

# The Contribution of Mangrove Forest to Coastal Household Income in East Lombok, Indonesia

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## KEYWORDS

Coastal development; Ecosystem services valuation; Household income; Mangrove governance; Nature-based solutions; Willingness to pay

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## ABSTRACT

This study examines the contribution of mangrove ecosystems to coastal household income in Jerowaru Village, East Lombok, Indonesia, and evaluates how direct economic benefits shape community incentives for mangrove conservation. Positioned within the governance and development agenda, the study addresses the role of natural capital in supporting coastal welfare and nature-based development in an emerging economy context. A mixed-method design was employed using household questionnaires, direct interviews, and focus group discussions involving 115 respondents living near the mangrove area. The study applied a direct use-value and market-price approach to estimate household income from mangrove-related activities, including ecotourism, fish harvesting, crab and prawn collection, and firewood use. Willingness to pay was also assessed to capture community-level conservation incentives. The findings show that 87.8% of respondents receive direct economic benefits from mangrove resources, while 12.2% report no direct income contribution. Most households gain only IDR 100,000–250,000 per month, indicating that mangroves function mainly as a supplementary livelihood source. Despite high conservation awareness, willingness to pay remains limited, revealing a gap between ecological concern and economic incentives. This study contributes household-level evidence on mangrove ecosystem valuation in a small-island Indonesian setting. By linking direct-use valuation, livelihood dependence, and conservation incentives, it offers policy-relevant insights for community-based mangrove governance, coastal development, and nature-based strategies in Indonesia and comparable developing economies.

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## 1. INTRODUCTION

Mangrove habitats are some of the most productive coastal systems in the world. They give coastal people a lot of ecological and economic benefits. From an environmental economics standpoint, mangroves provide an essential type of natural capital that

sustains livelihoods, bolsters food security, and augments resistance to environmental and economic disturbances (Barbier, 2011; Brander et al., 2024). These functions are especially significant in developing nations, where many coastal households rely on ecosystem services for food and money.

A 2022 World Bank report highlights that Indonesia is home to 20% of the global mangrove population, with the 2021 National Mangrove Map by the Ministry of Environment and Forestry placing the country's total coverage at around 3.5 million hectares. The national standard SNI 7717-2020 divides these ecosystems into three categories based on their canopy coverage percentage: dense (>70%), moderate (30-70%), and sparse (<30%).

Regarding spatial distribution, 2,261,921 hectares (79%) fall within state forest lands, leaving 702,798 hectares (21%) outside of them. Within these non-forest areas, the current data identifies 586,054 hectares of dense mangroves, 86,834 hectares of moderate mangroves, and 29,910 hectares of sparse mangroves. Although these environments host diverse species and offer vast socio-economic benefits, the country experiences a regular contraction of its mangrove resources. The primary catalyst for this loss is anthropocentric land conversion, including logging, mining, infrastructure development, and agriculture (Cahyaningsih et al., 2022). Indeed, if mangrove exploitation and management are carried out efficiently, mangrove forests will bring both economic and non-economic benefits to society (Agaton & Collera, 2022; Arifin et al., 2019; Aung et al., 2022; Son et al., 2022; Zainal et al., 2023). Coastal communities rely heavily on mangrove ecosystems, which serve as highly productive habitats offering crucial ecological and economic resources. These diverse environments play a multifaceted role, supporting sustainable fisheries, timber production, and ecotourism while acting as vital carbon sinks and natural barriers for shoreline protection (Asir Ramesh et al., 2022; Ewers Lewis et al., 2018; Nyangoko, Shalli, et al., 2022; Rumondang et al., 2024; Wahyuni et al., 2021). Mangroves are protecting coastal communities from disasters such as degradations, cyclones, and tsunamis (Agrawal et al., 2016; Asir Ramesh et al., 2022; Veettil, 2022).

The research found that mangroves serve as carbon sinks (Liu et al., 2022; Xiong et al., 2024), mangrove conservation zones can be used for tourists (Arifin et al., 2019; Zainal et al., 2023), mangrove trees, which are often found in coastal areas, may be used to boost the local economy (Aung et al., 2022), the preservation and usage of mangrove forests can improve the local's socioeconomic status (Lin et al., 2022; Nyangoko, Shalli, et al., 2022). Furthermore, mangrove provides ecosystem life for fish (mangrove fish) (Castellanos-Galindo et al., 2021; Nabilah et al., 2021; Stuthmann et al., 2022; J. Zhao et al., 2022; P. Zhao et al., 2022), and people living around tend to consume the mangrove-associated fish frequently (Ickowitz et al., 2023). Centering on Jerowaru Village in East Lombok, Indonesia, this study investigates the socio-economic contributions of mangrove ecosystems to the coastal community. It categorizes the demographic reach of these benefits to evaluate the precise impact of mangroves on residents. Additionally, the research quantifies the economic value of local resource utilization, converting these

activities into monetary terms using the Indonesian Rupiah (IDR). Lastly, the paper explores the contemporary challenges confronting these coastal forests from the viewpoint of the local population.

Numerous research reveal that mangroves improve the well-being of families in many ways. Provisioning services, including fish, crabs, shrimp, firewood, and construction supplies, are the most direct and palpable revenue streams for coastal households (Salem & Mercer, 2012; Vo et al., 2012). Mangroves also help offshore fisheries by providing nursery and feeding grounds, which keeps fish stocks healthy throughout time (Castellanos-Galindo et al., 2021; Ickowitz et al., 2023). Mangroves offer regulating functions like coastal protection, carbon sequestration, and water filtration, which make people's lives more stable but are frequently less obvious to the people who live nearby (Barbier et al., 2011; Seddon et al., 2020).

Despite growing recognition of the importance of mangrove ecosystems, empirical evidence at the household level remains limited, particularly in small-island and remote coastal areas. Numerous valuation studies concentrate on aggregate economic values or national-scale evaluations, which obfuscate the distribution of benefits across households and the actual income individuals generate from mangrove-related activities (Brander et al., 2024). It is essential to understand how much each household contributes since decisions about how to make a living, like whether to protect or exploit mangroves, are determined at this level.

The research findings show that there is a rising interest in nature-based solutions (NbS), such as mangrove restoration, as affordable approaches to strengthen the local people to cope with climate change while supporting environmentally sustainable livelihoods (Arkema et al., 2013; Seddon et al., 2020). However, the concept of Nature-based solutions can only succeed if local communities or people support the area and derive positive impacts. When mangroves are viewed as offering little economic return, communities may be less willing to protect them, which can result in continued damage. In East Lombok, Indonesia, mangrove forests are located near coastal communities characterized by limited employment opportunities, low levels of formal education, and a strong dependence on natural resources for livelihoods. Although mangroves are present and used to some extent, preliminary evidence indicates that they contribute only marginally to household income. This raises important questions about the factors limiting the realization of mangrove-related benefits and the potential for improved management to enhance local livelihoods and well-being.

In light of this context, the study aims to: (1) ascertain the methods by which coastal households in Jerowaru Village utilize mangrove ecosystems; (2) quantify the impact of mangrove-related activities on household income through a market-based valuation framework; and (3) investigate local perceptions and management obstacles that hinder the economic potential of mangroves. This research offers micro-level empirical evidence from a small-island coastal context, enhancing the literature on mangrove ecosystem service valuation, coastal livelihoods, and nature-based remedies. The results provide policy-relevant insights for formulating community-based mangrove

management and rehabilitation strategies that harmonize conservation objectives with family economic incentives.

## **2. LITERATURE REVIEW**

### **2.1 Mangrove Provides Multifunctional Ecological Services**

Ecologically, mangrove forests have many vital roles. One of their main functions is to protect the coast from abrasion and sea waves (Herison et al., 2024; Nurhayati et al., 2020; Sidik et al., 2018; Yonvitner et al., 2020). Strong mangrove roots prevent soil erosion and reduce the impact of large waves and tropical storms. Mangroves also play an important role as a barrier to seawater intrusion, which protects freshwater sources in coastal areas from saltwater pollution (Lugendo & Kimirei, 2021; Luo et al., 2021; Rakib et al., 2022). Another important function is as a habitat for various types of flora and fauna (Castellanos-Galindo et al., 2021; Ickowitz et al., 2023; Stuthmann et al., 2022; J. Zhao et al., 2022; P. Zhao et al., 2022). Mangrove forests are a place to live, a place to find food, and a place to breed for various marine organisms such as fish, shrimp, crabs, mollusks, and water birds. Therefore, mangrove areas are often referred to as "nursery grounds" for commercial marine biota.

In addition, mangroves act as a very effective carbon sink (Chatting et al., 2020, 2022; Ewers Lewis et al., 2018; Lagomasino et al., 2019). Mangroves are able to store large amounts of carbon, both in plant biomass and in the soil. This makes mangroves an important tool in mitigating global climate change (Agaton & Collera, 2022; Chatting et al., 2022; Sidik et al., 2018). Mangrove forests also act as natural filters. Mangrove roots help filter waste, sediment and heavy metals from river water before it reaches the sea, thereby maintaining coastal water quality and supporting the sustainability of the surrounding marine ecosystem (da Silva Cardoso et al., 2023; Kusumaningtyas Perwitasari et al., 2020; Pringgenies et al., 2021; "Urban Mangrove Wetlands, Challenges and Its Conservation: Sri Lanka Perspectives," 2018).

Mangrove forests are coastal ecosystems that have important ecological functions, such as protecting the coast from abrasion, fish spawning grounds, and absorbing carbon (Agrawal et al., 2016; Asir Ramesh et al., 2022; Ewers Lewis et al., 2018; Liu et al., 2022; Xiong et al., 2024). In addition, mangroves have significant economic value for local communities, especially in the fisheries, forestry, and ecotourism sectors (Castellanos-Galindo et al., 2021; Ickowitz et al., 2023; Lin et al., 2022; Zainal et al., 2023).

### **2.2 Mangrove Ecosystems as Natural Capital for Coastal Livelihoods**

Mangrove ecosystems are widely recognized as a critical component of coastal natural capital, particularly in tropical developing countries where livelihoods are closely linked to ecosystem services. From a livelihood perspective, mangroves support households through direct provisioning services, such as fish, crustaceans, timber, and fuelwood, as

well as indirect services that enhance long-term productivity and risk reduction (Barbier et al., 2011). These services are especially important for small-scale fishers and resource-dependent households with limited access to alternative income sources.

Empirical studies across Southeast Asia, Africa, and Latin America consistently demonstrate that mangroves play a key role in sustaining subsistence consumption and supplementary income (Nyangoko, Shalli, et al., 2022; Salem & Mercer, 2012). Mangrove-associated fisheries, in particular, contribute to food security by supporting juvenile fish and invertebrate populations that are later harvested both within and beyond mangrove forest (Castellanos-Galindo et al., 2021; Ickowitz et al., 2023). However, the magnitude of livelihood benefits varies significantly to locals depending on ecosystem condition, accessibility, and locals' engagement.

Despite their importance, mangroves are often undervalued in local decision-making processes, especially where benefits are diffuse or seasonal. This undervaluation can weaken incentives for conservation and accelerate degradation, creating a negative feedback loop between declining ecosystem quality and household welfare (Barbier et al., 2011).

### **2.3 The Economics Function of Mangrove**

Economically, mangrove forests make a significant contribution, especially for coastal communities that depend on natural resources for their livelihoods. One of the main economic functions of mangroves is as a source of fisheries (Castellanos-Galindo et al., 2021; Ickowitz et al., 2023; Stuthmann et al., 2022; J. Zhao et al., 2022; P. Zhao et al., 2022). Catches such as fish, shrimp, and crabs from mangrove areas are an important livelihood for small fishermen. In addition to wild catches, mangroves also support sustainable cultivation systems, such as silvofishery—a combination of fish/shrimp ponds and mangrove conservation around the ponds. This system increases economic productivity while maintaining the ecosystem. Other products that have economic value are firewood, charcoal, and natural materials from leaves and tree bark for traditional or craft purposes (Aye et al., 2019; Mohamed et al., 2023; Nyangoko, Berg, et al., 2022; Pringgenies et al., 2021; Sondak et al., 2019; “Urban Mangrove Wetlands, Challenges and Its Conservation: Sri Lanka Perspectives,” 2018). Some areas also use mangroves to make natural batik dyes (Pringgenies et al., 2021).

Another economic function that is increasingly developing is in the field of ecotourism (Azzahra et al., 2023; Erlinda et al., 2022; Harto et al., 2021; Utami et al., 2022; Vipriyanti et al., 2024; Zainal et al., 2023). Conserved mangrove forests can be developed as nature-based and educational tourist destinations. Activities such as mangrove forest exploration, boat tours, and planting mangroves with tourists become new sources of income for the community. With good management and active community participation, the ecological and economic functions of mangrove forests can run in balance and strengthen each other. Sustainable conservation is essential so that these benefits can continue to be enjoyed by future generations.

Several studies have confirmed that the existence of mangrove forests supports the productivity of the surrounding waters because they provide shelter and breeding grounds for various species of fish and shrimp that have economic value (Agustriani et al., 2023; Asir Ramesh et al., 2022; Castellanos-Galindo et al., 2021; Ickowitz et al., 2023; Lin et al., 2022; Nyangoko, Shalli, et al., 2022; Stuthmann et al., 2022; Zainal et al., 2023). Thus, the income of communities that depend on marine products is greatly influenced by the existence and condition of mangrove forests.

## **2.4 Economic Valuation of Mangrove Ecosystem Services**

Economic valuation has been widely used to make mangrove ecosystem services visible to policymakers and stakeholders. Valuation studies commonly distinguish between direct use values (e.g. fisheries, timber, tourism), indirect use values (e.g. coastal protection, carbon sequestration), and non-use values (existence and bequest values) (Brander et al., 2024). Among these, direct use values are most readily observed at the household level and are particularly relevant for livelihood-focused research. Market price and production-based approaches are frequently applied to estimate household income derived from mangrove provisioning services (Salem & Mercer, 2012; Sondak et al., 2019). These approaches are well suited to contexts where mangrove products are harvested for subsistence or sold in local markets, as is common in many Indonesian coastal villages. While such methods capture only a subset of total ecosystem value, they provide conservative and policy-relevant estimates of realized economic benefits. In contrast, indirect services such as coastal protection and carbon storage are typically valued using avoided damage costs or benefit transfer methods at regional or national scales. Although these services often exceed direct use values in magnitude, they are less visible to households and therefore less influential in shaping day-to-day livelihood decisions. This gap between ecological importance and perceived household benefits remains a key challenge in mangrove conservation.

Mangrove ecosystems generate multiple ecosystem services that support coastal livelihoods. Within the framework of ecosystem services, mangroves provide provisioning services such as fisheries, crabs, fuelwood, and tourism opportunities that directly contribute to household income. According to the sustainable livelihood framework, natural resources such as mangrove forests represent a form of natural capital that households utilize to sustain their livelihoods and diversify income sources. When mangrove ecosystems degrade, the availability of these services declines, which may reduce household income and weaken incentives for conservation.

## **2.5 Household-Level Dependence and Distributional Considerations**

Numerous researchs emphasize the importance of household-level analysis to understand how ecosystem benefits are distributed within communities (Brander et al., 2024). Aggregate valuation figures may mask significant heterogeneity, where some households rely heavily on mangroves while others benefit marginally or not at all. Such

differences influence attitudes toward conservation, compliance with regulations, and willingness to participate in collective management. Household dependence on mangroves is shaped by socioeconomic factors including occupation, education, asset ownership, and access to alternative livelihoods (Nyangoko, Shalli, et al., 2022). In many cases, poorer households are more dependent on mangrove resources but have limited capacity to engage in sustainable management or value-added activities. This raises important equity considerations and highlights the need for livelihood-sensitive conservation strategies. In Indonesia, household-level studies remain relatively scarce, particularly in small-island and eastern regions. Existing research has largely focused on ecological assessments or aggregate economic values, leaving a gap in understanding how mangrove services translate into actual household income and welfare outcomes at the local scale.

## **2.6 Nature-Based Solutions and Livelihood Resilience**

Nature-based solutions (NbS), including mangrove conservation and rehabilitation, have gained prominence as cost-effective strategies for addressing climate change, coastal hazards, and livelihood vulnerability (Seddon et al., 2020). Mangroves are increasingly promoted as NbS due to their ability to simultaneously provide ecological protection and socioeconomic benefits (Arkema et al., 2013).

However, the success of NbS depends on local incentives and institutional contexts. Where mangrove-related income remains low or uncertain, communities may prioritize short-term extraction over long-term conservation (Barbier et al., 2011). Empirical evidence suggests that NbS are most effective when coupled with livelihood diversification, market access, and community-based management arrangements that enhance tangible benefits at the household level.

This literature underscores the need for empirical studies that link mangrove ecosystem services, household income, and local perceptions, particularly in contexts where mangroves are degraded and underutilized. By providing household-level valuation evidence from East Lombok, this study contributes to a more grounded understanding of how mangrove-based NbS can support sustainable and resilient coastal livelihoods.

Building on the above literature, this study addresses three key gaps, followed by (1) limited household-level valuation evidence from small-island coastal systems in Indonesia; (2) insufficient integration of livelihood dependence and local perceptions into mangrove valuation; and (3) weak empirical grounding of nature-based solution narratives at the community scale. By quantifying realized mangrove income and examining management constraints, this research advances the literature on mangrove ecosystem services from aggregate valuation toward livelihood-relevant, policy-actionable analysis.

### 3. METHODOLOGY

#### 3.1 Study Area and Sampling

The study was conducted in Jerowaru Village, East Lombok, Indonesia, where mangrove forests cover approximately 10 hectares. The mangrove area is partially utilized for fisheries, firewood collection, and small-scale ecotourism. A household-level survey was conducted between September 2024 to December 2024, targeting residents living within a 2 km radius of the mangrove forest. A total of 115 respondents were selected using purposive sampling. Eligibility criteria included: (1) minimum age of 17 years, and (2) residence in the village for at least one year. This approach ensured that respondents had sufficient experience interacting with the mangrove ecosystem.

The study employed purposive sampling to select households that directly depend on mangrove resources. A total of XX households were surveyed in Jerowaru Village. Although the sampling method limits statistical generalization to the broader population, the approach allows for in-depth analysis of households actively engaged in mangrove-based livelihoods. Jerowaru Village was selected due to its proximity to significant mangrove ecosystems and the high dependence of local communities on coastal resources.

#### 3.2 Data Collection

To gather primary empirical data, this study deployed a multi-method approach consisting of focus group discussions, direct face-to-face interviews, and semi-structured questionnaires. The survey instruments delineated the participants' socio-demographic profiles; encompassing age, sex, educational background, and employment status alongside household financial metrics and specific patterns of mangrove resource utilization. Respondents quantified either their physical harvest volumes or the revenue generated from various ecosystem services, specifically tourism, firewood collection, and marine harvesting (crabs, prawns, and fish). Furthermore, local perceptions of environmental preservation were assessed using a 5-point Likert scale, spanning from 1 (not important) to 5 (very important). Willingness to pay for mangrove conservation programs was also assessed to capture perceived benefits and conservation incentives.

#### 3.3 Valuation Approach

This study adopts a direct use-value valuation framework, focusing on provisioning ecosystem services that generate observable income at the household level. This approach is widely applied in mangrove valuation studies where livelihoods are dominated by small-scale, informal, and subsistence-oriented activities of locals (Salem & Mercer, 2012; Vo et al., 2012). The valuation deliberately excludes regulating and cultural services (e.g., coastal protection, carbon sequestration) from monetary

estimation due to data constraints and the difficulty of attributing these benefits directly to individual households. As such, the estimated values represent a conservative lower bound of the total economic value of mangroves. Furthermore, willingness-to-pay (WTP) analysis employed a simplified contingent valuation approach in which respondents were asked whether they would be willing to contribute financially to mangrove conservation programs and the maximum amount they would be willing to pay.

### 3.4 Valuation Equations

Household income derived from mangrove-related activities was calculated using the market price method. For each household  $i$ , the monthly value of mangrove benefits ( $V_i$ ) is defined as:

$$V_i = \sum_{j=1}^n (Q_{ij} \times P_j) \quad (1)$$

Where:

$Q_{ij}$  = quantity of mangrove-related product  $j$  harvested or service provided by household  $i$  per month

$P_j$  = local market price of product or service  $j$

$n$  = number of mangrove-related activities (fish, crabs, prawns, firewood, tourism)

Household income derived from mangrove-related activities was estimated using self-reported quantities of harvested resources multiplied by prevailing local market prices. To minimize recall bias, respondents were asked to report production levels based on their most recent harvesting period and typical monthly activities. Price data were cross-checked with local traders and village market prices. The income estimates reported in this study represent gross income and do not deduct operational costs due to the small-scale and informal nature of most mangrove-based activities. These techniques aim to minimize recall bias. All values are reported in Indonesian Rupiah (IDR). Hence, to assess the economic importance of mangrove resources, the share of mangrove-derived income relative to total household income was calculated for each respondent household.

$$\text{Contribution (\%)} = \text{Mangrove Income} / \text{Total Household Income} \times 100 \quad (2)$$

## 4. RESULTS AND DISCUSSION

Spanning approximately 10 hectares within Jerowaru Village in East Lombok, Indonesia, this specific mangrove ecosystem has been partially repurposed for community-led initiatives. Specifically, local residents have allocated a tenth of this total expanse for the establishment of a sustainable ecotourism zone.

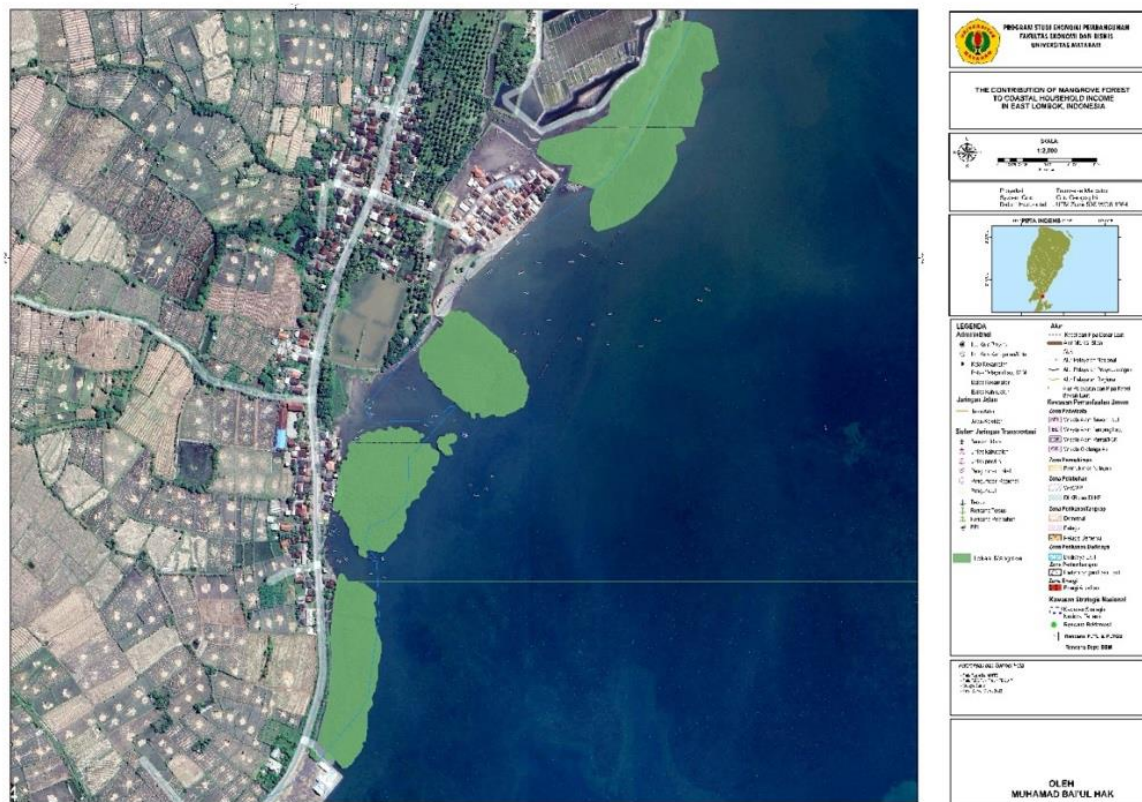


Figure 1. Work during recession

As detailed in Table 1, the demographic profile of the participants reveals that the vast majority (96%) fall within the active age brackets of 17–35 and 36–55 years. In terms of gender distribution, males represent 56.5% of the cohort, while females account for 43.5%. The data also highlights a predominantly lower level of formal education among the community members residing adjacent to the mangrove forest; specifically, 38.8% of respondents completed only six years of primary schooling, followed by 30.2% and 25.9% who finished nine and twelve years of education, respectively. Occupationally, fishing emerges as the primary livelihood, engaging 32.8% of the sample, with farming (18.1%) and manual labor (17.2%) constituting the next most prevalent economic activities.

Table 1. Demographic Profile of Respondents

Variable	Responses	Frequency	Percentage (%)
Age	17-35	58	50.4
	36-55	53	46.1
	> 55	4	3.5
Sex	Male	65	56.5
	Female	50	43.5
Education (Year)	6	45	38.8
	9	35	30.2
	12	30	25.9
	16	5	4.3
Occupation	Farmer	21	18.1
	Fisherman	38	32.8
	Labor	20	17.2
	Retail	13	11.2
	Entrepreneur	10	8.6
	Housewife	4	3.4
Others	9	7.8	

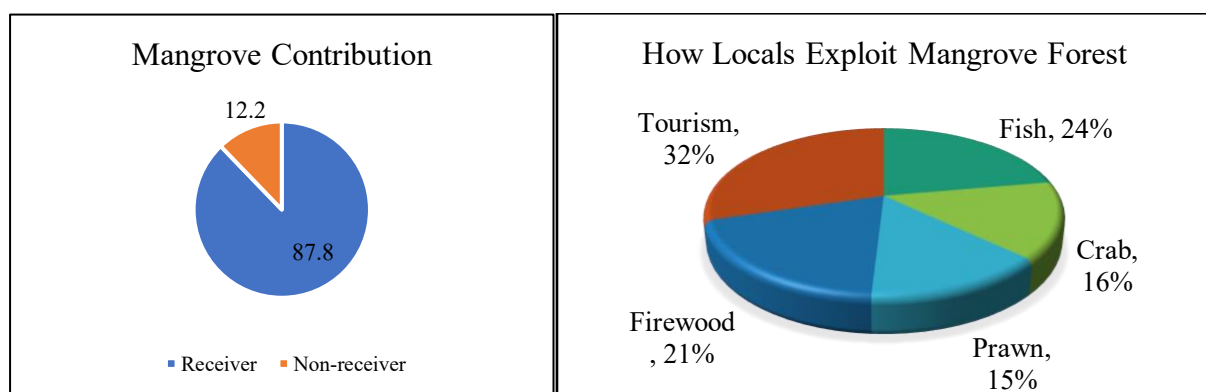
Variable	Responses	Frequency	Percentage (%)
Awareness Level	Very Important	81	70.4
	Important	32	27.8
	Neutral	2	1.7
Total		115	100.0

The local population exhibits a strong theoretical commitment to conservation; survey data shows that 70.4% view mangrove protection as essential, 27.8% classify it as important, and a negligible 1.7% remain neutral. However, a distinct disconnect exists between these pro-environmental attitudes and actual behavioral execution. While residents express a willingness to financially back preservation efforts, their concrete financial commitment is minimal.

**Table 2.** Distribution of Respondents' Monthly Willingness to Pay (WTP) Thresholds

Amount of Money (IDR)	Frequency	Percentage (%)
Less than 5,000	36	31.1
5,000 – 10,000	53	46.1
15,000 – 20,000	15	13.0
More than 20,000	11	9.6
Total	115	100.0

As illustrated in Table 2, a substantial 77.2% of participants would only contribute less than IDR 10,000 monthly to a preservation fund. Meanwhile, roughly 13% are willing to allocate between IDR 15,000 and IDR 20,000, and a small minority (9.6%) are prepared to contribute upwards of IDR 20,000 per month. This constrained Willingness to Pay (WTP) suggests that community members perceive the direct benefits of mangrove ecosystems to be low, an outlook that is further reinforced by the region's depressed household income levels.



**Figure 2.** Socio-Economic Utilization of Mangrove Forests by Local Communities

As illustrated in Figure 2, the vast majority of the surveyed cohort (87.8%) actively utilize mangrove resources through a combination of ecotourism initiatives, firewood collection, and various fisheries, specifically targeting fish, crabs, and prawns. Conversely, approximately 12.2% of the participants derive no direct utility or benefits from these coastal forest ecosystems. The local community engages with the mangrove ecosystem through diverse economic pathways. According to the data, tourist-related operations represent 32% of this engagement, while fisheries serve as another major component, specifically divided into fish harvesting (24%), crabbing (16%), and prawn collection (15%). In addition to these commercial and food-sourcing activities, the

extraction of forest biomass for firewood accounts for the remaining 21% of local utilization.

The dominance of tourism, fishing, and firewood collection as income sources reflects the limited diversification of mangrove-based livelihoods in Jerowaru Village. Although respondents expressed high awareness of the importance of mangrove conservation, this awareness does not translate into strong conservation behavior or willingness to invest financially in preservation. This gap suggests that perceived economic returns from mangroves are insufficient to motivate active stewardship. These findings are supported by previous researches that mangroves contribute insignificantly due to human behaviour (Dookie et al., 2025; Ordóñez & Arenas, 2019).

**Table 3.** Financial Contribution of Mangrove Services to Households (IDR/Month)

Economic Value of Ecosystem Services (IDR)	Frequency	Percentage (%)
0	14	12.2
100,000 – 250,000	65	56.5
250,001 – 500,000	27	23.5
More than 500,000	9	7.8
Total	115	100.0

Based on table 3, mangrove forests provide important economic benefits for coastal communities. There are 101 respondents (87.8%) get benefit from mangrove in total dan the rest gain zero benefit. Following by 65 respondents (56.5%) benefit from mangroves between IDR 100,000 to IDR 250,000 per month. Then, 27 respondents (23.5%) get IDR 250,001 to IDR 500,000 per month and only 9 people (7.8%) gain more than IDR 500,000 per month. On the other hand, there are 14 respondents (12.2%) have nothing from mangroves. This finding aligns with previous studies showing that mangroves often provide supplementary rather than primary income, particularly in degraded or poorly managed systems (Nyangoko, Shalli, et al., 2022; Salem & Mercer, 2012).

In the context of policy aspect, these results show the importance of linking mangrove conservation with measurable livelihood improvements. Nature-based solutions such as mangrove rehabilitation have strong potential to generate ecosystem productivity and increase household income, but only if accompanied by institutional support, capacity building, and market access (Arkema et al., 2013; Seddon et al., 2020).

## 5. CONCLUSION

This study examined the contribution of mangrove ecosystems to coastal household income in Jerowaru Village, East Lombok, Indonesia. The findings show that mangroves provide direct but modest economic benefits to coastal households through ecotourism, fish harvesting, firewood collection, crab catching, and prawn gathering. Although 87.8% of respondents receive benefits from mangrove resources, most households gain only IDR 100,000–250,000 per month, indicating that mangrove-based activities remain supplementary rather than primary sources of income. These findings confirm that mangroves support household welfare, but their realized economic value remains constrained by limited livelihood diversification, weak value-added activities, and insufficient economic incentives for conservation.

The study contributes to the literature on environmental economics, coastal development, sustainable livelihoods, and community-based natural resource governance by providing household-level evidence from a small-island Indonesian context. Unlike studies that emphasize aggregate ecological values or potential economic benefits, this research highlights the actual income experienced by local households and shows how tangible economic returns shape conservation incentives. The finding that conservation awareness is high while willingness to pay remains low indicates that ecological concern alone is insufficient to sustain community-based mangrove protection when livelihood returns are limited. This underscores the importance of linking conservation agendas with household welfare, livelihood resilience, and inclusive local development.

The policy implication is that mangrove conservation should be integrated with development strategies that improve household welfare and strengthen local stewardship. Local governments and community-based institutions should enhance fisheries productivity, improve ecotourism management, develop value-added mangrove-based products, and expand market access for coastal households. Such interventions can increase both the perceived and actual economic returns from conservation. This study is limited by its focus on direct use values, cross-sectional household data, and purposive sampling. Future research should incorporate seasonal and longitudinal data, compare multiple coastal communities, and estimate indirect and non-market ecosystem services, including coastal protection, carbon sequestration, biodiversity, and cultural values. Further studies should also examine how institutions, property rights, collective action, and local financing mechanisms influence the effectiveness of mangrove governance and nature-based development in Indonesia and comparable developing economies.

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### Author Contributions

M.B.H: Conceptualization, Formal Analysis, Writing – Original Draft Preparation, Writing – Review & Editing

R.N: Data Curation, Visualization

M.D.F: Funding Acquisition, Investigation, Project Administration

A.F: Resources, Software

P.P: Supervision, Validation

D.K: Methodology

### Disclosure Statement

No potential conflict of interest has been reported by the author(s).

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## REFERENCES

Agaton, C. B., & Collera, A. A. (2022). Now or later? Optimal timing of mangrove rehabilitation under climate change uncertainty. *Forest Ecology and Management*, 503. <https://doi.org/10.1016/j.foreco.2021.119739>

- Agrawal, M., Reddy, D. S., & Prasad, R. C. (2016). Automatic Extraction of Mangrove Vegetation from Optical Satellite Data. *The International Archives of the Photogrammetry, Remote Sensing and Spatial Information Sciences*, XLI-B8. <https://doi.org/10.5194/isprs-archives-xli-b8-555-2016>
- Agustriani, F., Iskandar, I., Yazid, M., & Fauziyah. (2023). Economic Valuation of Mangrove Ecosystem Services in Sembilang National Park of South Sumatra, Indonesia. *Journal of Hunan University Natural Sciences*, 50(1). <https://doi.org/10.55463/issn.1674-2974.50.1.16>
- Arifin, M., Rasyid, A. R., Jamaluddin, J., Setyo, D. P., & Armansyah, A. (2019). The existence of a mangrove ecosystem as nature tourism-based on global warming mitigation in Lakkang island. *IOP Conference Series: Earth and Environmental Science*, 235(1). <https://doi.org/10.1088/1755-1315/235/1/012014>
- Arkema, K. K., Guannel, G., Verutes, G., Wood, S. A., Guerry, A., Ruckelshaus, M., Kareiva, P., Lacayo, M., & Silver, J. M. (2013). Coastal habitats shield people and property from sea-level rise and storms. *Nature Climate Change*, 3(10). <https://doi.org/10.1038/nclimate1944>
- Asir Ramesh, D., Karthi, N., Dhivya, S., Infantina, A., & Priya, P. (2022). Economic assessment mangrove ecosystems' goods services of India. *Journal of Social Review and Development*, 1(2).
- Aung, T. S., Overland, I., Vakulchuk, R., & Xie, Y. (2022). The environmental burdens of special economic zones on the coastal and marine environment: A remote sensing assessment in Myanmar. *Remote Sensing Applications: Society and Environment*, 28. <https://doi.org/10.1016/j.rsase.2022.100809>
- Aye, W. N., Wen, Y., Marin, K., Thapa, S., & Tun, A. W. (2019). Contribution of mangrove forest to the livelihood of local communities in Ayeyarwaddy Region, Myanmar. *Forests*, 10(5). <https://doi.org/10.3390/f10050414>
- Azzahra, P. R., Sumarga, E., & Sholihah, A. (2023). Mangrove ecotourism development at Karimunjawa National Park, Indonesia. *Biodiversitas*, 24(8). <https://doi.org/10.13057/biodiv/d240827>
- Barbier, E. B., Hacker, S. D., Kennedy, C., Koch, E. W., Stier, A. C., & Silliman, B. R. (2011). The value of estuarine and coastal ecosystem services. *In Ecological Monographs*, 81(2). <https://doi.org/10.1890/10-1510.1>
- Brander, L. M., de Groot, R., Schägner, J. P., Guisado-Goñi, V., van 't Hoff, V., Solomonides, S., McVittie, A., Eppink, F., Sposato, M., Do, L., Ghermandi, A., Sinclair, M., & Thomas, R. (2024). Economic values for ecosystem services: A global synthesis and way forward. *Ecosystem Services*, 66. <https://doi.org/10.1016/j.ecoser.2024.101606>
- Cahyaningsih, A. P., Deanova, A. K., Pristiawati, C. M., Ulumuddin, Y. I., Kusumawati, L., & Setyawan, A. D. (2022). Review: Causes and impacts of anthropogenic activities on mangrove deforestation and degradation in Indonesia. *International Journal of Bonorowo Wetlands*, 12(1). <https://doi.org/10.13057/bonorowo/w120102>
- Castellanos-Galindo, G. A., Baos, R. A., & Zapata, L. A. (2021). Mangrove-associated fish assemblages off the southern Panama Bight region (tropical eastern Pacific). *Neotropical Ichthyology*, 19(4). <https://doi.org/10.1590/1982-0224-2021-0025>
- Chatting, M., Al-Maslamani, I., Walton, M., Skov, M. W., Kennedy, H., Husrevoglu, Y. S., & Le Vay, L. (2022). Future Mangrove Carbon Storage Under Climate Change and Deforestation. *Frontiers in Marine Science*, 9. <https://doi.org/10.3389/fmars.2022.781876>

- Chatting, M., LeVay, L., Walton, M., Skov, M. W., Kennedy, H., Wilson, S., & Al-Maslamani, I. (2020). Mangrove carbon stocks and biomass partitioning in an extreme environment. *Estuarine, Coastal and Shelf Science*, 244. <https://doi.org/10.1016/j.ecss.2020.106940>
- da Silva Cardoso, A., Kohlman Rabbani, E. R., Dayse Delmiro, T., Bezerra Moccock, J. F., da Silva, S. P. R., Filippelli, G., da Silva Macedo, J. V., & Barreto Monteiro, E. C. (2023). Mollusk shell waste: alternatives for reuse in construction. *International Journal of Environment and Waste Management*, 31(1). <https://doi.org/10.1504/IJEWMM.2023.129727>
- Dookie, S., Ansari, A. A., & Jaikishun, S. (2025). Forest-fire interactions, impacts, and implications: a focus on mangroves. *In New Zealand Journal of Forestry Science*, 55. <https://doi.org/10.33494/nzjfs552025x405x>
- Erlinda, S., Mulyadi, A., Zulkarnain, & Suwondo. (2022). Policy Strategy for Sustainable Management of Mangrove Ecotourism in Siak Regency, Riau Province, Indonesia. *International Journal of Sustainable Development and Planning*, 17(1). <https://doi.org/10.18280/ijstdp.170117>
- Ewers Lewis, C. J., Carnell, P. E., Sanderman, J., Baldock, J. A., & Macreadie, P. I. (2018). Variability and Vulnerability of Coastal 'Blue Carbon' Stocks: A Case Study from Southeast Australia. *Ecosystems*, 21(2). <https://doi.org/10.1007/s10021-017-0150-z>
- Harto, S., Sidiq, R. S. S., & Karneli, O. (2021). Development Strategy Mangrove Ecotourism Based on Local Wisdom. *Sosiohumaniora*, 23(1). <https://doi.org/10.24198/sosiohumaniora.v23i1.31315>
- Herison, A., Bengen, D. G., Putra, A. D., Romdania, Y., Sanjaya, A., & Arief, F. D. (2024). Effects of Avicennia Marina Mangrove Sedimentation on Wave Attenuation. *Jurnal Teknologi*, 86(2). <https://doi.org/10.11113/jurnalteknologi.v86.19492>
- Ickowitz, A., Lo, M. G. Y., Nurhasan, M., Maulana, A. M., & Brown, B. M. (2023). Quantifying the contribution of mangroves to local fish consumption in Indonesia: a cross-sectional spatial analysis. *The Lancet Planetary Health*, 7(10). [https://doi.org/10.1016/S2542-5196\(23\)00196-1](https://doi.org/10.1016/S2542-5196(23)00196-1)
- Kusumaningtyas Perwitasari, W., Muhammad, F., & Wasiq Hidayat, J. (2020). Silvofishery as an alternative system of sustainable aquaculture in mororejo village, kendal regency. *E3S Web of Conferences*, 202. <https://doi.org/10.1051/e3sconf/202020206043>
- Lagomasino, D., Fatoyinbo, T., Lee, S., Feliciano, E., Trettin, C., Shapiro, A., & Mangora, M. M. (2019). Measuring mangrove carbon loss and gain in deltas. *Environmental Research Letters*, 14(2). <https://doi.org/10.1088/1748-9326/aaf0de>
- Lin, R., Yu, S., & Hong, B. (2022). Socioeconomic Patterns for Global Mangrove Cover Changes with Multi-Database Analyses. *Wetlands*, 42(2). <https://doi.org/10.1007/s13157-022-01535-9>
- Liu, J., Li, Y., Duan, D., Peng, G., Li, P., Lei, P., Zhong, H., Tsui, M. T. K., & Pan, K. (2022). Effects and mechanisms of organic matter regulating the methylmercury dynamics in mangrove sediments. *Journal of Hazardous Materials*, 432. <https://doi.org/10.1016/j.jhazmat.2022.128690>
- Lugendo, B. R., & Kimirei, I. A. (2021). Anthropogenic nitrogen pollution in mangrove ecosystems along Dar es Salaam and Bagamoyo coasts in Tanzania. *Marine Pollution Bulletin*, 168. <https://doi.org/10.1016/j.marpolbul.2021.112415>

- Luo, Y. Y., Not, C., & Cannicci, S. (2021). Mangroves as unique but understudied traps for anthropogenic marine debris: A review of present information and the way forward. *In Environmental Pollution*, 271. <https://doi.org/10.1016/j.envpol.2020.116291>
- Mohamed, M. K., Adam, E., & Jackson, C. M. (2023). The Spatial and Temporal Distribution of Mangrove Forest Cover from 1973 to 2020 in Chwaka Bay and Menai Bay, Zanzibar. *Applied Sciences (Switzerland)*, 13(13). <https://doi.org/10.3390/app13137962>
- Nabilah, R., Sitanggang, F. I., & Rahayu, Y. (2021). Mangrove Species Diversity, Stand Structure, and Zonation - A Case Study at Pahawang Kecil Island. *IOP Conference Series: Earth and Environmental Science*, 830(1). <https://doi.org/10.1088/1755-1315/830/1/012004>
- Nurhayati, A. P., Raka Siwi, B. R. F., & Muzoffar, C. A. (2020). Mangrove conservation in coastal areas Samas beach lagoon for controlling sea water abrasion. *Proceedings of the 7th International Conference on Asian and Pacific Coasts, APAC 2013*.
- Nyangoko, B. P., Berg, H., Mangora, M. M., Shalli, M. S., & Gullström, M. (2022). Local perceptions of changes in mangrove ecosystem services and their implications for livelihoods and management in the Rufiji Delta, Tanzania. *Ocean and Coastal Management*, 219. <https://doi.org/10.1016/j.ocecoaman.2022.106065>
- Nyangoko, B. P., Shalli, M. S., Mangora, M. M., Gullström, M., & Berg, H. (2022). Socioeconomic determinants of mangrove exploitation and management in the Pangani River Estuary, Tanzania. *Ecology and Society*, 27(2). <https://doi.org/10.5751/ES-13227-270232>
- Ordóñez, O. G., & Arenas, M. R. B. (2019). Impacts of marine debris contamination in the mangrove ecosystem of the Ciénaga Grande de Santa Marta, Colombian Caribbean. *Revista Ciencias Marinas y Costeras*, 11(2). <https://doi.org/10.15359/revmar.11-2.8>
- Pringgenies, D., Ridlo, A., Fatma Dewi, L., & Djunaedi, A. (2021). The Commercial Value of Mangrove-Based Pigments as Natural Dye for Batik Textiles. *In Mangrove Ecosystem Restoration [Working Title]*. IntechOpen. <https://doi.org/10.5772/intechopen.95341>
- Rakib, M. R. J., Hossain, M. B., Islam, M. S., Hossain, I., Rahman, M. M., Kumar, R., & Sharma, P. (2022). Ecohydrological features and biodiversity status of estuaries in Bengal delta, Bangladesh: A comprehensive review. *In Frontiers in Environmental Science*, 10. <https://doi.org/10.3389/fenvs.2022.990099>
- Rumondang, R., Feliatra, F., Warningsih, T., & Yoswati, D. (2024). Sustainable management model and ecosystem services of mangroves based on socio-ecological system on the coast of Batu Bara Regency, Indonesia. *Environmental Research Communications*, 6(3). <https://doi.org/10.1088/2515-7620/ad2d01>
- Salem, M. E., & Mercer, D. E. (2012). The economic value of mangroves: A meta-analysis. *Sustainability*, 4(3). <https://doi.org/10.3390/su4030359>
- Seddon, N., Sengupta, S., Hauler, I., & Rizvi, A. R. (2020). Nature-based solutions in nationally determined contributions - IUCN Library System. *Gland, Switzerland and Oxford, UK: IUCN and University of Oxford*.
- Sidik, F., Supriyanto, B., Krisnawati, H., & Muttaqin, M. Z. (2018). Mangrove conservation for climate change mitigation in Indonesia. *In Wiley Interdisciplinary Reviews: Climate Change*, 9(5). <https://doi.org/10.1002/wcc.529>

- Son, L. V., Phong, N. V., Kien, T. T., Chau, N. T. P., Hoa, L. T., & Le Phu, V. (2022). Impacts of Livelihood Activities on the Environment and Natural Resources of Can Gio Mangrove Forest, Ho Chi Minh City. *IOP Conference Series: Earth and Environmental Science*, 964(1). <https://doi.org/10.1088/1755-1315/964/1/012014>
- Sondak, C. F. A., Kaligis, E. Y., & Bara, R. A. (2019). Economic valuation of Lansia Mangrove forest, north Sulawesi, Indonesia. *Biodiversitas*, 20(4). <https://doi.org/10.13057/biodiv/d200407>
- Stuthmann, L. E., Castellanos-Galindo, G. A., & Robertson, D. R. (2022). The functional ecology of mangrove fishes across the Isthmus of Panama. *Diversity and Distributions*, 28(8). <https://doi.org/10.1111/ddi.13519>
- Urban Mangrove Wetlands, Challenges and its Conservation: Sri Lanka Perspectives. (2018). *International Journal of Research Studies in Biosciences*, 6(3). <https://doi.org/10.20431/2349-0365.0603005>
- Utami, T. N., Fattah, M., & Intyas, C. A. (2022). The System Dynamic of Mangrove Ecotourism of “Kampung Blekok” Situbondo East Java Indonesia: Economic and Ecological Dimension. *Environmental Research, Engineering and Management*, 78(2). <https://doi.org/10.5755/j01.erem.78.2.30322>
- Veettil, B. K. (2022). Current status of mangrove vegetation in Batticaloa Lagoon, Sri Lanka, using high-resolution satellite imagery. *Journal of Coastal Conservation*, 26(6). <https://doi.org/10.1007/s11852-022-00923-x>
- Vipriyanti, N. U., Semadi, I. G. N. M. D., & Fauzi, A. (2024). Developing mangrove ecotourism in Nusa Penida Sacred Island, Bali, Indonesia. *Environment, Development and Sustainability*, 26(1). <https://doi.org/10.1007/s10668-022-02721-9>
- Vo, Q. T., Kuenzer, C., Vo, Q. M., Moder, F., & Opetl, N. (2012). Review of valuation methods for mangrove ecosystem services. In *Ecological Indicators*, 23. <https://doi.org/10.1016/j.ecolind.2012.04.022>
- Wahyuni, E., Zulhafandi, Hendris, & Jarin. (2021). Detection of Community Knowledge Level of Economic, Ecological Benefits and Causes of Damage to Mangrove Forest Ecosystems. *IOP Conference Series: Earth and Environmental Science*, 748(1). <https://doi.org/10.1088/1755-1315/748/1/012017>
- Xiong, Y., Dai, Z., Long, C., Liang, X., Lou, Y., Mei, X., Nguyen, B. A., & Cheng, J. (2024). Machine Learning-Based examination of recent mangrove forest changes in the western Irrawaddy River Delta, Southeast Asia. *Catena*, 234. <https://doi.org/10.1016/j.catena.2023.107601>
- Yonvitner, Perdinan, Agus, S. B., Rusrita, G., Ramadhani, R. A., & Akmal, S. G. (2020). Mangrove governance: Establish a new paradigm of mangrove management "from village to the world". *IOP Conference Series: Earth and Environmental Science*, 550(1). <https://doi.org/10.1088/1755-1315/550/1/012012>
- Zainal, S., Ilham, I., Nirzalin, Fakhurrazi, & Yunanda, R. (2023). Rationality of Developing the Protected Mangrove Forests as Ecotourism. *Revista de Gestao Social e Ambiental*, 17(7). <https://doi.org/10.24857/rgsa.v17n7-010>
- Zhao, J., Li, C., Wang, T., Li, C., Shen, J., Liu, Y., & Wu, P. (2022). Distribution Pattern of Mangrove Fish Communities in China. *Biology*, 11(12). <https://doi.org/10.3390/biology11121696>
- Zhao, P., Sanganyado, E., Wang, T., Sun, Z., Jiang, Z., Zeng, M., Huang, Z., Li, Y., Li, P., Bi, R., & Liu, W. (2022). Accumulation of nutrients and potentially toxic elements in

plants and fishes in restored mangrove ecosystems in South China. *Science of the Total Environment*, 838. <https://doi.org/10.1016/j.scitotenv.2022.155964>