and graduation each accounted for 20% of the sample. A relatively small proportion possessed ITI/Diploma qualifications (3.3%), while only 1.7% had no formal education, and another 1.7% had attained post-graduation or above. These findings suggest that the majority of respondents had attained basic to intermediate levels of formal education.

The occupational profile reveals that daily wage labour was the most common occupation among the respondents, accounting for 26.7% of the sample. This was followed by housewives (21.7%) and respondents employed in private sector jobs (20%). Boating-related occupations represented 8.3% of the respondents, while fishing and self-employment each accounted for 6.7%. Agriculture, government employment, and student respondents each constituted 3.3% of the sample. The occupational distribution reflects the predominance of livelihood-oriented and informal sector occupations within the study area.

Regarding residential status, the majority of respondents (85%) reported living in their own houses, whereas 15% resided in rented accommodation. This indicates a high level of residential stability among the participants.

The demographic profile of the respondents indicates that the study population was predominantly male, possessed varying levels of educational attainment with a concentration in primary and secondary education, and was largely engaged in daily wage labour and other livelihood-based occupations. Furthermore, most respondents resided in self-owned houses. These demographic characteristics provide an important contextual background for understanding community awareness, perceptions, and participation related to mangrove conservation in the study area.

4.3 Knowledge about mangroves

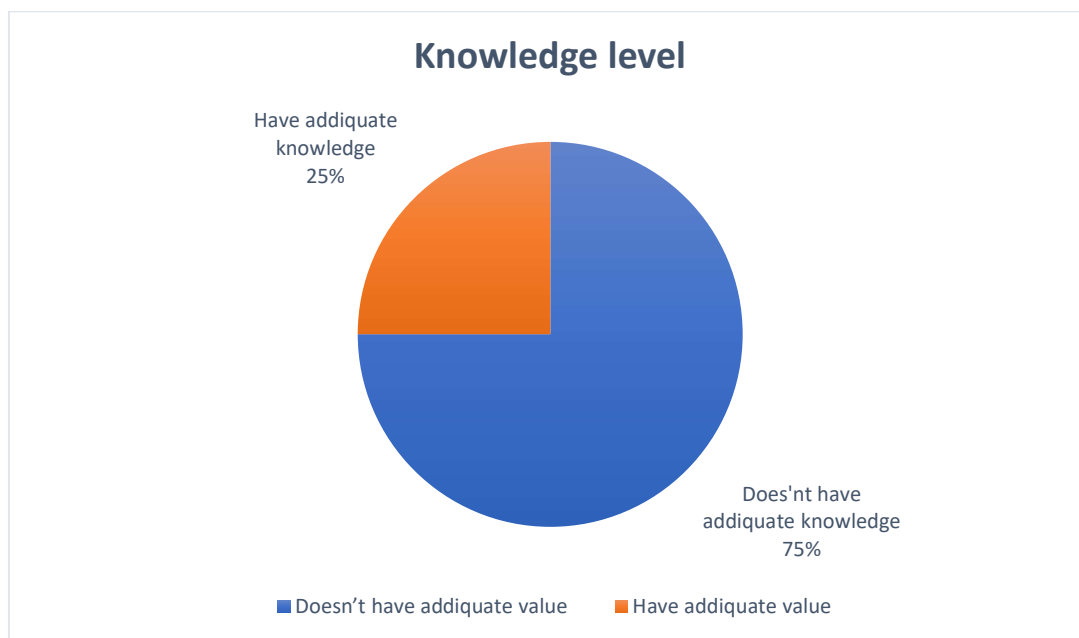


Figure 1: Knowledge Level

Figure 1 illustrates the respondents' level of knowledge regarding mangroves. The findings reveal that 77% of the respondents do not possess adequate knowledge about mangroves, whereas only 23% reported having adequate knowledge. This indicates that the overall level of awareness and understanding of mangrove ecosystems among the study population is relatively

low. The predominance of inadequate knowledge suggests that many respondents may not be fully aware of the ecological importance and conservation significance of mangroves. Therefore, the findings highlight the need for awareness and educational programmes to improve community knowledge and encourage active participation in mangrove conservation efforts.

CROSS-TAB TABLE - 1

DEMOGRAPHIC PROFILE		KNOWLEDGE LEVEL	
		Doesn't have adequate knowledge	Have adequate knowledge
Gender	Female	37.80%	40.00%
	Count	17	6
	Male	62.20%	60.00%
	Count	28	9
Educational qualification	No formal education	2.20%	0.00%
	Count	1	0
	Primary education	31.10%	33.30%
	Count	14	5
	High school	20.00%	26.70%
	Count	9	4
	Higher secondary	15.60%	33.30%
	Count	7	5
	ITI/Diploma	4.40%	0.00%
	Count	2	0
	Graduation	24.40%	6.70%
	Count	11	1
	Post-Graduation	2.20%	0.00%
	Count	1	0
Occupation	Fishing	6.70%	6.70%
	Count	3	1

	Agriculture	2.20%	6.70%
	Count	1	1
	Daily wage labour	31.10%	13.30%
	Count	14	2
	Private job	24.40%	6.70%
	Count	11	1
	Government job	4.40%	0.00%
	Count	2	0
	Self-employed	4.40%	13.30%
	Count	2	2
	Boating	6.70%	13.30%
	Count	3	2
	Housewife	15.60%	40.00%
	Count	7	6
	Student	4.40%	0.00%
	Count	2	0

Table 2: Cross-tab Table of Knowledge Level and Demographic Profile

Table 2 presents the cross-tabulation of respondents' knowledge level regarding mangroves with selected demographic variables, namely gender, educational qualification, and occupation.

With regard to gender, the findings indicate that males constituted a higher proportion of the respondents in both knowledge categories. Among respondents with inadequate knowledge, 62.2% were male and 37.8% were female. Similarly, among those with adequate knowledge, 60.0% were male, and 40.0% were female. This suggests that knowledge levels about mangroves were relatively similar across genders, although males represented a larger share of the study population.

In terms of educational qualification, respondents with primary education formed the largest proportion among both those with inadequate knowledge (31.1%) and those with adequate knowledge (33.3%). Respondents with higher secondary education also accounted for a

considerable proportion of those possessing adequate knowledge (33.3%), compared to 15.6% among those with inadequate knowledge. Conversely, respondents with graduation-level education represented 24.4% of those with inadequate knowledge but only 6.7% of those with adequate knowledge. The results indicate that knowledge about mangroves does not consistently increase with higher educational attainment, suggesting that factors other than formal education may influence awareness levels.

Regarding occupation, respondents engaged in daily wage labour constituted the largest proportion of those with inadequate knowledge (31.1%), followed by those employed in private jobs (24.4%). Among respondents with adequate knowledge, housewives represented the highest proportion (40.0%), followed by self-employed individuals and those involved in boating (13.3% each). Respondents engaged in fishing accounted for 6.7% in both knowledge categories. These findings suggest that knowledge regarding mangroves varies across occupational groups, possibly reflecting differences in exposure to environmental information and interactions with coastal ecosystems.

The cross-tabulation indicates variations in knowledge levels across gender, educational qualification, and occupation. However, the majority of respondents across most demographic categories were found to possess inadequate knowledge about mangroves, highlighting the need for awareness and educational initiatives targeting different sections of the community to promote mangrove conservation.

4.4 Attitude towards mangrove conservation

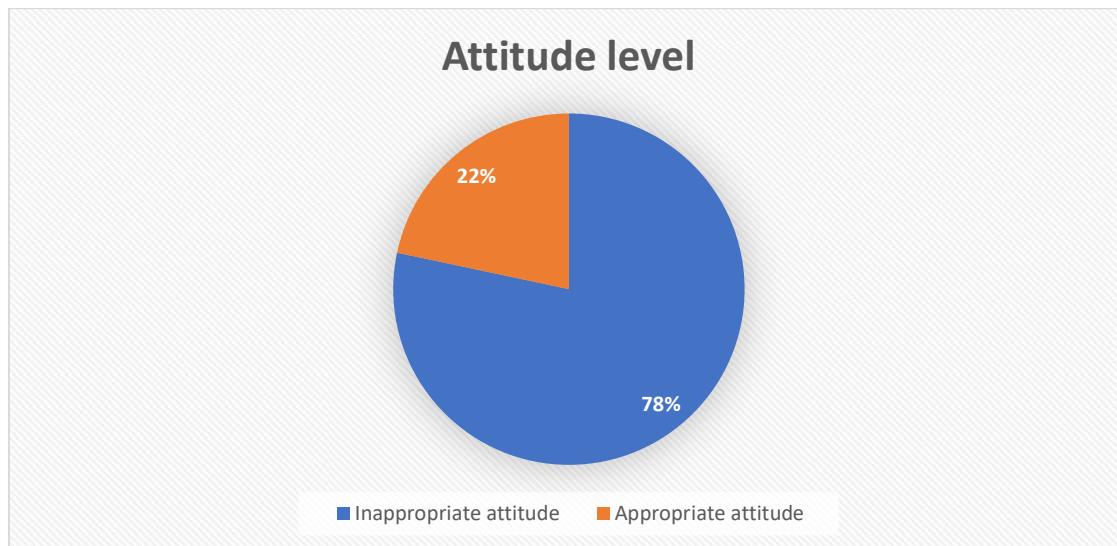


Figure 2: Attitude level

Figure 2 presents the attitude level of respondents towards mangrove conservation. The findings reveal that 78% of the respondents exhibit an inappropriate attitude, whereas only 22% demonstrate an appropriate attitude towards mangrove conservation.

The predominance of inappropriate attitudes indicates that a large proportion of the respondents may not fully recognise the importance of mangrove ecosystems and their conservation. Such attitudes may negatively influence support for conservation initiatives and reduce community participation in activities aimed at protecting and restoring mangrove habitats. On the other hand, the relatively small proportion of respondents with an appropriate attitude suggests that positive perceptions towards mangrove conservation are limited within the study area.

These findings highlight the need for awareness and educational interventions to foster positive attitudes towards mangrove conservation. Enhancing community understanding of the ecological, economic, and social benefits of mangroves may contribute to the development of more favourable attitudes and greater involvement in conservation efforts. Overall, the results suggest that the attitude of the respondents towards mangrove conservation is generally unfavourable, emphasising the importance of attitude-oriented conservation and awareness programmes in the study area.

CROSS-TAB TABLE – 2

DEMOGRAPHIC PROFILE		ATTITUDELEVEL	
		Inappropriate attitude	Appropriate attitude
Gender	Female	31.90%	61.50%
	Count	15	8
	Male	68.10%	38.50%
	Count	32	5
Educational qualification	No formal education	0.00%	7.70%
	Count	0	1
	Primary education	27.70%	46.20%
	Count	13	6
	High school	25.50%	7.70%
	Count	12	1
	Higher secondary	21.30%	15.40%
	Count	10	2
	ITI/Diploma	4.30%	0.00%
	Count	2	0
	Graduation	21.30%	15.40%
	Count	10	2
	Post-Graduation	0.00%	7.70%
	Count	0	1
Occupation	Fishing	0.00%	30.80%
	Count	0	4
	Agriculture	2.10%	7.70%
	Count	1	1
	Daily wage labour	31.90%	7.70%
	Count	15	1
	Private job	19.10%	23,1%

	Count	9	3
	Government job	4.40%	0.00%
	Count	2	0
	Self-employed	8.50%	0.00%
	Count	4	0
	Boating	10.60%	0.00%
	Count	5	0
	Housewife	21.30%	23.10%
	Count	10	3
	Student	2.10%	7.70%
	Count	1	1

Table 3: Cross-tab table of demographic profile and attitude level

Table 3 presents the association between respondents' attitude levels and selected demographic characteristics. The findings indicate that females exhibited a higher proportion of appropriate attitude (61.5%) compared to males (38.5%), whereas inappropriate attitude was more prevalent among males (68.1%). With respect to educational qualification, respondents with primary education constituted the largest proportion of those with appropriate attitude (46.2%), followed by those with higher secondary education and graduation (15.4% each). In contrast, inappropriate attitude was predominantly observed among respondents with primary education (27.7%) and high school education (25.5%). Regarding occupation, respondents engaged in fishing accounted for the highest proportion of appropriate attitude (30.8%), followed by private employees and housewives (23.1% each). Conversely, inappropriate attitude was highest among daily wage labourers (31.9%), followed by housewives (21.3%) and private employees (19.1%). These findings suggest that attitude towards mangrove conservation varied across demographic groups, with females, fishers, and relatively educated respondents demonstrating more favourable attitudes towards mangrove conservation.

4.5 Socio-environmental Barriers Affecting Mangrove Conservation

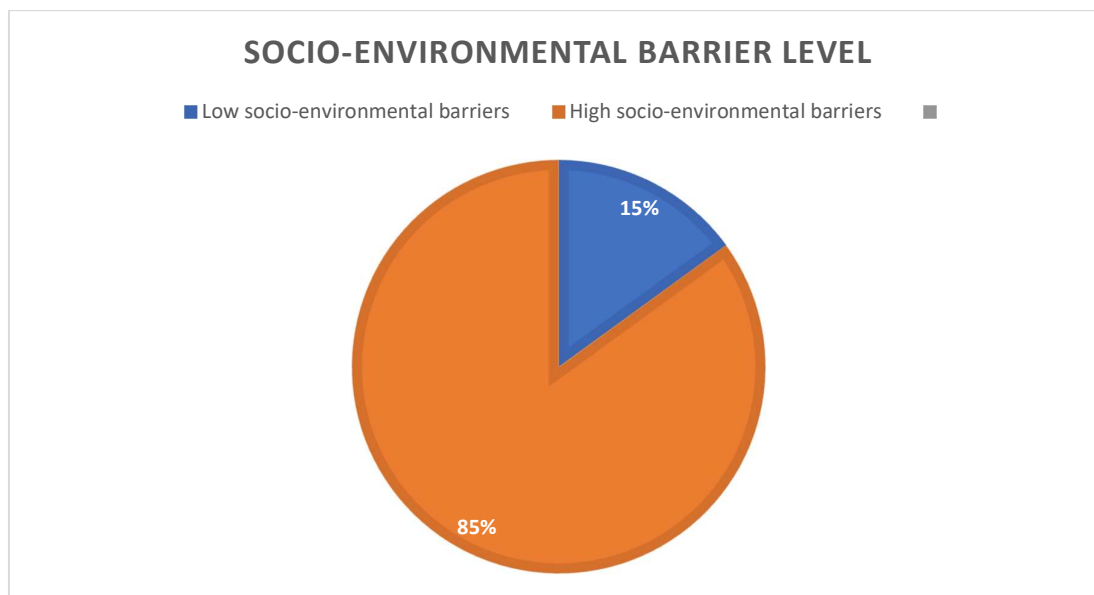


Figure 3: Socio-environmental barrier level

The pie chart illustrates the distribution of respondents based on their level of socio-environmental barriers in mangrove conservation. It is evident that a majority of the respondents (85%) experience high socio-environmental barriers, while only a small proportion (15%) reported low socio-environmental barriers. This indicates that most respondents face significant constraints, such as social, economic, institutional, or environmental challenges, that may hinder their participation in mangrove conservation activities. The dominance of high barrier levels suggests that socio-environmental factors strongly influence conservation efforts in the study area, highlighting the need for targeted interventions to reduce these barriers and promote effective community involvement in mangrove conservation.

CROSS-TAB TABLE 3

DEMOGRAPHIC PROFILE	SOCIO-ENVIRONMENTAL BARRIERS	

		Low socio-environmental barriers	High socio-environmental barriers
Gender	Female	66.70%	33.30%
	Count	6	17
	Male	33.30%	66.70%
	Count	3	34
Educational qualification	No formal education	11.10%	0.00%
	Count	1	0
	Primary education	44.40%	29.40%
	Count	4	15
	High school	11.10%	23.50%
	Count	1	12
	Higher secondary	0.00%	23.50%
	Count	0	12
	ITI/Diploma	0.00%	3.90%
	Count	0	2
	Graduation	33.30%	17.60%
	Count	3	9
	Post-Graduation	0.00%	2.00%
	Count	0	1
Occupation	Fishing	11.10%	5.90%
	Count	1	3
	Agriculture	11.10%	20.00%
	Count	1	1
	Daily wage labour	33.30%	25.50%
	Count	3	13
	Private job	33.30%	17.60%
	Count	3	9
	Government job	0.00%	3.90%
	Count	0	2

	Self-employed	0.00%	7.80%
	Count	0	4
	Boating	0.00%	9.80%
	Count	0	5
	Housewife	0.00%	25.50%
	Count	0	13
	Student	11.10%	2.00%
	Count	1	1

Table 4: Cross-tab table of demographic profile and socio-environmental barriers

Table 4 presents the distribution of socio-environmental barriers across different demographic characteristics of the respondents, including gender, educational qualification, and occupation.

With regard to gender, the findings indicate that a higher proportion of males (66.7%) experienced high socio-environmental barriers compared to females (33.3%). Conversely, among respondents reporting low socio-environmental barriers, females constituted 66.7%, while males accounted for 33.3%. This suggests that male respondents perceived greater socio-environmental barriers to mangrove conservation than female respondents.

In terms of educational qualification, respondents with primary education represented the largest proportion of those experiencing high socio-environmental barriers (29.4%), followed by respondents with high school education (23.5%) and higher secondary education (23.5%). Among respondents reporting low socio-environmental barriers, the highest proportions were observed among those with primary education (44.4%) and graduation (33.3%). The findings indicate that perceptions of socio-environmental barriers vary across educational groups, although respondents with lower and middle levels of education constitute a substantial proportion of those reporting high barriers.

Regarding occupation, respondents engaged in daily wage labour accounted for the largest proportion of those experiencing high socio-environmental barriers (25.5%), followed by housewives (25.5%) and those employed in private jobs (17.6%). Among respondents reporting low socio-environmental barriers, daily wage labourers and private employees each

constituted 33.3%, while fishing and agriculture each accounted for 11.1%. Notably, all respondents engaged in government jobs, self-employment, boating, and housework were categorised under high socio-environmental barriers. This suggests that occupational differences may influence perceptions of barriers affecting mangrove conservation.

The findings reveal that high socio-environmental barriers were more prevalent among male respondents, individuals with primary to higher secondary levels of education, and respondents engaged in daily wage labour, housework, and private employment. The results indicate that socio-environmental barriers are perceived differently across demographic groups, highlighting the importance of considering demographic characteristics when designing community-based mangrove conservation programmes and awareness initiatives in the study area.

4.6 Willingness to participate in mangrove conservation activities

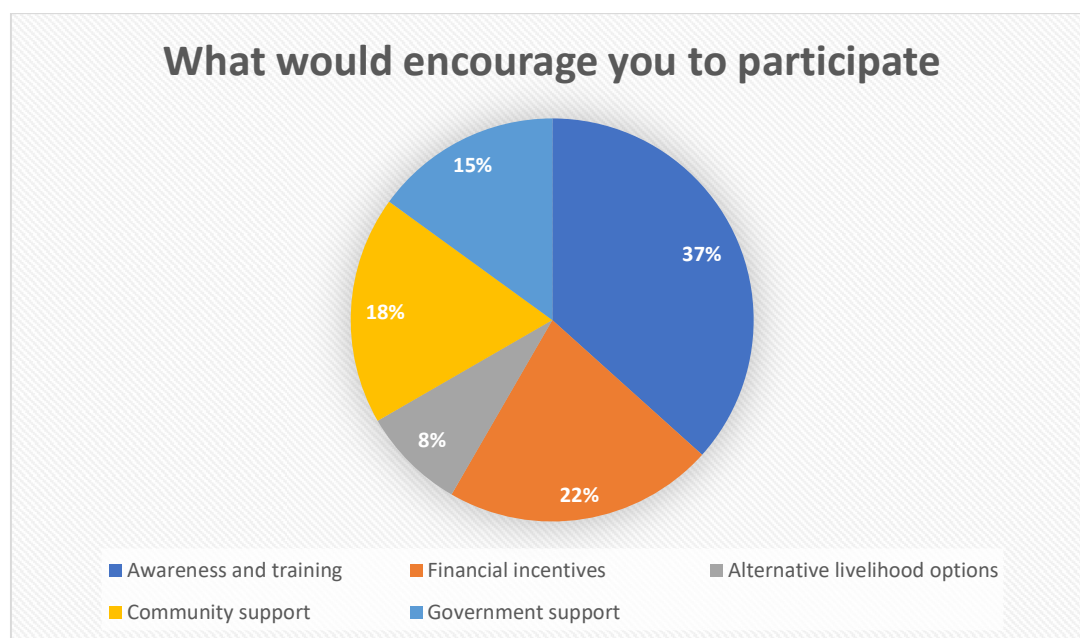


Figure 4: Factors encouraging participation in mangrove conservation activities

Figure 4 illustrates the factors that would encourage respondents to participate in mangrove conservation activities. The findings show that awareness and training (37%) was identified as the most important factor encouraging participation. This indicates that respondents believe

that gaining knowledge and practical skills related to mangrove conservation would increase their willingness to become involved in conservation initiatives.

The second most frequently cited factor was financial incentives (22%), suggesting that economic benefits or monetary support could motivate community members to participate in conservation activities. Community support (18%) was also identified as an important motivating factor, highlighting the role of collective action and local cooperation in promoting conservation efforts.

Furthermore, government support (15%) was reported as a factor that could encourage participation, indicating the importance of policy support, assistance programmes, and institutional involvement in conservation activities. The least preferred factor was alternative livelihood options (8%), although a small proportion of respondents still considered livelihood opportunities important for their participation in conservation initiatives.

The findings suggest that awareness and capacity-building programmes are the most effective means of enhancing community participation in mangrove conservation, followed by financial assistance and community support. The results emphasize the need for educational interventions, training programmes, and supportive community and government initiatives to strengthen public involvement in mangrove conservation efforts in the study area.

WILLINGNESS TO PARTICIPATE		FREQUENCY	PERCENTAGE
STRICT RULES	Yes	26	43.3
	No	5	8.3
	Not sure	29	48.3
INFLUENCE OF AWARENESS	Strongly Disagree	30	50
	Disagree	2	3.3
	Neutral	0	0
	Agree	20	33.3

	Strongly Agree	8	13.3
INFLUENCE OF TRAINING PROGRAMME	Yes	26	43.3
	No	5	8.3
	Maybe	29	48.3
PRESENCE OF LOCAL GROUP OR ASSOCIATION	Yes	18	30
	No	5	8.3
	Not sure	37	61.7
AWARENESS CAMPAIGNS CAN CHANGE HARMFUL PRACTICES	Strongly Disagree	0	0
	Disagree	1	1.7
	Neutral	6	10
	Agree	35	58.3
	Strongly Agree	18	30

Table 5: Willingness to participate in mangrove conservation activities

Table 5 presents the respondents' willingness to participate in mangrove conservation activities based on various influencing factors.

Regarding the implementation of strict rules for mangrove conservation, 48.3% of the respondents were not sure whether strict regulations would encourage their participation, while 43.3% believed that strict rules would encourage participation. Only 8.3% of the respondents reported that strict rules would not encourage them. This indicates that although many respondents recognize the potential role of regulations, a considerable proportion remain uncertain about their effectiveness in promoting community participation.

With respect to the influence of awareness on participation, 50% of the respondents strongly disagreed that their willingness to participate is influenced by awareness, while 33.3% agreed and 13.3% strongly agreed. A small proportion (3.3%) disagreed. These findings suggest that respondents hold mixed opinions regarding the role of awareness in motivating participation,

with half of the respondents expressing that awareness alone may not be sufficient to encourage their involvement in mangrove conservation activities.

Concerning the influence of training programmes, 48.3% of the respondents indicated "Maybe", while 43.3% responded "Yes", and 8.3% responded "No." This finding suggests that training programmes have the potential to encourage community participation, although many respondents remain uncertain about their effectiveness.

Regarding the presence of local groups or associations involved in mangrove conservation, 61.7% of the respondents were not sure whether such groups existed in their locality. Only 30% reported the presence of local conservation groups, while 8.3% stated that no such groups existed. This indicates limited public awareness regarding community organisations engaged in mangrove conservation and suggests the need to strengthen local institutional visibility and participation.

Finally, with regard to whether awareness campaigns can change harmful practices affecting mangroves, the majority of respondents expressed positive opinions. More than half (58.3%) agreed, while 30% strongly agreed that awareness campaigns can bring about positive behavioural changes. Only 1.7% disagreed, and 10% remained neutral. These findings demonstrate a strong belief among respondents that awareness campaigns are an effective strategy for reducing harmful practices and promoting mangrove conservation.

The findings indicate that respondents show a moderate level of willingness to participate in mangrove conservation activities. Although uncertainty exists regarding the effectiveness of strict regulations, training programmes, and the presence of local conservation groups, the majority of respondents believe that awareness campaigns can positively influence community behaviour. These results highlight the importance of strengthening awareness programmes, capacity-building initiatives, and community-based organisations to enhance public participation in mangrove conservation within the study area.

CROSS TAB TABLE - 4

4.6.1 Willingness to participate in conservation activities – knowledge level

Willing to participate in future mangrove conservation activities	KNOWLEDGE LEVEL	
	Doesn't have adequate knowledge	Have adequate knowledge
Yes	28.9%	13.3%
No	8.9%	13.3%
Maybe	62.2%	73.3%
Total	100.0%	100.0%

Table 6: Cross-tabulation of Knowledge Level and Willingness to Participate in Future Mangrove Conservation Activities

Table 6 presents the association between respondents' knowledge level and their willingness to participate in future mangrove conservation activities.

Among respondents who do not have adequate knowledge about mangroves, 62.2% reported that they may be willing to participate in future conservation activities, 28.9% expressed willingness to participate, while 8.9% were unwilling to participate. Similarly, among respondents who have adequate knowledge, the majority (73.3%) indicated that they may be willing to participate, whereas 13.3% expressed willingness to participate and 13.3% reported that they were not willing to participate.

The findings indicate that, irrespective of their level of knowledge, the majority of respondents were uncertain about participating in future mangrove conservation activities, as reflected by the high proportion selecting "Maybe." Although respondents with adequate knowledge showed a slightly higher level of uncertainty (73.3%) compared to those with inadequate knowledge (62.2%), respondents with inadequate knowledge reported a comparatively higher proportion of definite willingness to participate (28.9% compared to 13.3%).

The results suggest that knowledge alone may not be sufficient to influence respondents' willingness to participate in future mangrove conservation activities. Other factors, such as

awareness programmes, training opportunities, community support, and institutional encouragement, may play an important role in motivating active participation. These findings highlight the need for comprehensive community engagement strategies that combine knowledge enhancement with practical opportunities for involvement in mangrove conservation.

CROSS TAB TABLE -5

4.6.1 Willingness to participate in conservation activities – Attitude level

Willing to participate in future mangrove conservation activities	ATTITUDE LEVEL	
	Inappropriate attitude	Appropriate attitude
Yes	19.1%	46.2%
No	10.6%	7.7%
Maybe	70.2%	46.2%
Total	100.0%	100.0%

Table 7: Cross-tabulation of Attitude Level and Willingness to Participate in Future Mangrove Conservation Activities

Table 7 presents the association between respondents' attitudes towards mangrove conservation and their willingness to participate in future mangrove conservation activities.

Among respondents with an inappropriate attitude, the majority (70.2%) indicated that they may be willing to participate in future mangrove conservation activities. In contrast, 19.1% expressed a definite willingness to participate, while 10.6% reported that they were not willing to participate.

Among respondents with an appropriate attitude, an equal proportion (46.2%) stated that they were willing to participate and may be willing to participate in future mangrove conservation activities, whereas only 7.7% indicated that they were not willing to participate.

The findings suggest that respondents with an appropriate attitude towards mangrove conservation demonstrate a greater level of definite willingness to participate in future conservation activities compared to those with an inappropriate attitude. However, a considerable proportion of respondents in both attitude groups selected "Maybe," indicating some degree of uncertainty regarding their future participation.

The results indicate that a more positive attitude towards mangrove conservation is associated with a higher willingness to participate in future conservation activities. Nevertheless, the high proportion of respondents expressing uncertainty highlights the need for targeted awareness programmes, community engagement initiatives, and motivational interventions to encourage active participation in mangrove conservation efforts.

CHAPTER V:
FINDINGS, SUGGESTIONS &
CONCLUSION

5.1 Introduction

This chapter presents the major findings, suggestions, and conclusions of the study on "Community Awareness and Socio-Environmental Barriers in Mangrove Conservation in Kollam, Kerala." The chapter is based on the analysis and interpretation of data collected from 60 respondents through descriptive statistics and cross-tabulation. The major findings are presented thematically in accordance with the objectives of the study, highlighting the respondents' demographic characteristics, level of knowledge and attitudes towards mangrove conservation, socio-environmental barriers, willingness to participate in conservation activities, and the relationship between awareness and participation. Based on these findings, practical suggestions are proposed to enhance community awareness, strengthen public participation, and improve institutional support for mangrove conservation. The chapter concludes by summarising the key outcomes of the study and emphasizing the importance of collaborative and community-based approaches for the sustainable conservation and management of mangrove ecosystems in Kollam district.

5.2 Findings

The study was conducted to assess the level of community awareness about mangroves and to identify the socio-environmental barriers affecting mangrove conservation in Kollam district. The findings presented in this section are derived from the analysis of data collected from 60 respondents using descriptive statistics and cross-tabulation. The findings have been organised into thematic areas based on the objectives of the study to provide a comprehensive understanding of the respondents' demographic characteristics, knowledge, attitudes, socio-environmental barriers, willingness to participate in conservation activities, and the relationship between awareness and participation.

5.2.1 Demographic Characteristics of the Respondents

The study revealed that the respondents represented diverse demographic backgrounds, providing a broad understanding of community perspectives on mangrove conservation. The majority of the respondents were male (61.7%), while females constituted 38.3% of the sample. Most respondents had attained primary education (31.7%), followed by high school education

(21.7%), while only a few had no formal education or postgraduate qualifications. Occupationally, daily wage labourers formed the largest group (26.7%), followed by housewives (21.7%) and private employees (20%). Furthermore, a large majority of the respondents (85%) lived in their own houses, indicating a relatively stable residential population. These demographic characteristics suggest that the study predominantly represents long-term local residents whose livelihoods and living conditions may influence their perceptions of mangrove conservation.

5.2.2 Community Knowledge and Awareness of Mangroves

The findings indicate that community knowledge regarding mangroves was generally inadequate. More than three-fourths of the respondents (77%) lacked adequate knowledge about mangroves, while only 23% demonstrated adequate knowledge. Cross-tabulation analysis further showed that inadequate knowledge was common across all demographic categories, regardless of gender, education, or occupation. Interestingly, higher educational attainment did not necessarily correspond with better knowledge of mangroves, suggesting that formal education alone does not guarantee environmental awareness. These findings highlight a significant knowledge gap within the community and indicate the need for targeted environmental education and awareness programmes.

5.2.3 Community Attitudes Towards Mangrove Conservation

The study found that respondents generally exhibited unfavourable attitudes towards mangrove conservation. Nearly four-fifths of the respondents (78%) demonstrated an inappropriate attitude, while only 22% showed an appropriate attitude towards conservation. Female respondents were more likely to possess favourable attitudes than male respondents. Similarly, respondents engaged in fishing displayed comparatively more positive attitudes than those involved in other occupations. Although some educational groups demonstrated relatively better attitudes, inappropriate attitudes were predominant across most demographic categories. These findings suggest that positive perceptions towards mangrove conservation remain limited within the study area and that awareness alone may not be sufficient to foster positive environmental attitudes.

5.2.4 Socio-Environmental Barriers to Mangrove Conservation

The findings reveal that socio-environmental barriers are a major challenge to effective mangrove conservation in the study area. A substantial majority of respondents (85%) reported experiencing high socio-environmental barriers, while only 15% reported low barriers. Male respondents perceived greater barriers than females, and high barriers were particularly common among respondents with primary to higher secondary education and those engaged in daily wage labour, housework, and private employment. These findings indicate that various social, economic, and environmental constraints may restrict community participation in conservation activities, emphasizing the importance of addressing these barriers through inclusive and community-oriented conservation strategies.

5.2.5 Community Willingness to Participate in Mangrove Conservation

The findings indicate that respondents demonstrated a moderate level of willingness to participate in future mangrove conservation activities, although uncertainty remained high. Awareness and training programmes were identified as the strongest motivating factor for participation (37%), followed by financial incentives (22%), community support (18%), and government support (15%). Nearly half of the respondents (48.3%) were uncertain whether strict conservation rules or training programmes would encourage their participation. Moreover, 61.7% were unsure about the existence of local conservation groups in their communities. However, a large majority believed that awareness campaigns could successfully change harmful practices affecting mangroves, with 58.3% agreeing and 30% strongly agreeing. These findings suggest that respondents recognise the importance of education and capacity building in promoting community participation.

5.2.6 Relationship Between Awareness, Attitude, and Willingness to Participate

The cross-tabulation analysis demonstrated that knowledge and attitude influence willingness to participate in mangrove conservation, although the relationship was not particularly strong. Respondents with both adequate and inadequate knowledge predominantly selected "Maybe" when asked about future participation, indicating uncertainty irrespective of knowledge level.

This suggests that knowledge alone may not be sufficient to encourage active involvement in conservation activities.

In contrast, respondents with appropriate attitudes towards mangrove conservation showed greater willingness to participate than those with inappropriate attitudes. Nearly half (46.2%) of respondents with appropriate attitudes expressed definite willingness to participate, compared to only 19.1% among those with inappropriate attitudes. Nevertheless, uncertainty regarding participation remained evident across both groups. These findings suggest that fostering positive attitudes, together with providing practical opportunities, awareness programmes, and institutional support, is likely to enhance community participation in mangrove conservation.

5.3 Suggestions

The suggestions presented in this section are based on the major findings of the study. They are intended to address the gaps identified in community awareness, attitudes, participation, and the socio-environmental barriers affecting mangrove conservation in Kollam district. These recommendations aim to strengthen community involvement, improve awareness and capacity, and enhance institutional support for the sustainable conservation and management of mangrove ecosystems.

5.3.1 Community Awareness and Capacity Building

- Conduct regular awareness programmes on the ecological, economic, and disaster risk reduction benefits of mangroves.
- Organise workshops, seminars, and training programmes to improve community knowledge about mangrove conservation.
- Introduce environmental education on mangrove ecosystems in schools and colleges to promote awareness among younger generations.
- Develop educational materials such as pamphlets, posters, videos, and social media campaigns in the local language to reach a wider audience.
- Celebrate environmental events such as Mangrove Day and Environment Day through community-based awareness activities.

- Encourage local media to disseminate information on the importance of mangrove conservation and sustainable environmental practices.

5.3.2 Strengthening Community Participation and Conservation Initiatives

- Promote community-based mangrove plantation and restoration programmes with active participation from local residents.
- Encourage the formation and strengthening of local mangrove conservation committees and volunteer groups.
- Involve local self-government institutions, community-based organizations, and non-governmental organizations in planning and implementing conservation activities.
- Provide skill development and training programmes that enable community members to actively participate in conservation and restoration efforts.
- Recognize and appreciate individuals and community groups who actively contribute to mangrove conservation to encourage wider participation.
- Create opportunities for youth clubs, women's groups, fishermen's associations, and educational institutions to participate in conservation programmes.

5.3.3 Policy and Institutional Support

- Strengthen the implementation of existing environmental laws to prevent illegal cutting, land reclamation, and encroachment of mangrove areas.
- Improve coordination among government departments, local self-government institutions, environmental organisations, and local communities for effective mangrove management.
- Allocate adequate financial and technical support for community-based mangrove conservation projects.
- Develop sustainable livelihood opportunities, such as eco-tourism and environmentally friendly income-generating activities, to reduce pressure on mangrove ecosystems.
- Establish regular monitoring and evaluation mechanisms to assess the effectiveness of mangrove conservation programmes.

- Encourage further research on mangrove conservation in different regions of Kerala to support evidence-based planning and policy development.

5.4 Conclusion

Mangrove ecosystems are invaluable natural resources that contribute significantly to biodiversity conservation, coastal protection, disaster risk reduction, climate regulation, and the livelihoods of coastal communities. Despite their ecological and socio-economic importance, these ecosystems continue to face increasing threats from human activities and environmental degradation. As highlighted throughout this study, the success of mangrove conservation depends not only on ecological interventions but also on the awareness, attitudes, participation, and collective efforts of local communities.

The study was undertaken to understand the level of community awareness about mangroves and to identify the socio-environmental barriers affecting mangrove conservation in Munroe Island, Kollam district. The study also examined the knowledge, attitudes, and practices of local residents and explored the relationship between awareness and willingness to participate in conservation activities, in line with its stated objectives.

The findings revealed that the majority of respondents possessed inadequate knowledge about mangrove ecosystems and exhibited inappropriate attitudes towards their conservation. Although respondents recognised the value of awareness programmes and acknowledged the importance of community participation, many remained uncertain about actively engaging in future conservation initiatives. The study further identified high socio-environmental barriers, indicating that environmental awareness alone is insufficient to promote conservation behaviour unless supported by favourable social, institutional, and environmental conditions.

The cross-tabulation analysis also showed that knowledge alone did not consistently translate into willingness to participate in conservation activities. Respondents with more positive attitudes were comparatively more willing to participate, suggesting that attitude, motivation, institutional support, and opportunities for involvement are important factors influencing community participation. These findings reinforce the need for integrated conservation

approaches that combine environmental education with practical community engagement and supportive institutional mechanisms.

From a social work perspective, the study highlights the importance of community-based environmental conservation. Social workers can play a significant role in promoting environmental awareness, mobilising community participation, facilitating collaboration among stakeholders, and advocating for sustainable natural resource management. Strengthening partnerships between local communities, government agencies, educational institutions, and non-governmental organisations will be essential for addressing the socio-environmental barriers identified in this study and for ensuring the long-term protection of mangrove ecosystems.

This study contributes to the limited body of research on community awareness and socio-environmental barriers affecting mangrove conservation. The findings provide valuable insights for policymakers, environmental organisations, social work practitioners, and researchers in designing community-oriented conservation programmes and sustainable management strategies. By enhancing community awareness, fostering positive attitudes, reducing socio-environmental barriers, and creating meaningful opportunities for participation, it is possible to strengthen mangrove conservation efforts and ensure the sustainable management of these vital ecosystems for present and future generations.

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ANNEXURE I: TOOL FOR DATA COLLECTION

1. SOCIO-DEMOGRAPHIC PROFILE

1.1 Age

1.2 Gender

- Female
- Male
- Other

1.3. Educational qualification

- No formal education
- Primary Education
- High School
- Higher Secondary
- ITI / Diploma
- Graduation
- Post-Graduation and above

1.4. Occupation

- Fishing
- Agriculture
- Daily wage labour
- Private job
- Government job
- Self-employed
- Boating
- Housewife
- Student

- Other

1.5. Monthly household income

1.6. Type of residence

- Own house
- Rented
- Other

1.7. Distance of your house from the mangrove area

2. KNOWLEDGE ABOUT MANGROVES

2.1 Have you heard about mangroves?

- Yes
- No

2.2. Can you identify mangrove plant species?

- Yes
- No

2.3. Are there any benefits of mangroves?

- Yes
- No

2.4. If yes, what are the benefits of mangroves?

- Reduce soil erosion / Coastal Erosion
- Provide habitat for fish, crabs, and birds
- Improve water quality
- Support livelihoods (Fishing / Tourism)

- Act as natural barriers against cyclones / Storms
- All of the above

2.5. Do mangroves help reduce soil erosion and coastal erosion in your area?

- Strongly Agree
- Agree
- Neutral
- Disagree
- Strongly Disagree

2.6. Do mangroves provide habitat for fish, crabs, and birds?

- Strongly Agree
- Agree
- Neutral
- Disagree
- Strongly Disagree

2.7. Do mangroves support local livelihoods?

- Yes
- No

2.8. If yes, how do mangroves support local livelihood?

2.9. Do mangroves help improve water quality?

- Strongly Agree
- Agree
- Neutral
- Disagree
- Strongly Disagree

2.10. Do mangroves act as natural barriers against cyclones and storms?

- Strongly Agree
- Agree
- Neutral
- Disagree
- Strongly Disagree

2.11. Do mangroves help in protecting coastal areas from floods and erosion?

- Strongly Agree
- Agree
- Neutral
- Disagree
- Strongly Disagree

2.12. Do mangroves provide breeding grounds for fish and other marine life?

- Strongly Agree
- Agree
- Neutral
- Disagree
- Strongly Disagree

2.13. In what ways do mangroves support local livelihoods?

- Fishing
- Fuelwood
- Tourism
- Other

2.14 Mangroves help reduce the impact of cyclones and storms

- Strongly Agree

- Agree
- Neutral
- Disagree
- Strongly Disagree

2.15. Which of the following are threats to mangroves?

- Land reclamation
- Aquaculture
- Pollution
- Development Project
- Cutting for fuelwood
- Don't know
- Other:

2.16. Can cutting mangroves affect fish availability?

- Yes
- No
- Not sure

2.17. Do mangroves help protect land during heavy rains?

- Yes
- No
- Not sure

2.18. Are mangroves protected by law?

- Yes
- No
- Not sure

2.19. If yes, what are the provisions to protect mangroves?

- Restricting cutting and destruction of mangrove trees
- Declaring mangrove areas as protected or eco-sensitive zones
- Regulating coastal development and land reclamation
- Promoting mangrove conservation and restoration programmes
- All of the above

2.20. Do mangroves help reduce climate change effects?

- Yes
- No
- Not sure

2.21. Do you know where mangroves grow naturally?

- Yes
- No

3. ATTITUDES TOWARDS MANGROVE CONSERVATION

3.1. Mangroves are important for coastal protection

- Strongly Agree
- Agree
- Neutral
- Disagree
- Strongly Disagree

3.2. Mangrove conservation is important for the future of this community

- Strongly Agree
- Agree
- Neutral
- Disagree
- Strongly Disagree

3.3. Protecting mangroves should be a responsibility of the local community.

Do you think mangrove conservation should be a priority for coastal communities?

- Strongly Agree
- Agree
- Neutral
- Disagree
- Strongly Disagree

3.4. Would you support government initiatives to protect mangrove forests?

- Strongly Support
- Support
- Neutral
- Oppose
- Strongly Oppose

3.5. Development activities should be restricted in mangrove areas

- Strongly Agree
- Agree
- Neutral
- Disagree
- Strongly Disagree

3.6. Loss of mangroves will increase flood and environmental risks

- Strongly Agree
- Agree
- Neutral
- Disagree
- Strongly Disagree

3.7. I feel personally responsible for protecting mangroves

- Strongly Agree
- Agree
- Neutral
- Disagree
- Strongly Disagree

3.8. Protecting mangroves is important for the community

- Strongly Agree
- Agree
- Neutral
- Disagree
- Strongly Disagree

3.9. Everyone in the community should help protect mangroves

- Strongly Agree
- Agree
- Neutral
- Disagree
- Strongly Disagree

3.10. Mangrove protection is more important than short-term profit

- Strongly Agree
- Agree
- Neutral
- Disagree
- Strongly Disagree

3.11. Children and youth should learn about mangroves

- Strongly Agree
- Agree
- Neutral
- Disagree
- Strongly Disagree

3.12. Mangroves are important for the future of our children

- Strongly Agree
- Agree
- Neutral
- Disagree
- Strongly Disagree

3.13. I feel proud when mangroves in my area are protected

- Strongly Agree
- Agree
- Neutral
- Disagree
- Strongly Disagree

4. PRACTICES RELATED TO MANGROVES

4.1. Have you ever participated in mangrove conservation activities?

- Yes
- No

4.2. If yes, what kind of activities?

- Mangrove planting
- Awareness programmes
- Cleaning activities

- Reporting illegal cutting
- Other

4.3. Do you or your family use mangrove resources (fuelwood, fish, etc.)?

- Regularly
- Occasionally
- Never

4.4. If yes, what type of mangrove resources do you or your family use?

- Fishing
- Crab collection
- Shrimp collection
- Fuelwood
- Shell collection
- Tourism
- Other

4.5. Do you report mangrove destruction to authorities?

- Yes
- No

4.6. If yes, to whom do you report mangrove destruction?

4.7. Have you ever helped in planting mangroves?

- Yes
- No

4.8. Do you avoid throwing garbage near mangroves?

- Always
- Sometimes

- Never

4.9. Have you encouraged others not to cut mangroves?

- Yes
- No

4.10. Do you follow rules related to mangrove protection?

- Yes
- No
- Not sure

4.11. Have you attended any meeting or programme on mangroves?

- Yes
- No

5. SOCIO-ENVIRONMENTAL BARRIERS TO CONSERVATION

5.1. What are the issues that make mangrove conservation difficult?

- Land ownership
- Waste dumping and pollution
- Lack of public awareness
- Weak law enforcement
- Other

5.2. Dependence on mangrove areas for livelihood prevents conservation

- Strongly Agree
- Agree
- Neutral
- Disagree
- Strongly Disagree

5.3. Pollution from waste dumping affects mangrove health

- Strongly Agree
- Agree
- Neutral
- Disagree
- Strongly Disagree

5.4. Government policies and enforcement are weak in protecting mangroves

- Strongly Agree
- Agree
- Neutral
- Disagree
- Strongly Disagree

5.5. There is a lack of awareness programmes on mangrove conservation

- Strongly Agree
- Agree
- Neutral
- Disagree
- Strongly Disagree

5.6. Community participation in conservation activities is low

- Strongly Agree
- Agree
- Neutral
- Disagree
- Strongly Disagree

5.7. People cut mangroves because they need money or work

- Strongly Agree
- Agree
- Neutral
- Disagree
- Strongly Disagree

5.8. Poor coordination between government and community affects conservation

- Strongly Agree
- Agree
- Neutral
- Disagree
- Strongly Disagree

5.9. Limited funding is a barrier to mangrove protection

- Strongly Agree
- Agree
- Neutral
- Disagree
- Strongly Disagree

5.10. Climate change (sea-level rise, salinity) is harming mangroves

- Strongly Agree
- Agree
- Neutral
- Disagree
- Strongly Disagree

6. WILLINGNESS TO PARTICIPATE IN CONSERVATION

6.1. Are you willing to participate in future mangrove conservation activities?

- Yes
- No
- Maybe

6.2. What would encourage you to participate?

- Awareness and training
- Financial incentives
- Alternative livelihood options
- Community support
- Government support

6.3. Would you support strict rules to protect mangrove areas?

- Yes
- No
- Not sure

6.4. Higher awareness about mangroves increases willingness to conserve them

- Strongly Agree
- Agree
- Neutral
- Disagree
- Strongly Disagree

6.5. Would training programs increase community participation in conservation?

- Yes
- No
- Maybe

6.6. Is there any local group or association to protect mangroves?

- Yes
- No
- Not sure

6.7. Would you participate if activities fit your free time?

- Yes
- No
- Maybe

6.8. Do you believe awareness campaigns can change harmful practices?

- Strongly Agree
- Agree
- Neutral
- Disagree
- Strongly Disagree

7. SUGGESTIONS

7.1. What suggestions do you have for improving mangrove conservation in your area?