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Urbanisation and Demand for Wetland Ecosystem Services: Evidence from Kerala, India

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ABSTRACT

The wetlands in Kerala face numerous challenges as a result of the growing population's increased pressure on land and unscientific tourism activities. The present research tries to fill the gap in the literature regarding the change in the demand for ecosystem services or the shift in occupational structure of the beneficiaries of the surrounding population of Kavvayi associated with urbanisation. The research investigates the impact of plastic waste on the demand for recreational benefits at Kavvayi Lake. The study reveals that a sustainable utilization of wetland resources in the context of urbanization has been identified as a viable management strategy formulated by the local self-government in Payyanur.

***Key words**: Economic valuation, Ecosystem Services, Tourism, Urbanisation, Wetlands*

Introduction

The transition from a dispersed to a concentrated pattern of human settlements is known as urbanization. It is a steadily increasing population density within an urban area (Davis, 1965). Wetlands are impacted by urbanization primarily through habitat destruction, the addition of suspended solids, hydrological changes, and subsequently changed water quality. (Darnell, 1976; Philip *et al.,* 2020). From an environmental and socioeconomic perspective, wetlands are regarded as one of the planet's most productive ecosystems. Since wetlands contribute in a variety of ways to a healthy and enjoyable environment, their importance is gradually receiving the attention it deserves on a global scale (Cohen *et al.,* 2016). The term refers to "the fields of lagoons, peat, or other substrates, whether organic or synthetic, whether ongoing or inactive, filled with fluid that is moving or stationary, fresh saltwater or saline, such as areas of seawater, the lowest point of which at lower tide is not greater than 6 meters," as per the 1971 Ramsar Convention. They are widely recognized as the most productive ecosystem and are often compared to the "kidneys" of the planet due to their crucial role in preserving water quality through the filtration of sediments and contaminants (Mitsch and Gosselink, 1993). It is an essential element of the biosphere, functioning as a recreational space, a source of nourishment, a sink and transformer of various chemical, biological, and genetic materials, and contributing aesthetically while serving as a natural home for many birds, aquatic life, and creature species (Barbier, 1997). The products and services supplied by natural and managed ecosystems are extensively relied upon by human beings. Ecosystem services are the collective term used to denote the benefits that ecosystems bring to

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human beings. Cultural, regulating, supplying, and supporting services comprise the services offered by an ecosystem, as classified by the Millennium Ecosystem Assessment (2005) of United Nations.

Wetlands serves an essential part in decreasing the problem of flooding caused by storms and rising sea levels (Barbier, 1994; Brander, 2006). This is because of the enormous amount of water that they are able to absorb. Substitutes for ecosystem services are becoming more prevalent as technology continues to improve, which leads to a decline in the quality of ecosystem services, particularly those that regulate and support ecosystems. As a result, the actual worth of ecosystems is not taken into consideration during the time of economic growth. The evidences that are currently available point to the fact that anthropogenic activities such as agriculture, industrial development, tourism, and urbanization were responsible for a significant amount of wetland loss in countries across the globe (Zamora, 1984; Tiner, 1984; Pullan, 1988; WCMC, 1992; CES, 1995).

These locations had experienced a significant decline in the quality of ecosystem services as a consequence of this. The restoration of wetland areas has received more attention over the past decade in almost all regions of the world where the effects of wetland degradation have been widely acknowledged (Acreman, 1994; Acreman and Hollis, 1996; IUCN, 1998; Khaleel, 2005; Barbier, 2007). On the other hand, sustainable management of wetland areas is frequently not a priority and is often regarded as unproductive waste land. This is mostly due to the fact that the economic benefit of wetland areas is not fully realized (Barbier, 2007). In an optimal scenario, the assessment of ecosystem services' worth should provide decision makers with guidance regarding the conservation and management of environmental services.

According to Barbier (Barbier, 1994), wetland ecosystems are largely dominated by the influence of water and provide a multitude of ecosystem services that have significant economic, ecological, scientific, cultural, and recreational significance. These ecosystem services should be managed in an efficient and effective manner for the benefit of future generations. It has been determined that there are 4354 wetland areas in Kerala, of which 2592 are more than 2.25 hectares in size. According to the Ministry of Environment and Forest (2012), the entire wetland area is estimated to be 160590 hectares, and almost twenty percent of the total landmass within the state is comprised of a large network of backwaters, lagoons, natural lakes, rivers, mangroves and canals. These are highlighted as major tourism spots and now the State's sustainable tourism efforts involved the incorporation of novel technology such as Augmented Reality (Reejo, 2023) for the promotion of tourism in the State.

However, the wetlands face numerous challenges as a result of the growing population's increased pressure on land and unscientific tourism activities (Panicker, 2018). Kannur, the Northern district of Kerala, has the capacity to distribute approximately 83 percent of the total mangrove stock, including the Kavvayi Backwater. However, this area is currently facing substantial risks from human activities such as solid waste disposal, land reclamation, tourism and other anthropogenic pressures. These concerns have been highlighted in various studies (Jagathap, 2002; Khaleel, 2005; Kokkal, 2008; Sreeja, 2009; Harikumar, 2016). Due to the fact that this ecosystem was traditionally considered to be wasteland, the conversion of wetlands has taken place (Jagathap, 2002). Sand mining, tourism activities lacking scientific foundations, the degradation of mangrove forests, an overabundance of aquatic weeds, improper waste disposal, and pollution have been identified as the primary environmental concerns within the catchment area of the Kavvvayi wetland (Harikumar, 2016). Wetlands are habitats for numerous uncommon species of hydrophytic plants, birds, and fishes; yet, their biodiversity has been gravely threatened by these problems. Determining the principal ecosystem services rendered by the Kavvayi backwater in Payyannur is the objective of the current research paper. It conducts a thorough literature review in an effort to identify appropriate methods for assessing the economic value of the ecosystem services provided by the Kavvayi Wetland by looking at the methods used to quantify the economic worth of biodiversity. By conducting an in-depth survey, the study also attempts to determine how urbanization impacts the demand for ecosystem services and threat of plastic waste in Kerala's Kavvayi Wetland.

Materials and Methods

The study used both primary and secondary source of data. The investigative methodology employed in the study encompasses comprehensive surveys, literature reviews, stakeholder discussions, observa-

tional techniques, and examination of case studies. In order to ascertain the indirect, direct, and non-use benefits of products and services provided by wetlands, it is critical to observe the key stakeholders engaged in the process. Review of literature, discussion with stakeholders, local communities and other beneficiaries have been done to determine the benefits provided by the wetlands in Kerala. An extensive review of literature has been done to review the method used for economic evaluation of ecosystem services. To understand the link between urban population expansion and change in demand for ecosystem services of Kavvayi backwater, analysis of census data in various years will be used. It helps to identify shifts in the occupational structure of people and the resulted changes in the demand for eco system services. Prioritisation of use and non-use values particular to Kavvayi wetland have been identified through available literature and discussion with the stakeholders. In depth survey has been conducted among 10 households residing within the distance of 5 KM from the wetland. Similarly, informal interview has been conducted among the nearby restaurants, tea stall owners and private boat owners within 5 KM from the backwater to understand the earnings from tourism and fishing in the region. This helped to draw conclusion on the demand for ecosystem services due to occupational shift and threat of plastic waste from both the tourists and households in the recreational site of the Kavvayi backwater in Payyannur, Kerala.

The Ecosystem Services and Kavvayi Wetland in Kerala

Total economic valuation approach is a useful framework and that has been used for identifying various ecosystem services associated with the Wetlands in Kerala. It comprises the direct use of wetland goods (fish, grass, wood, tourism earnings) and the indirect uses. This approach will help to avoid double counting of ecosystem functions of wetlands (Baral *et al.,* 2016). The greatest mangrove forest in Kerala, the Kavvayi wetland system, is situated in a densely populated section of the Malabar littoral in India. Unfortunately, anthropogenic activities have posed a significant threat to this area. Featuring small islands and mangroves, the Kavvayi backwater, which is nourished by five rivers, is the largest wetland ecosystem in North Kerala, encompassing an area of 1264.62 square kilometers. It runs from the Kannur district town of Payyanur to the Kasaaragod district town of Neeleshwaram. Moreover, discussion with the stakeholders reveals that it has many provisional services like fishing, roofing materials, birds, tourism earnings and recreational services like boating and provision of several recreational spots. Fishing is the main livelihood option of the people who live in the surroundings of Kavvayi backwater. The Kavvayi backwater adds the aesthetic and historical dimensions of the city of Payyannur. Many tourists visit Kavvayi Kayal in Payyannur during the season of Theyyam and Poorakkali, art forms associated to temples in the Northern Kerala. Kavvayi Backwater is thus an integral part of the culture and history of the city. Furthermore, this wetland's dense mangroves serve as a powerful coast guard, preventing inundation of sea and floods during the monsoon season. In summary, the Kavvayi Backwater offers ecosystem services that are extremely valuable physically and economically, and the local population has benefited much from it.

Results

The Economic Evaluation of Services provided by Ecosystems

Quantifying the economic value of non-market services and products in monetary terms should be obligatory in the "Age of Men" or "Anthropocene" to ascertain their genuine economic benefit, optimize benefits over time, and enhance investment in wetland conservation.

(Barbier, 1994). Utilizing the Total Economic Value method, numerous values associated with protected areas were identified (Pearce and Warford, 1993; IUCN, 1998). Economic valuation of environmental resources is essential for comprehending the true economic worth of wetland services and their significance for the social welfare of local communities and the national economy, according to scholars such as B, Sony, and Khanal (Baran et al. 2016). The Total Economic Value approach and benefit transfer method were employed to evaluate the direct and indirect utilization of ecosystem services. Several research employ the benefit transfer method to estimate the indirect utilization of ecosystem services (Woodward and Wui, 2001; Brander *et al.,* 2006).

Worldwide, two alternative methodologies, the Contingent Valuation Method (Kadekodi, 2004) and

Travel Cost Method or TCM have been used widely for estimating the value of recreational site (Markandya, 2001; Champ, 2003; Chopra, 2004; Guha and Ghosh 2009; Mishra, 2014). Guha and Ghosh, (2009), have used TCM to calculate the worth of recreational activities provided by the Sundarban mangrove habitat. According to them, if there is a market for recreational services, TCM is a more acceptable method as it is based on the visitors' revealed preferences rather than 'stated' ones. The TCM will assist decision-makers in establishing an entry price that can either optimize revenue or regulate visitor numbers to the facility.

However, relatively few studies have been done in wetland system of Kerala (Khaleel, 2005) used an interdisciplinary approach with components of cartographic appraisal of the landscape units in localities for the identification and estimation of ecosystem service value in the mangrove forest in North Kerala. Market Price Approach and Travel Cost Method to calculate the direct use values and recreational services respectively in the case of Ashtamudy Lake in Kollam District (Anoop, 2007). Sreeja points out that economic valuation is the best tool in the effort to improve the management of ecosystem services and had used the method of Costanza, to determine the ecosystem service value (ESV) of mangrove forests spread over in Kannur District (Sreeja, 2009). The Kole wetland system in Thrissur District has been studied and estimated the non use value based on contingent valuation method to conserve the wetland resources for the future use (Binilkumar, 2010). The economic worth of the ecological advantages of Mangrove forests in the districts of Ernakulam and Kannur can be estimated using the contingent valuation approach (Hema and Indira Devi, 2015). Total Economic Valuation framework is used to assess the economic worth of ecosystem services in Vellayani Lake in Thiruvananthapuram District (Vijayan, 2015). However, these literatures do not discuss the economic worth of services of a backwater in the context of increased urban population growth.

Consequently, the economic assessment of ecosystem services is essential for the efficient management of wetland resources within the State. A standardized accepted common rule of economic valuation of wetlands is inappropriate in the case of Kavvayi in the context of increased urban population.

The literature study indicates that the Market Price Approach and the Travel Cost Method are appropriate for evaluating the monetary worth of ecosystem services offered by a wetland.

Under Market Price Approach, to assess the provisional services, primary data can be collected from 10 percent of total households residing within the distance of 5 KM from it. Similarly, 10 per cent of total restaurants, tea stall owners and private boat owners within 5 KM from the wetland can be interviewed to estimate the earnings from tourism and fishing. Detailed and separate questionnaires can be prepared for this purpose. Market Prices approach can be used to derive the total economic benefits from these provisional services.

Generally, to calculate the total net economic benefit of the society, the following formula can be used. i.e..,

$$TR = P \times Q - C$$

Here, TR is the total revenue of household from the provisional services; P is the price of commodity in the market; Q is the total quantity collected and C is the cost of quantity collected which is equal to time or the opportunity cost of time.

In order to assess the worth of recreational services provided by a wetland, the Travel Cost Method (TCM) is commonly applied. With a well-structured questionnaire schedule, data can be collected from the total number of tourists visiting the lake by selecting a week day, a weekend day and a holiday. Based on it, the prediction of number of tourists who visits in the area will be done. To evaluate the significance of the frequency of visits individuals make to the site, the following simple formula can be used.

$$Tr = f(TCr, TCs, Y, Z)$$

In this context, Tr denotes the frequency of visits to the site; TCr represents the travel cost to the specific site; TCs indicates the journey cost to alternative sites; Y signifies the income of the tourists; and Z reflects the demographic background of the visitors.

To estimate other indirect use values of wetland such as biodiversity conservation, carbon sequestration, ground water recharge, flood, livestock bathing etc., method of benefit transfer can be used. Secondary source of data will be collected in this regard. The formula will be used for value transfer with income adjustment is

$$Bp^{l} = Bs\,(Yp / Ys)^{\beta}$$

Bp^{l} is the adjustment benefit at the policy site; Bs

is the The principal benefit assessment from the research location; Yp is the income level at the policy site; Ys is the income level at the study site and â is the degree to which people are willing to pay for environmental goods as a function of their income

Urbanisation and Increased Demand for Ecosystem Services

The study concentrates on Kavvayi backwater complex in Payyannur municipal area in Kannur District of Kerala. During the past centuries and even during British East India Company, it was served as an inland port in Payyannur. From ancient time and even after the advent of European's, it retained the position of city as an administrative and business centre. According to Census of India (2011), Payyannur municipality consists of 41 wards with 16996 houses.

It is evident from Census data that Kannur became the most urbanised district in Kerala with an urban population of 50.6 percent (Census of India, 2001) and it increased to 65 percent in 2011(Census of India, 2011). The urbanisation in this area caused to increase the demand for ecosystem services from the Kavvayi wetland system. At this time, it has undergone a transformation into a popular destination for recreation, and the local populace has become accustomed to relying on fishing and tourism as sources of income (Harikumar, 2016).

Moreover, there is a progressive encroachment of Kavvayi wetland system in Kannur, due to population pressure on land coupled with unscientific tourism activities and solid waste disposal into the water (Khaleel, 2005; Sreeja, 2009; Harikumar, 2016). According to a study conducted by Kerala State Literacy Mission Authority (2017), 26.9 percent of water resources in the state are completely polluted. Solid waste contributes around 53 per cent of pollution and of these, 20 percent from plastic waste. In recreational sites of Kavvayi also, plastic waste is a big threat.

The results of the in-depth survey show that the locals' primary source of income is now service-oriented tourism and allied industries rather than traditional agricultural practices. The report clearly shows that increased tourism and urbanization in the area have led to a shift in occupation. Another significant milestone in the growth of tourism in this area is the establishment of the Kannur airport and improved infrastructure. The purpose of the case study is to comprehend how urbanization has led to a shift in occupations.

The case of Sujith (anonymous name), a returnee from the Gulf, exemplifies how the region effectively capitalized on the emerging prospects of travel and tourism. The wetland system of Kavvayi comprises several diminutive islands. In 2013, he established a resort on one of the islands situated in the Kavvayi backwater, close to Payyannur, using funds from his personal account. Since a decade ago, he has been conducting responsible tourism activities in this region with great success. His initial focus was providing lodging for tourists visiting the island. One year later, he expanded his enterprise by introducing boat services to mangrove forests. He founded a travel company in 2018, and his enterprise now provides a variety of services to travellers so they can embrace the backwater beauty of Kavvayi. Attractive services are available to entice visitors to his resort. During the winter, night kayaking, stargazing, bioluminescence spotting, and other activities are popular attractions. These activities are led by certified and trained guides. The visit to his mangrove adventure travel services is an experience that leaves a lasting impression on each visitor. The success tale of Sujith is not an isolated incident. Several young individuals have established businesses in the region as a result of the tourism industry. Based on the in-depth survey and case study, it is evident that the Kavvayi Wetland system in Payyannur has witnessed significant growth in tourism activities, owing to urbanization-induced changes in occupation and enhanced infrastructure.

In order to determine whether plastic refuse poses a threat to recreational benefits (a negative externality of tourism), information was gathered via an open-ended questionnaire from tourists, households, and fishermen. It facilitated the identification of the plastic waste disposal source into the lake. Enhanced tourism operations, including increased domestic travel, the use of plastic bottles and packets, and the provision of boat services, among others, pose a grave hazard of plastic waste to the backwater. However, it appears that local self-governance is making significant strides in this regard by prohibiting the use of plastic in this region. A plan of action to preserve the backwater's flora and fauna has been put into effect. Adapting observation techniques reveals that the inhabitants of this region are acutely cognizant of the critical nature of Kavvayi Wetland biodiversity conservation. A five-day continuous observation indicates that the dis-

posal of plastic refuse into the backwater is not visible, despite the fact that locals are protesting and closely observing the activity.

Conclusion

Sustainable management of environmental resources, specifically wetland ecosystem services, is critical for the well-being of local communities residing in urban areas. Assessing the recreational value of Kavvayi could be the subject of the study, which would contribute to the optimization of local resource management. A sustainable utilization of wetland resources in the context of urbanization has been identified as a viable management strategy formulated by the local self-government. In contrast, the inability of conventional national accounts to account for the value of natural capital has generated widespread support for the notion of "Green National Accounts." The inclusion of both the depletion and utilization of natural capital in national accounts is generally recognized. Kerala, renowned as "God's Own Country" on account of its awe-inspiring backwaters and verdant landscapes, has been designated as an international tourist hotspot. Consequently, the intrinsic worth of its natural resources is immeasurable. In order to achieve sustainable development objectives on a national and global scale, it is possible to raise awareness about the necessity for Green National Accounts by approximating the economic value of the Kavvayi backwater. Highlighting the initiative to include Kavvayi wetland on the Ramsar site list and to preserve the site's biodiversity for the benefit of humanity is crucial, according to the study's findings.

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Conflict of Interest

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