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Measures for Mitigating Adverse Impacts of Tourism in wetlands

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Abstract: ***Wetlands are among the most productive ecosystems globally, providing crucial services such as water filtration, food resources, building materials, transportation routes, and coastal protection. Additionally, they support recreational and tourism activities, collectively known as ecosystem services. The migration of numerous bird species and the rich plant diversity within wetlands underscore the importance of effective biodiversity conservation initiatives. However, wetlands face significant threats from urbanization, pollution, resource overharvesting, climate change, and tourism. Tourism, in particular, leads to habitat destruction, pollution, and environmental degradation, compromising water quality and soil stability. Thus, assessing the impacts of tourism on wetlands is essential to develop strategies that enhance their resilience and protect these critical ecosystems. A practical approach to promoting sustainable tourism involves implementing visitor management strategies that regulate visitor behaviour to minimize site impacts. Zoning is an effective visitor management tool that aims to balance the negative impacts of tourism while promoting ecotourism and wetland restoration. While existing literature suggests various zoning factors, each wetland's unique biological characteristics require tailored approaches. This research focuses on importance of zoning and identifying specific zoning parameters to manage tourism impacts in Kerala's wetlands, aiming to support sustainable tourism and conservation efforts.***

Keywords: Wetlands, Tourism, Visitor Management, Zoning.

1. INTRODUCTION

A. Background Study

Wetlands are vital for achieving international commitments related to climate change, biodiversity, and sustainable development. They provide essential functions like flood

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management, groundwater replenishment, climate regulation, coastal stabilization against erosion, recreational activities, and support for sustainable tourism. They also sustain different ecosystems through complex food webs. Furthermore, wetlands are important for regional economies because they provide jobs and habitat for a variety of plant and animal species. [1] Wetlands worldwide are experiencing a 35% decline since 1970 due to unsustainable management practices and exploitation, particularly in the Asiatic region. [2] This decline threatens biodiversity and wetland functions, with major threats including hydrological changes, catchment degradation, pollution, and invasive species proliferation. Overharvesting, unregulated tourism, and climate change exacerbate these issues, posing serious risks to wetlands' survival and sustainability. [3] Wetlands are vital to global tourism, offering activities like birding, wildlife viewing, kayaking, speedboat and photography. They promote environmental education and sustainable practices. However, wetlands are disappearing rapidly, three times faster than forests, due to numerous challenges. Since the 1700s, 90% of the world's wetlands have been damaged, with a 35% decline between 1970 and 2015, accelerating since 2000. [4]

B. Need of the Study

Kerala's total land area is 4% made up of wetlands, of which 25.45% are coastal and 72.3% are inland. There are three Ramsar sites in the state: Vembanad Kol Wetland, Sasthamkotta Lake, and Ashtamudi Wetland. [5] Kerala's hills and wetlands are seriously threatened by the state's growing tourism industry, especially in the significant wetland area of Vembanad. The location, which receives 1.1 million visits a year, has problems with ecosystem destruction, solid waste disposal, and land expansion. The extent of the Vembanad estuary decreased from 365 km2 in 1834 to 179.25 km2 in 2010, and Ashtamudi Lake saw a notable loss of land. [6] The Malarikkal Wetland in Kottayam is confronted with issues such as the devastation of water lilies and the ecological consequences of uncontrolled tourism. These examples highlight the need for sustainable management strategies to mitigate tourism's adverse effects and preserve Kerala's delicate wetland ecosystems as eco-tourism destinations.

The aim of the study is to identify the suitable mitigating measure to reduce the adverse of tourism in wetland destinations. The four main objective of the study is 1) To conduct a background study on wetlands, wetland tourism and its impacts. 2) To identify the suitable mitigating measure to reduce the adverse impacts of tourism 3) To compare analyse various case examples of identified method. 4) To identify different parameters for the selected method to reduce the adverse impacts of tourism.

2. RELATED WORKS

Wetlands are globally recognized for their ecosystem services and popular tourist destinations, offering diverse recreational activities like birdwatching, kayaking, and photography. Of the 2,263 Ramsar Sites in the world, 1,660 (73%) are claimed to provide ecological services related to tourism and recreation. [7] In Kerala, India, wetlands attract both domestic and international tourists for boating, fishing, kayaking, and cultural experiences. However, the rapid expansion

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of tourism poses serious environmental threats, including noise pollution, overfishing, siltation, encroachment, and pollution from tourist activities. [8]
Mitigating the impacts of tourism on wetlands, crucial for their ecological functions and biodiversity, necessitates strategic management measures. The World Tourism Organization (WTO) advocates two primary approaches: site management and visitor management. Site management involves administrative and physical interventions to regulate tourist activities, such as coordinating visitor arrivals, improving site infrastructure, and controlling access to sensitive areas. Meanwhile, visitor management tools like tourism carrying capacity and limits of acceptable change set thresholds for sustainable visitor numbers and activities, ensuring environmental and cultural preservation. These strategies aim to balance tourism benefits with conservation imperatives, safeguarding wetlands from degradation while enhancing visitor experiences through responsible and sustainable tourism practices. [9]

Visitor management is crucial in addressing the negative effects of tourism overcrowding in natural and protected areas. It involves using various strategies and tools to regulate visitor flows and behaviors. Key tools include carrying capacity, zoning, limits of acceptable change (LAC), price discrimination, and site hardening. Carrying capacity determines the maximum number of visitors a site can sustain without compromising its natural, cultural, or economic integrity. Zoning divides areas based on usage, LAC sets environmental impact thresholds, price discrimination adjusts fees, and site hardening enhances infrastructure to minimize ecological impact. [10]

Zoning is a crucial tool for reducing tourism's impact on wetlands. It divides an area into zones, regulating infrastructure and activities. The United Nations Environment Programme (UNEP) states that zoning balances conservation efforts with human activities by categorizing zones based on intensity and type of impact. [11] This approach helps manage negative impacts and enhances understanding among managers, operators, visitors, and local communities about the diverse recreational and tourism opportunities within and around protected areas.

Case Study

A. Wulliang Suhai Nature Reserve (WNR)

The Wulliang Suhai Nature Reserve in Inner Mongolia, the largest water body connected to the Yellow River, has experienced a surge in tourism, attracting around 100,000 visitors annually. The reserve has adopted a traditional three-zone management system, consisting of core, buffer, and experimental zones. However, concerns over increasing pressures led to the proposal of a new four-zone system, considering factors such as vegetation, bird migration, hydrology, human activity, land use, and endangered species. The proposed four zones include the core zone (20.5%), limited-use zone (22.4%), wise use zone (32.1%), and risk-control zone (25.1%). This updated zoning approach aims to better manage the dynamic ecological conditions of wetlands and provide a potential model for other reserves with similar environmental challenges. The proposed four zones include the core zone (20.5%), the limited-use zone (22.4%), the wise use zone (32.1%), and the risk-control zone (25.1%). [12]

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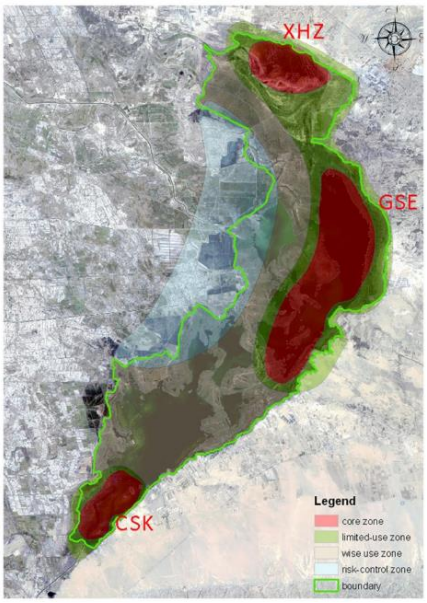

Fig.1 Proposed zones of Williang Suhai Nature Reserve (WNR)

B. Parishan Lake, Iran

Parishan Lake, a 4,800 hectare freshwater ecosystem in Iran's Zagros Mountains, is renowned for its diverse wildlife and bird species. Covering 266.5 square kilometers, it supports various habitats and is a popular site for scientific research and education. The lake's zoning system aims to balance conservation efforts with sustainable use, with zones based on sensitivity to human activity and ecological impact. The proposed revised zoning system aims to enhance conservation efforts and promote ecotourism sustainably. Two main zones were identified: a conservation zone to safeguard biodiversity and recreational zones focused on controlled visitor activities. These zones, categorized as Intensive and Extensive, provide designated spaces for tourism infrastructure and activities while maintaining ecological integrity. Zones 1 and 2 within the Extensive Recreational zone are strategically located to balance human access with conservation needs of critical bird habitats. [13]

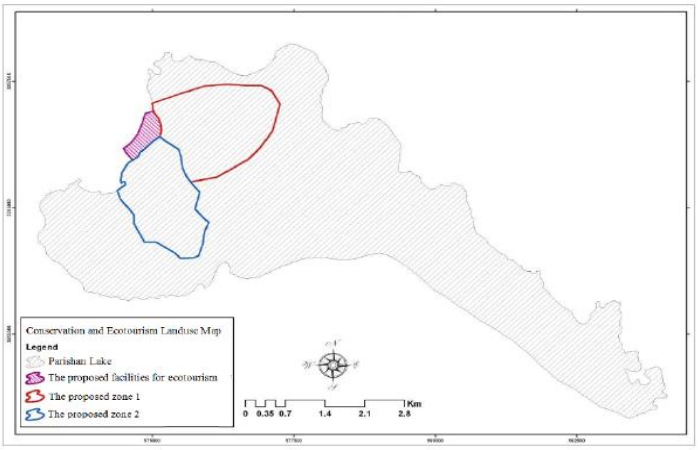

Fig.2 Proposed zoning system of Parishan Lake, Iran

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C. Anzali Lake, Iran

The Anzali Wetland in Iran's Gilan Province is a crucial ecosystem with 19,000 hectares of freshwater lagoons, reed beds, and meadows. It is a Ramsar site and a critical habitat for diverse wildlife, including 140,000 birds and 57 endangered fish. The wetland is divided into four regions based on ecological characteristics, each supporting biodiversity and human uses. A proposed zoning system aims to balance conservation efforts with sustainable human activities through active stakeholder involvement and community engagement. The plan divides the wetland into three main zones: Wetland zone, Buffer zone, and Transition zone. The Wetland zone includes protected subzones for eco-tourism, research, hunting, and fishing, the Buffer zone promotes low-impact agriculture and industrial activities, and the Transition zone accommodates developmental activities. Implementation involves collaboration among stakeholders and public engagement. [14]

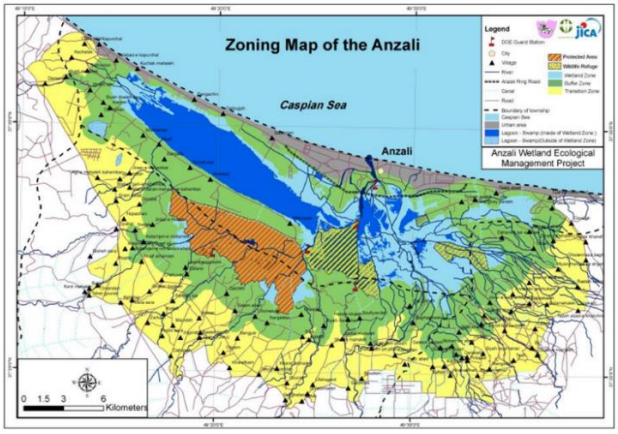

Fig.3 proposed three zones of Anzali Lake, Iran

Primary Study

A. Ashtamudi Lake, Kerala

Ashtamudi Lake, Kerala's second-largest wetland ecosystem, is a complex estuarine system with interconnected arms and islands. It is renowned for its biodiversity, including endangered species, marsh and mangrove habitats, bird species, fish species, and waterfowl. Ashtamudi Lake remains a popular destination for cultural and recreational activities, offering opportunities for houseboat stays, boat tours, birdwatching, kayaking, canoeing, and nature walks. Sustainable management practices are needed to preserve the lake's ecological health and its role as a sanctuary for diverse wildlife and cultural exchange in Kerala. [15]

Despite its ecological significance, the lake faces challenges from human activities like urbanization, waste disposal, agricultural runoff, construction, and industrial effluent discharge. These activities threaten the lake's environmental integrity and contribute to its ongoing degradation. [16]

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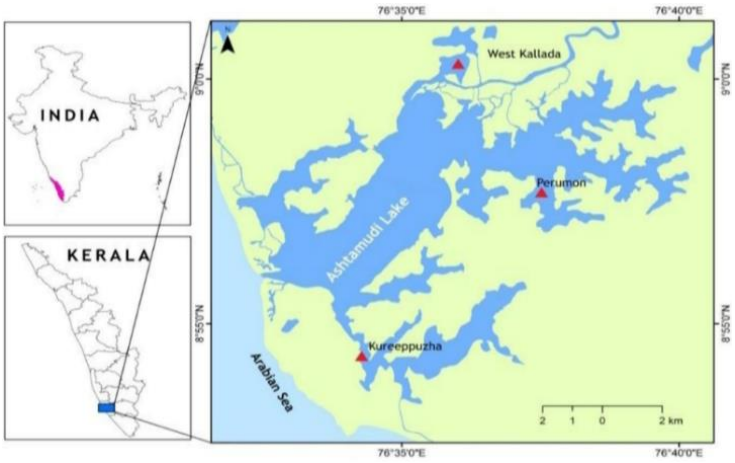

Fig.4 Location map of Ahtamudi Lake, Kerala

B. Expert Opinion Survey:

A survey of 15 experts in Kerala assessed the impact of tourism on wetlands. 80% of the experts believed tourism had predominantly negative effects. 73.3% of them emphasized the importance of zoning as a mitigation tool, with 26.7% highlighting carrying capacity as a primary concern. All experts agreed on the necessity of implementing zoning models for effective wetland conservation. Critical parameters for zoning included topography, local drainage patterns, cultural significance, biodiversity, flora and fauna diversity, demographic profiles, and climate change susceptibility.

3. METHODOLOGY

The methodology adopted for this research paper proceeds through three structured stages aimed at comprehensively addressing spatial issues related to wetlands. Stage 1 of this study establishes a foundational introduction aimed at identifying effective methods for addressing wetland issues spatially. The objectives include a comprehensive exploration of wetlands, wetland tourism, and their impacts, with a focus on mitigating adverse effects caused by tourism. Various case examples of mitigation methods will be compared and analyzed, and specific parameters for each method will be established to reduce tourism's negative impacts on wetland ecosystems. The scope encompasses analyzing visitor rates, ecological challenges, and socioeconomic indicators to propose strategies that balance tourism with wetland conservation. However, it acknowledges limitations, such as the exclusive focus on tourism-related threats to wetlands, despite other significant threats affecting these ecosystems. In Stage 2, the study undertakes an extensive literature review spanning several dimensions: the ecological significance and classification of wetlands, the regulatory framework outlined by the Ramsar Convention, and comprehensive assessments of wetland scenarios at global, national, and state levels. It delves deeply into major threats confronting wetlands, particularly the adverse impacts of tourism. This phase also entails the critical identification and evaluation of various global methods and tools, emphasizing their effectiveness in addressing spatial challenges unique to wetlands. In Stage 3, the study transitions to examining literature case studies that showcase real-world applications of different methods in addressing spatial

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challenges specific to wetlands. Through a comparative analysis of these case examples, the research aims to gain insights into the practical outcomes and effectiveness of each method across different contexts. This phase offers a nuanced understanding of the strengths and weaknesses associated with various approaches, contributing to the study's broader goal of identifying optimal strategies for managing wetland spatial issues. The final stage synthesizes findings from the literature study and case analyses to identify key parameters critical for implementing the selected method effectively. These parameters will inform the practical application of the chosen spatial approach in managing and conserving wetland ecosystems, ensuring a systematic and thorough investigation that integrates theoretical insights with practical examples to achieve robust conclusions and recommendations for spatial management of wetlands.

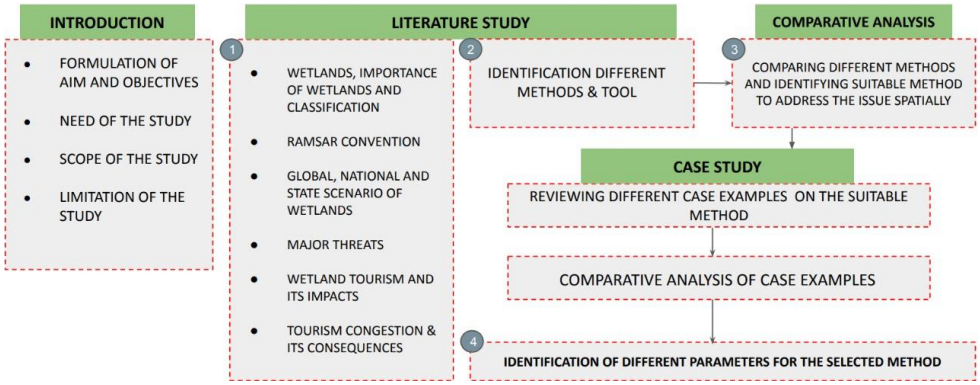
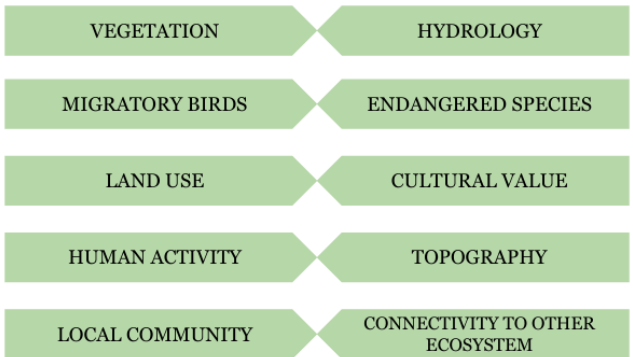


Fig.5 Methodology of the study

4. RESULTS & DISCUSSION

The literature review and expert opinion underscore the critical role of zoning as a fundamental tool for managing visitors in wetland areas, aimed at mitigating the adverse impacts of tourism. Zoning effectively controls visitor access across diverse areas within wetlands through proper spatial planning, acknowledging their distinct ecological and socio-economic attributes. Consequently, the identification and integration of various parameters are imperative for developing effective zoning models tailored to the specific needs of each wetland ecosystem. Identified parameters for preparing zoning models:



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5. CONCLUSION

Kerala, known as the "Land of Backwaters," is home to a diverse array of wetlands that are vital to the state's ecological balance and socioeconomic fabric. Protecting these wetlands is crucial for future economic prosperity. Responsible ecotourism can boost the economy, promote environmental awareness, and facilitate wetland restoration. However, sustainable practices must be adopted to mitigate adverse impacts.

Visitor management is a key strategy, with zoning being a key tool for visitor control in wetland tourist destinations. Zoning delineates distinct zones tailored to each wetland's unique ecological characteristics, regulating visitor access and minimizing human-induced disturbances. The development of zoning models must consider key parameters specific to each wetland site, recognizing the unique ecological nuances of each wetland. Different wetlands across. Different zoning plans could be necessary for Kerala, which would provide planners and decision-makers important information to work with when developing policies that reduce the negative effects of tourism on wetlands.

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