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Environmental Governance and Resource Management in the Andaman and Nicobar Islands

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Abstract

This study looked at how well resource management and environmental governance worked in the biodiverse and environmentally delicate tropical archipelago known as the Andaman and Nicobar Islands. In order to evaluate governance structures, stakeholder participation, and resource status, a mixed-methods approach was used to gather data from interviews, focus groups, field observations, and secondary sources. Despite the vital relevance of traditional ecological knowledge, the results showed difficulties with interagency cooperation, policy enforcement, and community involvement. According to resource evaluations, there have been decreases in fish populations and forest cover, which have been made worse by the quick rise of tourism and its effects on the environment. The study emphasizes the necessity of inclusive, flexible governance structures that incorporate local expertise and promote cooperation between NGOs, communities, and the government. To maintain the islands' long-term ecological and socioeconomic resilience, such strategies are essential for striking a balance between conservation goals and sustainable development.

Keywords: Environmental governance, Resource management, Andaman and Nicobar Islands, Sustainable development, Traditional ecological knowledge, Community participation.

1. INTRODUCTION

A distinctive and ecologically delicate tropical archipelago, the Andaman and Nicobar Islands are situated in the Bay of Bengal and are distinguished by their varied ecosystems, abundant biodiversity, and advantageous geopolitical location. These islands are home to mangrove systems, lush forests, coral reefs, and delicate coastal habitats that support indigenous inhabitants' livelihoods and offer essential ecological functions. However, the sustainable management of natural resources in this area has been severely hampered by the fast changes in the environment, the rise in human activity, and the demands of development. In order to strike a balance between ecological preservation and economic growth, local people, government organizations, and other stakeholders engage in a complex interplay known as environmental governance in the Andaman and Nicobar Islands. Because of the islands' remote location and ecological vulnerability, customized governance frameworks that prioritize adaptive management, participatory decision-making, and the fusion of traditional knowledge with scientific methods are required. In order to protect the islands' biodiversity, lessen the effects of climate change, and guarantee the long-term welfare of the local and indigenous communities, effective resource management is essential. Strategies for sustainable governance must balance the conflicting needs of infrastructure development, forestry, tourism, and fisheries while maintaining the integrity of ecosystems. Examining governance structures and management techniques that support resilience and sustainability is crucial given the archipelago's susceptibility to environmental deterioration and outside influences. To do this, it is necessary to comprehend the socio-ecological dynamics of the islands, promote cooperative management, and put laws into place that match local socioeconomic ambitions with conservation objectives.

2. LITERATURE REVIEW

Kiruba-Sankar et al. (2021) investigated local perspectives and tactics for advancing sustainable management in the Andaman and Nicobar Islands' fisheries governance. Their study highlighted the necessity of adaptable governance structures and community involvement in order to strike a balance between ecological conservation and fishermen's livelihood needs. The study shed light on the difficulties in managing marine resources in an island ecosystem that is rich in biodiversity but also vulnerable.

Poti (2024) examined how environmental changes are impacting mangrove ecosystems on the small islands of the Indian Ocean, specifically the Andaman and Nicobar Islands. The study examined governance practices and social-ecological responses used by local communities to adjust to environmental stresses such as anthropogenic pressures and sea level rise. The results emphasized how crucial it is to combine formal governance systems with traditional knowledge in order to improve resilience.

Sridhar et al. (2020) discussed small island management techniques in a thorough case study of Smith Island in the North Andaman. Their study brought to light the issues of resource scarcity, biodiversity preservation, and the effects of climate change that island populations face in terms of sustainable development. The study recorded adaptive management techniques that integrated community involvement with scientific evaluations.

Khan (2024) gave a thorough rundown of the Andaman and Nicobar Islands' administrative and geopolitical features inside the larger framework of Indian states and territories. The study described the islands' strategic importance as well as the governance issues brought on by their isolation, ecological sensitivity, and heterogeneous populace.

Biswas (2024) examined the effects of tourism on the Andaman and Nicobar Islands' ecosystem. According to the study, growing tourist numbers have put stress on delicate ecosystems, such as forest regions and coral reefs. In order to reduce environmental damage and foster economic growth, it also covered the necessity of sustainable tourist regulations.

Farheen (2023) carried out a comparative analysis of academic and literary works about the Andaman & Nicobar Islands and Lakshadweep. This study highlighted the distinct identities and difficulties faced by the island populations by critically analyzing the representations of cultural narratives and environmental circumstances. Farheen's comparison of these two island regions exposed unique socio-environmental problems, highlighting the Andaman and Nicobar Islands' susceptibility to ecological deterioration and the significance of conserving their cultural legacy in the face of development pressures.

Kiruba-Sankar and Barman (2024) concentrated especially on using citizen science to manage coastal wetlands in the Andaman and Nicobar archipelago. Their study showed how involving local communities in scientific data collecting and monitoring can greatly improve environmental evaluations' coverage and accuracy. The study emphasized the two advantages of citizen science: enhancing the accessibility of data for decision-makers and enabling local people to actively manage their natural resources. However, Kiruba-Sankar and Barman also noted issues that would make such programs less sustainable in the long run, like uneven participation, inadequate training, and resource limitations. According to their findings, citizen science holds promise for filling in the gaps in environmental governance, but it also necessitates significant institutional backing and capacity-building initiatives.

Sriniwas, Singh, and Ranabhat (2024) from the viewpoint of the local populace. According to their research, tourism has boosted economic growth and produced job possibilities, but it has also resulted in environmental damage, cultural upheaval, and greater strain on local infrastructure. Concerns regarding unsustainable tourism practices, like garbage production, habitat disruption, and excessive use of natural resources, were voiced by locals. The writers underlined the necessity of integrated tourism policies that strike a balance between social justice, environmental preservation, and economic gains. Their efforts shown how crucial it is to include local stakeholders in planning and management in order to guarantee that tourism growth promotes the islands' long-term viability.

Chakraborty and Prasad (2024) analyzed the changes in land cover and land use in the Baratang Group of Islands, which is a part of the Andaman and Nicobar archipelago, in great depth both spatially and chronologically. Their study used remote sensing data to show that the terrain has changed significantly in recent decades, mostly as a result of human activities including infrastructure development, agricultural, and settlement growth. As a result of these changes, ecosystems are now more susceptible to outside pressures, habitat fragmentation has occurred, and forest cover has decreased. The work of Chakraborty and Prasad made clear how important it is to plan land use and implement stringent regulations in order to reduce environmental effects and protect the islands' biodiversity hotspots.

PROPOSED METHOD

Investigating the frameworks and efficacy of resource management and environmental governance in the Andaman and Nicobar Islands was the goal of this study. To obtain a thorough understanding of stakeholder responsibilities, policy implementation, and resource sustainability issues, a mixed-methods approach was used. In order to examine governance frameworks and resource management strategies across a range of industries, including forestry, tourism, and fisheries, the study integrated qualitative and quantitative data collection methods.

3. Research Design

The current governance structures and resource management techniques were methodically documented using a descriptive and exploratory study design. Understanding the intricate relationships between institutional, social, and ecological elements affecting sustainable management on the islands was made easier by this approach.

3.1 Data Collection

Primary Data

Semi-structured interviews and focus groups with important stakeholders, such as local community leaders, government representatives, fishermen, environmental NGOs, and tourism operators, were used to gather primary data. The purpose of the interviews was to gather opinions on the efficiency of governance, resource usage patterns, and difficulties encountered in environmental management.

Selected locations were subjected to field observations in order to evaluate resource usage patterns and the practical use of conservation measures. Local communities were engaged and their perspectives on traditional knowledge and resource dependency were gathered through the use of participatory rural appraisal (PRA) instruments.

Secondary Data

Official government papers, policy documents, scholarly articles, and management plans pertaining to the environmental governance of the Andaman and Nicobar Islands were the sources of secondary data. These data sources helped pinpoint institutional structures and policy inadequacies while also provide a contextual backdrop.

3.2 Sampling

Participants with pertinent knowledge and experience in island government and resource management were chosen through the use of purposeful sampling. Interviews were conducted with about 50 respondents who represented various industries and regions throughout the archipelago.

3.3 Data Analysis

To find recurrent themes and stakeholder viewpoints on governance and management, qualitative data from focus groups and interviews was transcribed and then subjected to thematic content analysis. Descriptive statistics were used to examine quantitative data from secondary sources and field surveys in order to measure management outcomes and resource usage patterns. To improve the validity and reliability of the results, a triangulation of qualitative and quantitative data was carried out.

4. RESULTS AND DISCUSSION

The main conclusions of the study on resource management and environmental governance in the Andaman and Nicobar Islands are presented in this section. The findings are arranged according to themes that represent stakeholder participation, governance efficacy, and resource management results. In order to emphasize the difficulties and possibilities for sustainable management in the archipelago, the conversation incorporates these findings with previously published research.

4.1 Governance Effectiveness and Institutional Frameworks

The analysis revealed varying perceptions regarding the effectiveness of environmental governance among stakeholders. Table 1 summarizes stakeholder ratings of governance effectiveness across key criteria such as policy implementation, enforcement, and inter-agency coordination.

Table 1: Stakeholder Ratings of Governance Effectiveness (Scale 1–5)

Governance Criteria	Government Officials	Local Communities	NGOs	Average Rating
Policy Implementation	4.2	3.1	3.5	3.6
Enforcement of Regulations	3.8	2.9	3.0	3.2
Inter-agency Coordination	3.5	3.0	3.8	3.4
Community Involvement	3.0	4.0	4.2	3.7

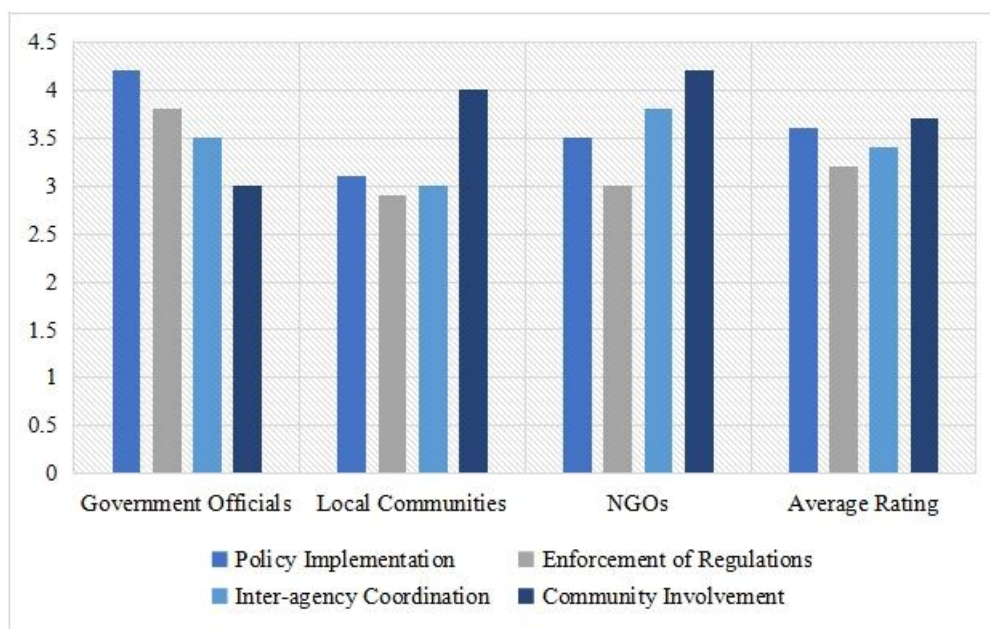


Figure 1: Stakeholder Ratings of Governance Effectiveness

Divergent viewpoints among stakeholders are evident in the governance criteria ratings, with government representatives typically giving policy implementation (4.2) and regulation enforcement (3.8) higher scores than do local communities and non-governmental organizations. While NGOs scored inter-agency coordination significantly higher (3.8), local communities awarded enforcement (2.9) and inter-agency coordination (3.0) lower marks, indicating perceived

inadequacies in these areas. Interestingly, NGOs (4.2) and local communities (4.0) gave community involvement the highest grades, while government officials only gave it a 3.0, indicating a lack of appreciation for community engagement initiatives. These disparities draw attention to difficulties in coordination and enforcement, underscoring the significance of expanding equitable participation in order to increase the efficacy of environmental governance in the Andaman and Nicobar Islands.

4.2 Stakeholder Participation and Traditional Knowledge

Local communities have important traditional ecological knowledge that was frequently underutilized in formal governance structures, as focus group discussions highlighted. Although they mentioned the lack of institutional structures for their involvement, community members said that they would be eager to take a more active role in resource management. A deeper comprehension of local needs and practices was made possible by the application of participatory techniques like PRA. According to a large number of responders, traditional sustainable fishing and forest harvesting methods are currently being threatened by outside commercial interests.

4.3 Resource Management Outcomes

Field observations and secondary data analysis highlighted mixed outcomes in resource management. Table 2 illustrates quantitative indicators of resource status across fisheries, forest cover, and tourism impact zones.

Table 2: Resource Status Indicators in the Andaman and Nicobar Islands

Resource Sector	Indicator	Baseline (2018)	Current (2024)	% Change
Fisheries	Fish Stock Biomass (tons)	5,000	4,200	-16%
Forests	Forest Cover (sq. km)	2,800	2,700	-3.6%
Tourism Impact	Visitor Numbers (annual)	50,000	120,000	+140%

Key resource sectors in the Andaman and Nicobar Islands saw significant changes between 2018 and 2024. A 16% decrease in fish stock biomass suggests overexploitation and stress on marine environments. A 3.6% decline in forest cover indicates continued but rather mild land-use changes or deforestation. On the other hand, yearly visitor numbers more than doubled, rising by 140%, indicating that tourism is growing quickly. This increase probably makes resource demands and environmental stress worse. In order to strike a balance between ecological preservation and economic expansion, these trends collectively demonstrate the pressing need for improved resource management and sustainable development plans.

5. Discussion

In line with Kiruba-Sankar et al. (2021) and Poti (2024), who identified comparable difficulties in resource sustainability, the results highlighted significant gaps in governance efficacy, especially in enforcement and coordination. The discrepancy in opinions between local populations and government representatives indicated that more inclusive governance approaches were required. Traditional knowledge turned out to be a useful tool for adaptive management, but institutional acceptance and integration were still few. In addition to improving resource stewardship, strengthening participatory governance could solve sustainability concerns including declining forests and fisheries. According to Biswas (2024), the swift expansion of tourism brought to light the necessity of strict environmental laws and sustainable tourism strategies. Because of the strains on natural resources, integrated management strategies that strike a balance between conservation priorities and economic development are required.

6. CONCLUSION

The study made clear that the Andaman and Nicobar Islands' resource management and environmental governance face significant obstacles, especially with regard to inclusive community engagement, enforcement, and coordination. Declining fish stocks and forest cover, together with increasing tourism expansion, indicate unsustainable resource usage

and growing environmental challenges, despite government agencies' best efforts. Effective management has been found to require incorporating traditional knowledge and encouraging collaborative governance engaging all stakeholders. To ensure the long-term viability and resilience of the islands' distinctive ecosystems, it is imperative to strengthen these participatory and adaptable frameworks in order to strike a compromise between conservation objectives and socioeconomic growth.

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