

# Mangrove ecotourism development at Karimunjawa National Park, Indonesia

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**Abstract.** *Azzahra PR, Sumarga E, Sholihah A. 2023. Mangrove ecotourism development at Karimunjawa National Park, Indonesia. Biodiversitas 24: 4457-4468.* Karimunjawa National Park (KJNP) is a marine conservation area with a high potential for developing mangrove ecotourism in Indonesia. Several essential aspects should be adequately understood to support mangrove ecotourism in KJNP, including the potential of tourism attractions, the ecological carrying capacity for tourism, the potential support from stakeholders, and the best strategies based on the latest conditions. This study aimed to (i) identify and analyze the potential of mangrove ecotourism attractions in KJNP, (ii) analyze the carrying capacity for mangrove ecotourism, (iii) analyze the level of influence and interest of stakeholders, and (iv) determine strategies for developing mangrove ecotourism in KJNP. The ecotourism attraction potentials were analyzed using a modified version of the assessment of Natural Tourism Attraction Objects (NTAO) (*Objek Daya Tarik Wisata Alam-ODTWA*). The carrying capacity was analyzed using the Area Carrying Capacity concept. The influence and interest level of stakeholders were analyzed using the economic characteristics of the community and the stakeholder grids. The strategy for developing mangrove ecotourism was determined using Strength, Weakness, Opportunity, Threat (SWOT), and Quantitative Strategic Planning Matrix (QSPM) analyses. The results showed that mangrove ecotourism in KJNP is highly potential and feasible to be developed based on the assessment of 15 criteria of NTAO with a carrying capacity of ca. 104 visitors/day. About 96% of the community agrees to support the development of mangrove ecotourism in KJNP. Karimunjawa National Park Office and the local community were identified as essential players from the eight recognizable stakeholders. Seven main strategies were formulated for developing mangrove ecotourism in KJNP, with the improvement of cooperation among stakeholders in developing facilities and tourist attractions and promoting mangrove ecotourism was perceived as the most urgent strategy to be implemented.

**Keywords:** Carrying capacity, community, ecotourism, mangrove, marine national park

## INTRODUCTION

Indonesia is an archipelagic country, having more than 17,504 islands and about 95,181 km of coastlines, which bears mangroves from several meters to several kilometers (Kusmana 2014). Indonesian coastal areas are characterized by unique ecosystems, including mangrove ecosystems that cover about 3.1 million hectares or approximately 20% of the global mangrove area (Kusmana 2015; Kusmana and Sukristijiono 2016). These mangroves are typically located between terrestrial and marine ecosystems and provide various benefits, especially for local communities (Kusmana 2015).

Mangrove ecosystems provide ecosystem services consisting of provisioning, regulating, supporting, and cultural services to support the livelihoods of coastal communities (Gnansounou et al. 2022). The provisioning services of mangroves include wood, construction materials, and medicines. Regulating mangroves' services covers their crucial ecological functions, including coastal erosion control, sediment stabilization, and salt intrusion prevention (Rizal and Dewanti 2017). The mangrove ecosystem in several places in Indonesia is also managed as a silvofishery area that combines the provisioning services,

such as fish and shrimp production, and the optimization of regulating services, such as carbon sequestration and carbon storage (Sumarga et al. 2022). Supporting services of mangroves include supplying organic detritus and nutrients to adjacent coastal waters (Rizal and Dewanti 2017). The cultural services of mangroves are mainly in their aesthetic value, cultural heritage, tourism, recreation, and education (Mehvar et al. 2018).

One type of cultural service that combines tourism, recreation, and education is called ecotourism (Ranjith 2020). Ecotourism encourages regional economic growth to improve local communities' welfare. It maintains the conservation of natural resources, especially biodiversity, as a tourist attraction that emphasizes minimizing negative environmental impacts (Fennell 2014; Sangpikul 2017). Ecotourism usually occurs in areas of natural richness, such as mangroves, with a high potential for development due to the unique characteristics of flora and fauna (Swangjang and Kornpiphat 2021). Mangrove ecotourism positively impacts preserving mangrove natural resources, economic growth, and coastal community welfare (Musa et al. 2020).

Karimunjawa National Park (KJNP) is a marine conservation area that consists of 19 islands located in the middle of the Java Sea, Indonesia. Mangrove forest is one

of the main ecosystem types in KJNP, primarily located in Kemujan Island with an area of 222 hectares (BTNKJ 2017). More than 80% of the population in KJNP depend on coastal natural resources for their livelihood, both as fishermen and tourism actors (Fafurida 2020). The mangrove ecosystem in KJNP has the potential to be developed for ecotourism. There are 24 valid mangrove species and 15 associated mangrove species in KJNP that potentially become tourist attractions (BTNKJ 2019). Mangrove tourism facilities have been developed, including a mangrove track on Kemujan Island in the KJNP area.

Several vital aspects should be adequately understood to support mangrove ecotourism in KJNP, including the potential of tourism attractions, the ecological carrying capacity of tourism, the potential support from stakeholders, and the best strategies based on current conditions. Considering their functions, benefits, sustainability, and community welfare, studying the strategy for managing and developing mangrove ecotourism in KJNP is necessary. Managers must highlight the uniqueness of their potential resources and offer mangroves as ecotourism products that lead to protecting the area. In addition, ecotourism should be developed to provide social and economic benefits to the local communities. The selected management strategy should integrate the interests of managers and local communities into management. This is crucial in the conservation area management in Indonesia, which generally deals with potential disturbances caused by human activities (Sumarga et al. 2021).

This study aims to analyze potential mangrove ecotourism attractions in KJNP, which include the carrying capacity for mangrove ecotourism, the level of influence and interest of the interested parties, and the proposal for developing mangrove ecotourism in KJNP. This study comprehensively addresses several central aspects of mangrove ecotourism development, which represents the strength of this study. This study potentially enriches scientific knowledge in conservation ecotourism management. This study also potentially supports the development of mangrove ecotourism in KJNP, which can

be implemented in other mangrove ecosystems in Indonesia and elsewhere.

## MATERIALS AND METHODS

### Study area

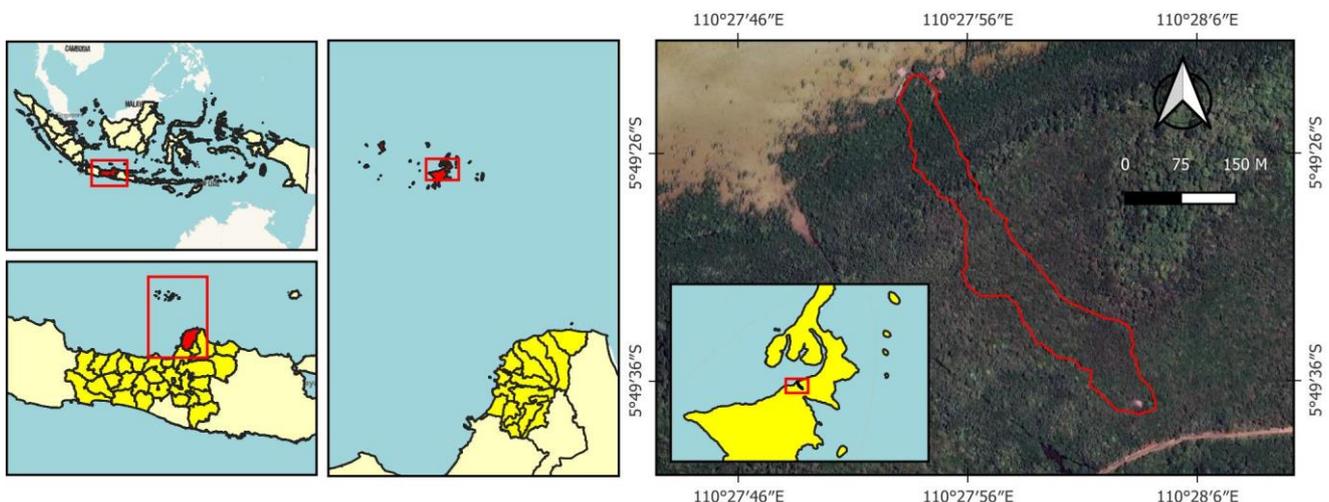
This research was conducted in the Karimunjawa National Park (KJNP) mangrove track, Jepara District, Central Java Province, Indonesia (Figure 1). KJNP is geographically located at coordinates 5°40'39"-5°55'00" S and 110°05' 57"-110°31'15" E. Mangrove ecosystem covers an area of 222 hectares or 0.2 % of KJNP area.

### Data collection and analysis

This study assessed the potential of natural tourism attractions, estimated the carrying capacity for mangrove ecotourism, analyzed the roles and interests of stakeholders, and determined the strategies for developing mangrove ecotourism using Strength, Weakness, Opportunity, Threat and Quantitative Strategic Planning Matrix (SWOT-QSPM) analysis. The procedures for data collection and analysis are as follows.

### Assessment of natural tourism attraction

The potential for natural tourism attractions was assessed by the modified guidance for Analysis of Operational Areas for Natural Tourism Attraction Objects (AOA-NTAO) (*Analisis Daerah Operasi Objek Daya Tarik Wisata Alam-ADO-ODTWA*) published by the Directorate General of Forest Protection and Nature Conservation (2003). Questionnaires were asked to visitors regarding the attractiveness of mangrove tourism objects using an accidental sampling method (Etikan et al. 2016), with some 60 respondents. This is done because the number of visitors is not certain. After all, tourists are relatively low for each day. The number of samples used for accidental sampling was  $n \geq 30$ ; based on statistics, the number of samples of more than 30 can be assumed to be normally distributed and categorized as a large sample (Kwak and Kim 2017).



**Figure 1.** Map of the study area at Karimunjawa National Park, Central Java, Indonesia

The natural tourism attractions were analyzed by valuing all AOA-NTAO criteria elements. There are 15 criteria for this analysis. The following formula calculated the score for each criterion:

$$S = N \times B$$

Where:

S : Score

N : Value of elements in the criterion

B : Weight

The score obtained was then compared with the total score of each criterion. The feasibility level was calculated using the following formula:

$$\text{Eligibility level (\%)} = \frac{S \text{ total}}{S \text{ maximum}} \times 100\%$$

The eligibility classification for an ecotourism area is presented in Table 1.

#### Mangrove ecotourism carrying capacity

The carrying capacity of mangrove ecotourism was calculated using the concept of Area Carrying Capacity. The carrying capacity of an area is the maximum number of physical visitors that can be accommodated in a specific time and space without disturbance to nature and humans, calculated using the following formula (Yulianda 2019).

$$\text{Area carrying capacity} = K \times \frac{Lp}{Lt} \times \frac{Wt}{Wp}$$

Where:

K : Potential ecological visitors per unit area = 1 person

LP : area or length of area utilized for mangrove ecotourism

Lt : Minimum area required by visitors for comfortable mangrove ecotourism activities

Wt : Area operational time in one day

Wp : time spent by visitors on mangrove ecotourism

Preferences for the length of visit and the distance between visitors were asked using a questionnaire.

#### Community perception of the development of mangrove ecotourism

Community perceptions were analyzed based on their responses to questions on (i) identity, (ii) mangrove ecosystem utilization activities, (iii) perception of mangrove ecosystems and ecotourism, and (iv) community participation in the development of mangrove ecotourism. Respondents were selected using an accidental sampling

method (Etikan et al. 2016). The number of respondents was determined using the Slovin formula as follows:

$$n = \frac{N}{Ne^2 + 1}$$

Where:

n : Sample size

N : Population size

e : Fault tolerance limit (10 %)

Based on the formula, the number of respondents from the local community required for this study is 100.

#### Stakeholder analysis

Data were obtained through in-depth interviews, including influence, involvement, interests, benefits, perceptions, decision-making, and relationships related to mangrove management in KJNP. Stakeholder analysis was carried out by (i) identifying stakeholders, (ii) grouping and categorizing stakeholders based on their interests and influence, (iii) assessing opportunities for stakeholder participation based on their authority, duties, and primary functions, and (iv) mapping stakeholders based on their importance and influence values in the matrix (Reed et al. 2009).

Stakeholders were determined by the snowball sampling method (Parker et al. 2019). The initial respondent who became the key informant was the Karimunjawa National Park Office (*Balai Taman Nasional Karimunjawa-BTNKJ*). A list of all stakeholders analyzed in this study is presented in Table 2.

Scoring was used to measure the level of interest and influence of stakeholders. The score was determined by interpreting descriptive answers from stakeholder interviews ranging from 1-5 (low to high). The scoring results from each stakeholder assessment were grouped based on the indicator type and placed on the stakeholder grid.

**Table 1.** Category criteria for potential Natural Tourism Attraction Objects (NTAO)

Potential value index (%)	Category	Potency
> 66,6	High	Worthy
33,3-66,6	Moderate	Moderately worthy
< 33,3	Low	Not worthy

Source: Directorate General of Forest Protection and Nature Conservation (2003)

**Table 2.** Identification of stakeholders in Karimunjawa National Park, Central Java, Indonesia mangrove management

Category	Stakeholders	Number of respondents
Government	Karimunjawa National Park Office ( <i>Balai Taman Nasional Karimunjawa-BTNKJ</i> )	2
	Karimunjawa and Kemujan Village Governments	2
Academics	National Research and Innovation Agency ( <i>Badan Riset dan Inovasi Nasional-BRIN</i> )	1
Entrepreneurs	Indonesian Tour Guide Association ( <i>Himpunan Pramuwisata Indonesia-HPI</i> )	2
	Karimunjawa Tourism Bureau Association ( <i>Persatuan Biro Wisata Karimunjawa-PBWK</i> )	2
Community	Community	2
	Visitors	2
	Wildlife Conservation Society (WCS)	1

*Analysis of mangrove ecotourism development strategies using the SWOT Matrix and QSPM*

The SWOT and QSPM analysis were performed with the following procedures.

**Evaluation of internal and external factors.** The initial step of SWOT analysis included Internal Factors Evaluation (IFE) and External Factors Evaluation (EFE). The internal factors (strengths and weaknesses) and external factors (opportunities and threats) were weighted on a scale of 0 to 1 (from not important to important) using paired comparison. The total weight for both internal factors and external factors is 1. Each factor was rated on a scale of 1 to 4 based on its influence. Rating for strengths and opportunities is either 3 or 4, while rating for weaknesses and threats is 1 or 2 (Rangkuti 2013).

**Strength, Weakness, Opportunity, and Threat (SWOT) strategy formulation.** SWOT analysis maximizes strengths and opportunities and minimizes weaknesses and threats (Rangkuti 2013). Based on identifying strengths, weaknesses, opportunities, and threats of mangrove ecotourism in KJNP, four strategies (S-O strategy, W-O strategy, S-T strategy, W-T strategy) were formulated using a SWOT matrix.

**Strategic priorities based on the Quantitative Strategic Planning Matrix (QSPM).** QSPM analysis was used to objectively determine strategic priorities based on internal and external factors. The preparation of the QSPM matrix was carried out by (i) listing internal strengths/weaknesses and external opportunities/threats based on the IFE and EFE matrix, (ii) giving the weight of each internal and external factor, (iii) evaluating the SWOT strategy matrix and identify alternative strategies that should be considered for implementation; and (iv) determining the Attractive Scores (AS), which are numbers that describe the relative attractiveness of each strategy in a particular series of alternatives that ranges from 1 to 4 (from not attractive to attractive). Total Attractive Scores (TAS) are obtained by multiplying the weight by AS (Ghorbani et al. 2015).

## RESULTS AND DISCUSSION

### Potential natural tourism attraction assessment

The results of the assessment and classification of the potential of natural tourism attractions in the KJNP mangrove track are listed in Table 3. This table shows the high potential of mangrove ecotourism development in the KJNP mangrove track based on the assessment of the 15 NTAO criteria. This quantitative assessment provides an initial assessment of developing ecotourism areas (Purwanto et al. 2014). The assessment of each criterion is described below.

#### *Natural tourism attraction*

Natural tourism attraction is the uniqueness of natural resources in an area that attracts people to visit the area (Purnomo et al. 2013). Tourism activities in mangrove ecosystems include birdwatching, fishing, enjoying the scenery, sports, education, and research. The potential

attractions for mangrove ecotourism in KJNP are mainly the diversity of mangrove trees and birds. KJNP mangrove has a high diversity of mangrove trees consisting of 24 valid mangrove species and 15 mangrove associates.

True mangrove species consist of *Acanthus ebracteatus* Vahl, *Acanthus ilicifolius* L., *Acrostichum aureum* L., *Acrostichum speciosum* Willd., *Aegiceras corniculatum* (L.) Blanco, *Avicennia marina* (Forssk.) Vierh., *Bruguiera cylindrica* (L.) Blume, *Bruguiera gymnorrhiza* (L.) Lam., *Bruguiera sexangula* (Lour.) Poir., *Ceriops tagal* (Perr.) C.B.Rob., *Excoecaria agallocha* L., *Heritiera littoralis* Dryand. ex Aiton, *Lumnitzera littorea* (Jack) Voigt, *Lumnitzera racemose* Willd., *Pemphis acidula* J.R. Forst. & G.Forst., *Rhizophora apiculata* Blume, *Rhizophora mucronata* Lam., *Rhizophora stylosa* Griffith, *Scyphyphora hydrophyllacea* C.F. Gaertn., *Sonneratia alba* Sm., *Sonneratia caseolaris* (L.) Engl., *Sonneratia ovata* Backer, *Xylocarpus granatum* J.Koenig, and *Xylocarpus moluccensis* (Lam.) M.Roem.

At the same time, the mangrove associates are behind the true mangroves and consist of *Barringtonia asiatica* (L.) Kurz, *Calophyllum inophyllum* L., *Clerodendrum inerme* (L.) Gaertn., *Hibiscus tiliaceus* L., *Melastoma candidum* D. Don, *Morinda citrifolia* L., *Pandanus tectorius* Parkinson ex Du Roi, *Passiflora foetida* L., *Pongamia pinnata* (L.) Pierre, *Scaevola taccada* (Gaertn.) Roxb., *Sesuvium portulacastrum* (L.) L., *Spinifex littoreus* (Burm.f.) Merr., *Stachytaroheta jamaicensis* (L.) Vahl, *Terminalia cattapa* L., and *Thespesia populnea* (L.) Sol. ex Correa. Bird diversity in KJNP mangrove includes *Pericrocotus flammeus* (J.R Forster, 1781), *Gerygone sulphurea* (Wallace, 1864), *Pachycephala grisola* (Blyth, 1843), *Orthotomus sericeus* (Temminck, 1836), *Cacomantis merulinus* (Scopoli, 1786), *Amaurornis phoenicurus* (Pennant, 1796), *Todirhamphus chloris* (Boddaert, 1783), *Leptocoma calcostetha* (Jardine, 1843), *Ixobrychus sinensis* (Gmelin, 1789), *Egretta sacra* (Gmelin, 1789), *Butorides striata* (Linnaeus, 1758), *Ardea purpurea* (Linnaeus, 1766), and migratory shorebirds which usually come from September to March (BTNKJ 2019).

#### *Market potential*

Central Java Province has an area of 32,800.69 km<sup>2</sup> (28.94% of the area of Java Island). It has a population of 37,030,000 people with a population density of 1,129 people/km<sup>2</sup> (BPS Central Java 2022). Gross domestic product per capita is an indicator to measure a region's prosperity level. The gross regional domestic product per capita of Central Java Province is IDR38,670,000, the lowest in Java and far below the national average that reaches IDR62,240,000 per year (Kusnandar 2022). Central Java province has a high population density and saturation level, so the market potential is high (Table 3).

#### *Accessibility*

The accessibility rating is low (Table 3) due to the distance from the provincial capital and domestic airports, and the area can only be accessed by sea transportation through Jepara and Semarang District Ports, Central Java,

Indonesia. The crossing from Jepara (Kartini Harbor) typically takes five hours (using Ferry Siginjai) or two hours (using Express Bahari). The crossing from the Semarang (Tanjung Mas Port) typically takes seven hours. The mangrove track is located on Kemujan Island and can be reached by car or motorcycle for 30 minutes from the center of Karimunjawa, with damaged roads in several places.

#### *Assessment of conditions around the area*

Conditions around the KJNP area are categorized as high (Table 3). KJNP office already has a spatial layout of a mangrove track in the form of a site design by Design Engineering Detail (DED), which has been implemented to date. Based on the results of interviews and questionnaires, community awareness of mangrove conservation is very high. The community realizes that mangroves' ecosystem services are essential and potentially become income sources.

#### *Management and service*

The current management and service are as high (Table 3) based on management, language skills, and visitor services. KJNP has performed the management cycle from planning, organization, implementation, and evaluation; two officers are responsible for managing the mangrove track, including entrance tickets, cleanliness, and security. Officers have limited language skills (Javanese language and Indonesian only). Based on the visitors' responses, service to visitors was categorized as good regarding friendliness, readiness, and communication skills. The main expected improvement relates to explaining the diversity of existing mangroves and fauna.

#### *Climate*

Tourists often consider the climate and weather factors, particularly temperature and rainfall, in determining tourist destinations (Day et al. 2013). The climatic conditions in the KJNP area are in the moderate category (Table 3). Based on Schmidt and Ferguson's classification, the climate in KJNP is categorized as type C, with an average rainfall of 3,000 mm/year and air temperatures ranging from 30 to 31°C. Sea wave is a limiting factor in shipping/crossing; in the Northwest wind period, especially from December to March, the wave is relatively high, with an average range of 0.56-1.58 meters (BTNKJ 2017).

#### *Accommodation*

Visitors commonly require accommodation from faraway places. Most visitors to KJNP come from Java Island and stay overnight. The number of accommodations around the area is as high (Table 3). Tourists can use accommodations up to a 15 km radius, including inns, homestays, hotels, and resorts.

#### *Supporting facilities and infrastructure*

The facilities available at tracking mangroves include (i) information centers, (ii) toilets, (iii) generator housings, (iv) shelters, (v) interpretation boards, (vi) viewing towers, and (vii) activity centers. At the same time, the available

infrastructures include parking areas, drainage, electricity networks, and landfills (Figure 2).

The facilities and infrastructures are categorized as high (Table 3). However, several facilities require repair, particularly the broken tracking lines and interpretation boards. Based on the results of interviews with tourism bureaus and visitors, it is necessary to have cafeteria facilities and add tourist attractions such as canoeing and flying fox games.

#### *Availability of clean water*

The availability of clean water is in the high category (Table 3). Water is continuously available in large volumes and good quality, although it cannot be consumed directly.

#### *Relationship with local attractions*

The relationship with surrounding tourist objects is highly assessed (Table 3). There are no similar tourist objects within a radius of 50 km. KJNP has natural beauty and unique marine tourism such as snorkeling, diving, fishing, sunset watching, and water sports.

#### *Security*

The security criterium is assessed in the high category (Table 3). There are no security problems or potential conflicts with wild animals. There is also no illegal logging and land encroachment by local communities in the area, supported by high public awareness of mangrove conservation.

#### *Area carrying capacity*

The calculation of the area carrying capacity based on Yulianda (2019) is 104 people/day. The annual number of visitors is < 1,000. The number of visitors ranges from 60 to 90 visitors during holidays and around 20 visitors on weekdays (BTNKJ 2019). The highest number of visitors does not exceed the area's carrying capacity, so this criterion is categorized as high (Table 3). The application of carrying capacity is essential to provide visitors with comfortable conditions and avoid negative impacts on visitors, particularly the potential damage to tourist attractions (Sobhani et al. 2022).

#### *Visitor settings*

The assessment of visitor regulatory criteria is in the moderate category (Table 3). KJNP currently does not limit the duration and number of visitors; visitor allotments are not required now due to the low visit rate.

#### *Marketing*

Assessment of marketing criteria is in the medium category (Table 3). KJNP promotes its mangrove tourism through websites, tourist events, and social media (Facebook, Instagram, Twitter, YouTube). The ticket price to enter the mangrove track is IDR10,000/person, which is considered cheap and affordable by 88% of visitors.

#### *Market share*

Market share criteria are included in the high category (Table 3). Elements of market share include visitor origin,

education level, income, and purpose of visit. Most visitors from outside the Jepara District have a university education level and a total income of more than IDR3,500,000 for recreational purposes only.

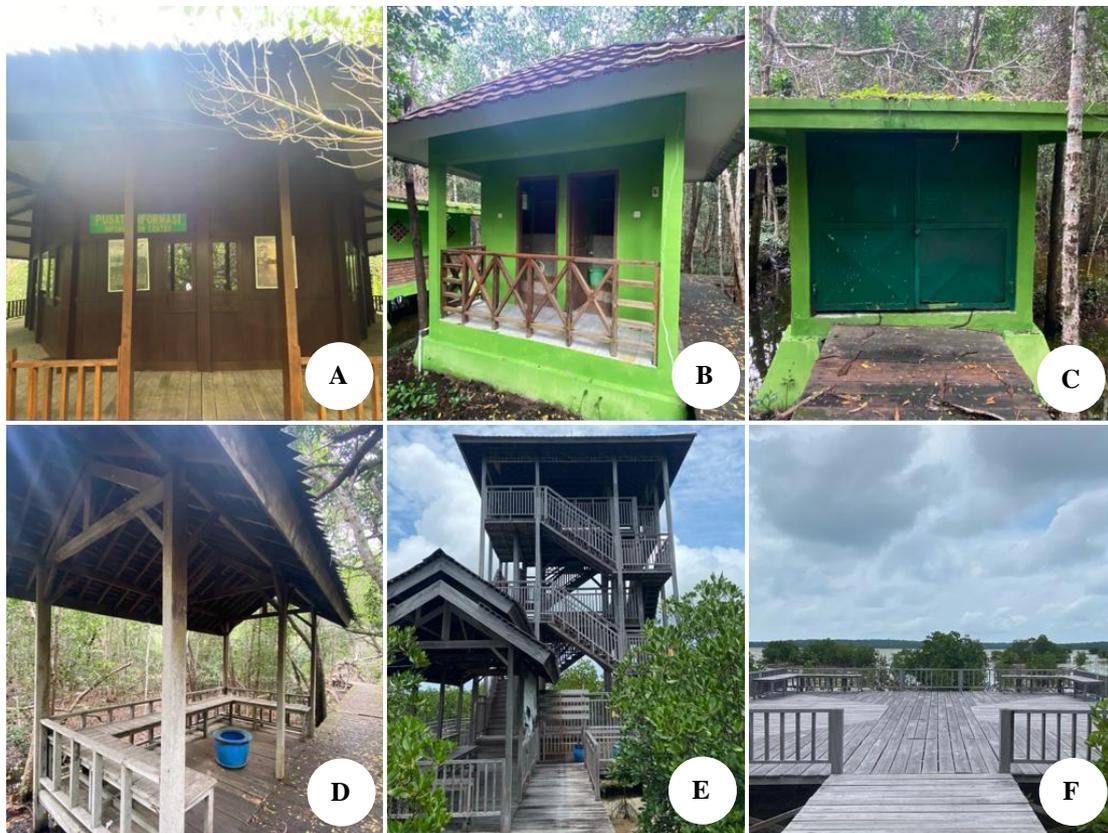
Understanding the relationship between tourism products and markets is crucial in ecotourism development. Tourism products include accessibility, accommodation,

environment, community, and institutions; meanwhile, market demand is influenced by the origin of visitors, ability to travel, and destination (Khan et al. 2022). Managers should be able to highlight the potential and attractiveness of natural tourism by being thoughtful about tourism products and the intended market.

**Table 3.** Assessment of the potential NTAO in Karimunjawa National Park, Central Java, Indonesia mangrove track, Indonesia

Criteria	NTAO Potential Value	NTAO Maximum Value	Potential Value Index	NTAO Potential Classification
Natural tourist attraction	1,110	1,250	88.8%	High
Market potential	875	950	92.1%	High
Accessibility	375	900	41.7%	Moderate
Assessment of conditions around the area	450	450	100.0%	High
Management and service	260	360	72.2%	High
Climate	320	480	66.6%	Moderate
Accommodation	90	90	100%	High
Supporting facilities and infrastructure	150	180	83.3%	High
Availability of clean water	750	900	83.3%	High
Relationship with local attractions	100	100	100%	High
Security	575	600	95.8%	High
Area carrying capacity	180	180	100%	High
Visitor settings	60	90	66.6%	Moderate
Marketing	60	120	50%	Moderate
Market share	345	360	95.8%	High
Total	5,700	7,010	81.3%	High

Note: NTAO: Natural Tourism Attraction Objects



**Figure 2.** Facilities in Karimunjawa National Park, Central Java, Indonesia mangrove track: A. Information center, B. Toilets, C. Genset room, D. Shelters, E. Viewing tower, F. Activity center

### Mangrove ecotourism carrying capacity

This study found that the carrying capacity of mangrove tourism in KJNP is 104 people/day. Compared to mangrove ecotourism in Lembar Village, West Lombok District, the carrying capacity of mangrove ecotourism is 33 people/day (Abdillah et al. 2020). The difference in carrying capacity is due to the different lengths of tracking mangroves. The carrying capacity implementation helps provide maximum value to increase the economy and community participation while maintaining the value of protection sustainability and suppressing negative impacts that may occur (Armono et al. 2017).

### Community perception on the development of mangrove ecotourism

#### Community characteristics

Table 4 presents the characteristics of the local community (represented by 100 respondents) in terms of education level, livelihoods, total income, utilization of mangroves, and income from mangroves. Table 4 shows that most local communities have good education levels (graduated from senior high school or university). This becomes a strong point in support of mangrove ecotourism in KJNP since people with higher education levels potentially have a better awareness and understanding of the importance of preserving natural ecosystems and the benefits they provide (Graça et al. 2018), including ecotourism service. This awareness can motivate people to take action to support mangrove preservation. Most people are self-employed in the tourism sector, and their incomes are above the regional minimum salary, so they are included in the upper middle class. Based on 100 respondents, 44% of the people have jobs utilizing mangroves, and 14% (6 people) make it their primary job. People benefit from mangroves in different ways, primarily by their involvement in mangrove ecotourism as tour guides with uncertain incomes.

#### Community perception of mangrove ecosystems and ecotourism

Community perception of the mangrove ecosystem and ecotourism in KJNP is listed in Table 5. Table 5 shows that almost all local people perceive the mangrove ecosystem and mangrove conservation nicely. This indicates a strong relationship between the two parameters. People's understanding of the high importance of mangroves in providing various benefits may motivate them to participate in protecting the mangrove ecosystem. This condition will be a supporting factor for the success of conservation efforts.

Community participation is a critical factor in developing mangrove ecotourism. Table 5 shows that most people understand mangrove ecotourism in KJNP and highly agree with the ecotourism development. The impact of the existence of mangrove ecotourism in KJNP makes a positive contribution to the economic aspects of the community due to participating in mangrove ecotourism by becoming tour guides and drivers.

**Table 4.** Community economic characteristics in Karimunjawa National Park, Central Java, Indonesia

Community characteristic	Description	
	Answer option	Percentage
Community education level	Primary Schol	24%
	Junior High School	11%
	Senior High School	44%
	College	21%
Community livelihoods	Tour guide	12%
	Employee	13%
	Fisherman	25%
	Entrepreneur	50%
Community income	<IDR 1,500,000	16%
	IDR 1,500,000-2,500,000	43%
	IDR 2,500,000-3,500,000	24%
	<IDR 3,500,000	17%
Utilization of mangrove ecosystems	Food/medicine	2%
	Wood	5%
	Driver	7%
	Fishing	34%
Income from the mangrove ecosystem	Tour guide	52%
	< IDR 500,000	16%
	IDR 500,000-1,000,000	20%
	IDR 1,000,000-1,500,000	5%
	Uncertain	59%

**Table 5.** Community perception on mangrove ecosystem and ecotourism in Karimunjawa National Park, Central Java, Indonesia

Community Perceptions	Description	
	Answer option	Percentage
Perceptions on mangroves	Not too important	4%
	Important	42%
	Very important	54%
Perceptions of mangrove conservation	Not too important	2%
	Important	37%
	Very important	61%
Understanding of mangrove ecotourism	Yes	77%
	No	23%
Approval of mangrove ecotourism development	Disagree	2%
	Agree	56%
	Strongly agree	42%
Interest in community involvement in mangrove ecotourism	Not involved	24%
	Research Companion	2%
	Driver	5%
	Souvenir maker	7%
	Food/beverage seller	7%
	Tour guide	55%

Most people also show their interest in directly participating in ecotourism activities. This relates to the potential benefits obtained by local people from ecotourism, including job opportunities, revenues from local businesses, improved infrastructure, and ecosystem preservation that contribute to improving community welfare (Butarbutar and Soemarno 2013; Saidmamatov et al. 2020)

**Table 6.** Roles and interests of stakeholders in Karimunjawa National Park, Central Java, Indonesia mangrove management

Stakeholder	Role	Interest
Karimunjawa National Park Office ( <i>Balai Taman Nasional Karimunjawa-BTNKJ</i> )	Inventory and construction of mangrove track Decision-making and preparing management plans Regulation and coordination in area management Security, preservation, and utilization of the area Providing training to the community School visits	Defending the area and preserving it according to its function (economic, ecological, social)
Wildlife Conservation Society (WCS)	Providing training to the community Assisting planning and regulation of the area Mangrove research studies	KJNP office partners Supporting achievement of the vision and mission of KJNP management
Indonesian Tour Guide Association ( <i>Himpunan Pramuwisata Indonesia-HPI</i> )	Recipients of tourism training and certification Accompanying tourists Coordination of tourism activities	Accompanying tourists
Karimunjawa Tourism Bureau Association ( <i>Persatuan Biro Wisata Karimunjawa-PBWK</i> )	Tourism promotion and marketing	Travel business
Village government	Involved in making area management decisions Coordination of tourist activities	Source of livelihood for the community
Community	Recipients of socialization Supporting protection and preservation	Source of livelihood Obtaining ecosystem services
Academics	Research collaboration Provider of training and certification facilities	Research place
Visitors	Tourism consumers	Tourism and educational places

### Stakeholder analysis

All parties having roles and interests in KJNP mangrove ecotourism were included in the stakeholder analysis. Table 6 presents the roles and interests of all stakeholders. Stakeholder involvement in resource management is based on different influences and interests. Differences in influence and interests include capacity, authority, and interests. These differences will impact the different roles of each stakeholder in management. Influence is the ability of stakeholders to influence the management process and other stakeholders; interests are stakeholders' dependence on resources or interest in being involved in management (Rahayuningsih and Aminsyah 2021). The level of interest and influence of KJNP mangrove management stakeholders is determined in the score. Stakeholder categories in KJNP mangrove management are presented in Figure 3.

#### Key players

Key players are stakeholder groups that have high influence and interest. Key players have many relationships among stakeholders and pioneers in an activity (Sentanu et al. 2021). KJNP office has the highest influence due to its role in management, decision-making, regulation, and coordination with other stakeholders. Communities do not have direct access to decision-making, but community responses and actions are considered in KJNP mangrove management. Communities have an interest in mangrove ecosystem services.

#### Context setters

Context setters are stakeholder groups with high influence but have low interest in regional resources.

Wildlife Conservation Society (WCS) is an international Non-Governmental Organization (NGO) that supports the KJNP office in achieving its management vision and mission and is interested in environmental missions. Context setters are stakeholder groups useful for formulating or bridging decisions and opinions. WCS helps the process of mentoring and community participation, so they are involved in the area management plan, especially related to sustainable tourism.

#### Subject

Karimunjawa Tourism Bureau Association (*Persatuan Biro Wisata Karimunjawa* or PBWK) and Indonesian Tour Guide Association (*Himpunan Pramuwisata Indonesia* or HPI) have an economic interest in mangroves through tourism activities; many visitors potentially increase their revenue. Meanwhile, the village government is interested in fulfilling economic interests through tourism activities or utilizing marine biota (fish, crabs, shellfish). The subject is a stakeholder group that has high interest but low influence. The subject can provide an essential role if it gets support from the key player. These three stakeholders are important but require empowerment in KJNP mangrove tourism planning.

#### Crowd

Crowd is a stakeholder group with little influence and interest in KJNP mangroves. This group contributes to mangrove management but is indirectly involved. The crowd acts as a group whose presence does not contribute to management (Sentanu et al. 2021). Academics are interested in KJNP mangroves as a research location for scientific research and development. Academics are more

influenced because their research is valuable input for managing KJNP mangrove tourism. Meanwhile, visitors are only interested in tourism and recreational activities.

**Ecotourism development strategy**

*Evaluation of internal and external factors*

Evaluation of internal factors (strengths and weaknesses) and external factors (opportunities and threats) in developing mangrove ecotourism in KJNP is presented in Tables 7 and 8.

The highest score on the internal factor is the strength factor (S1) relating to the potential of natural tourism objects owned, such as natural beauty, species diversity, and natural resource integrity. Ecotourism is sustainable natural resource-based tourism focusing on nature, landscapes, flora, fauna, and habitats (Fennell 2014).

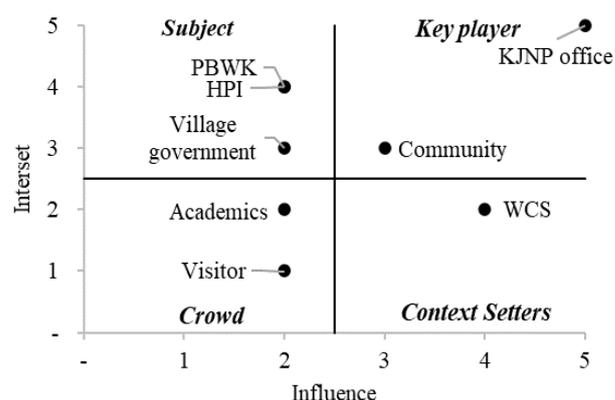
External factors that influence the management of mangrove tourism in KJNP consist of three opportunity factors and two threat factors. The highest score on the external factor is the opportunity factor (O2), namely the high desire of the community to participate in mangrove ecotourism. Ecotourism can provide environmental, cultural, and economic benefits. Ecotourism is the best solution to protect and utilize the environment and meet the economic needs of local communities (Osman et al. 2018).

The IFE and EFE scores were combined to get a point on the internal-external matrix as a direction for formulating the strategies. The IFE and EFE scores are in a cell V position, namely hold and maintain. The strategy that must be carried out is market penetration and product development (David 2011). In developing mangrove

ecotourism in KJNP, market penetration can be achieved by increasing promotion. At the same time, product development can be achieved by developing facilities, infrastructure, and tourist attractions.

*SWOT-QSPM analysis*

The SWOT matrix produces four alternative strategies for developing mangrove ecotourism in KJNP (Table 9). The alternative strategies obtained were then analyzed using QSPM analysis (Table 10)



**Figure 3.** Grid of stakeholders in KJNP mangrove management, Indonesia

**Table 7.** Internal Factors Evaluation (IFE) of Karimunjawa National Park, Central Java, Indonesia mangrove ecotourism

Code	Internal factor	Weight	Rating	Score (Weight x Rating)
<b>Strength</b>				
S1	Having NTAO potential that is feasible to be developed for mangrove ecotourism activities	0.30	4	1.20
S2	The area carrying capacity has not been exceeded for the development of mangrove ecotourism	0.25	3	0.75
<b>Weakness</b>				
W1	There are no visitor assistance facilities to explain mangroves	0.10	1	0.10
W2	Lack of facilities, infrastructure, and provided tourist attractions	0.20	2	0.40
W3	The low promotional intensity and not updated promotional materials	0.15	2	0.30
Total		1		2.75

**Table 8.** External Factors Evaluation (EFE) of Karimunjawa National Park, Central Java, Indonesia mangrove

Code	External factor	Weight	Rating	Score (Weight x Rating)
<b>Opportunity</b>				
O1	Stakeholder support in the development of mangrove ecotourism	0.20	3	0.60
O2	The high desire of the community to be involved in the development of mangrove ecotourism	0.25	4	1.00
O3	Mangroves as a source of community economic income	0.15	3	0.45
<b>Threat</b>				
T1	Tourism activities that focus on marine tourism	0.15	1	0.15
T2	Accessibility to locations is limited	0.25	2	0.50
Total		1		2.70

**Table 9.** SWOT matrix for mangrove ecotourism development in Karimunjawa National Park, Central Java, Indonesia

Internal external	Strength (S) S1, S2	Weakness (W) W1, W2, W3
Opportunity (O) O1, O2, O3	S-O Strategy Development of mangrove ecotourism by NTAO potential and carrying capacity of the area involving stakeholders (S1, S2, O1, O2, O3)-SO1	W-O Strategy Training and certification for the community related to mangrove ecotourism guides (W1, O1, O2, O3)-WO1 Collaboration with stakeholders in developing tourist facilities and attractions as well as promoting mangrove ecotourism (W2, W3 O1, O2, O3)-WO2
Threat (T) T1, T2	S-T Strategy Developing tour packages consisting of marine tourism and land tourism (S1, S2, T1, T2)-ST1	W-T Strategy Assistance from KJNP office staff for visitors (W1, T1)-WT1 Repair of facilities and infrastructure (W2, T1, T2)-WT2 Making the latest promotional materials and increasing the intensity of promotions (W3, T1)-WT3

**Table 10.** QSPM analysis calculation SWOT strategy for mangrove ecotourism development in Karimunjawa National Park, Central Java, Indonesia

Code	Weight	SO1		WO1		WO2		ST1		WT1		WT2		WT3	
		AS	TAS												
S1	0.30	4	1.20	3	0.90	3	0.90	4	1.20	3	0.90	3	0.90	3	0.90
S2	0.25	4	1.00	2	0.50	3	0.75	4	1.00	2	0.50	3	0.75	3	0.75
W1	0.10	2	0.20	4	0.40	2	0.20	1	0.10	4	0.40	2	0.20	1	0.10
W2	0.20	2	0.40	3	0.60	4	0.80	1	0.20	3	0.60	4	0.80	1	0.20
W3	0.15	2	0.30	2	0.30	4	0.60	1	0.15	2	0.30	2	0.30	4	0.60
O1	0.20	4	0.80	4	0.80	4	0.80	2	0.40	1	0.20	2	0.40	3	0.60
O2	0.25	4	1.00	4	1.00	4	1.00	2	0.50	1	0.25	2	0.50	3	0.75
O3	0.15	4	0.60	4	0.60	4	0.60	2	0.30	1	0.15	1	0.15	2	0.30
T1	0.15	1	0.15	3	0.45	2	0.30	4	0.60	4	0.60	4	0.60	4	0.60
T2	0.25	1	0.25	1	0.25	1	0.25	4	1.00	1	0.25	4	1	1	0.25
Total		5.90		5.80		6.20		5.45		4.15		5.60		5.05	
Priority		2		3		1		5		7		4		6	

Based on the results of QSPM calculations, alternative priority strategies for mangrove ecotourism development are determined (Table 11). The description of each suggestion for mangrove ecotourism development in KNJP is as follows:

**Cooperation among stakeholders to develop facilities, tourist attractions, and promoting mangrove ecotourism.** Community-based ecotourism development will improve community welfare and the community's participation in preserving the natural ecosystem (Purnomo et al. 2013). Therefore, to increase attractiveness and experience for visitors, several tourist facilities and attractions in KJNP, such as cafeterias, canoeing, and flying foxes, should be developed. KJNP can collaborate with third parties to develop tourist facilities and attractions (Indonesian Ministry of Environment and Forestry 2012). KJNP office has the authority to issue permits to individuals or business entities (cooperatives, regional-owned enterprises, and the private sector).

**Participatory development of mangrove ecotourism based on the potential of NTAO and its area-carrying capacity by involving stakeholders.** The development of ecotourism should pay attention to the sustainability of NTAO. Developing tourism facilities and infrastructure

without regard to the sustainability of NTAO will decrease the quality over time (Purnomo et al. 2013). This includes considering the carrying capacity to maintain resources, the balance of aquatic life systems, and the comfort of visitors when traveling (Yulianda 2019). Activities that can be developed and integrated with the mangrove track in KJNP include educational tours and bird watching.

**Providing training and certification facilities for the community related to mangrove ecotourism guides.** KJNP is a marine national park that focuses on marine tourism activities. Increasing the capacity of tourism actors regarding mangrove ecotourism can be achieved by providing training facilities and certification related to mangrove ecotourism guides. KJNP office can provide training facilities for tourism actors, including the community, HPI, and PBWK.

**Improvement of facilities and infrastructure.** The current condition of the KJNP mangrove track requires some repairs, including damaged tracking lines and species interpretation boards. Repairing and improving the quality of facilities and infrastructure is critical so that visitors get a good impression and want to revisit the area (Sihombing et al. 2022).

**Table 11.** Results of the SWOT-QSPM analysis for the development of mangrove ecotourism in Karimunjawa National Park, Central Java, Indonesia

Strategy	QSPM Score
WO2 : Cooperation among stakeholders in developing facilities, tourist attractions, and promoting mangrove ecotourism	6.20
SO1 : Participatory development of mangrove ecotourism based on the potential of NTAO and its area carrying capacity by involving stakeholders	5.90
WO1 : Providing training and certification facilities for the community related to mangrove ecotourism guides	5.80
WT2 : Improvement of facilities and infrastructure	5.60
ST1 : Developing marine and land tourism packages	5.45
WT3 : Creating up-to-date promotional materials and increasing the intensity of promotions	5.05
WT1 : Assistance from KJNP staff for visitors	4.15

#### Developing marine and land tourism packages.

Besides the mangrove track, KJNP has other tourist attractions, including land tours and marine tourism (BTNJK 2017). The main attraction for visitors is marine tourism. To attract visitors to the mangrove track, the KJNP office can collaborate with business actors such as tourism bureaus to create tour packages consisting of land and marine tours.

**Creating up-to-date promotional materials and increasing the intensity of promotions.** As part of ecotourism marketing efforts, promotions can be carried out in several forms, such as advertising, public relations, personal selling, and direct marketing. Accurate promotions are needed to meet tourist expectations. An example of a thriving ecotourism promotion is *Tangkahan* ecotourism, which can significantly increase visits with promotional activities. The promotional activities include website development cooperation with tour operators and related promotion agencies nationally and internationally (Yusnikusumah and Sulystiawati 2016).

**Assistance from KJNP staff for visitors.** Ecotourism development should reflect two principles, namely, the principles of education and tourism. The principle of education relates to the development of ecotourism that contains elements of education to change a person's attitude and behavior to care, be responsible, and commit to preserving the environment. Tourism's principle relates to providing visitors with satisfaction and experience (Constantin et al. 2022). KJNP office needs to improve facilities for visitors to provide education and interpretation.

From all the analyses, we found that 12 out of 15 criteria of tourism attractions in the mangrove track in Karimunjawa National Park (KJNP) are categorized as "high," indicating the high potential of mangrove ecotourism development in KJNP. The number of visitors is still less than the carrying capacity of mangrove ecotourism in KJNP, which is 104 people/day. Almost all local community agrees with the development of mangrove ecotourism in KJNP.

Among eight stakeholders, the local community and KJNP manager are the critical stakeholders in mangrove ecotourism development in KJNP. This study identified seven alternative strategies for developing mangrove ecotourism in KJNP, which cover improvements in stakeholder collaboration, community participation,

tourism packages, facilities and infrastructures, promotion, and services to visitors. The result of this study can be used for sustainable management of mangrove ecosystems by considering the potential for tourist attractions and the carrying capacity of mangrove ecosystems. The management strategy developed integrates the interests of managers, local communities, and the preservation of the mangrove ecosystems.

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#### REFERENCES

- Abdillah S, Harahab N, Primyastanto M, Semedi B. 2020. Analysis of suitability and carrying capacity of mangrove ecosystem for ecotourism in Lembar Village, West Lombok District, Indonesia. *Biodiversitas* 21 (2): 596-604. DOI: 10.13057/biodiv/d210222.
- Armono HD, Rosyid DM, Nuzula NI. 2017. Carrying capacity model applied to coastal ecotourism of Baluran National Park, Indonesia. *IOP Conf Ser: Earth Environ Sci* 79 (1): 012004. DOI: 10.1088/1755-1315/2F79/2F1/2F012004.
- BPS Central Java. 2022. Central Java Province in Figures 2022. CV Surya Lestari, Semarang. [Indonesian]
- BTNJK. 2017. Karimunjawa National Park Long Term Management Plan 2018-2027. BTNJK, Semarang. [Indonesian]
- BTNJK. 2019. Interpretation of Karimunjawa National Park mangrove Trekking. BTNJK, Semarang. [Indonesian]
- Butarbutar R, Soemarno S. 2013. Environmental effects of ecotourism in Indonesia. *J Indones Tour Dev Stud* 1 (3): 97-107. DOI: 10.21776/UB.JITODE.2013.001.03.01.
- Constantin CP, Ispas A, Candrea AN. 2022. Examining the relationships between visitors' profile, satisfaction, and revisit intentions: Evidence from Romanian ecotourism destinations. *Land* 11 (2): 186. DOI: 10.3390/land11020186.
- David FR. 2011. Strategic management concepts and cases. Prentice Hall, Bergen.
- Day J, Chin N, Sydnor S, Cherkauer K. 2013. Weather, climate, and tourism performance: A quantitative analysis. *Tour Manag Perspect* 5: 51-56. DOI: 10.1016/j.tmp.2012.11.001.

- Directorate General of Forest Protection and Nature Conservation. 2003. Guidelines for analysis of operational areas of natural tourism objects and attractions. Jakarta. [Indonesian]
- Etikan I, Musa SA, Alkassim RS. 2016. Comparison of convenience sampling and purposive sampling. *Am J Theor Appl Stat* 5 (1): 1-4. DOI: 10.11648/j.ajtas.20160501.11.
- Fafurida F, Oktavilia S, Prajanti SDW, Mareta YA. 2020. Sustainable strategy: Karimunjawa National Park marine ecotourism, Jepara, Indonesia. *Intl J Sci Technol Res* 9 (3): 3234-3239.
- Fennell DA. 2014. *Ecotourism*. Routledge, Thames. DOI: 10.4324/9780203382110.
- Ghorbani A, Raufirad V, Rafiaani P, Azadi H. 2015. Ecotourism sustainable development strategies using SWOT and QSPM model: A case study of Kaji Namakzar Wetland, South Khorasan Province, Iran. *Tour Manag Perspect* 16: 290-297. DOI: 10.1016/J.TMP.2015.09.005.
- Gnansounou SC, Salako KV, Sagoe AA, Mattah PAD, Aheto DW, Glèlè Kakai R. 2022. Mangrove ecosystem services associated threats and implications for wellbeing in the Mono Transboundary Biosphere Reserve (Togo-Benin), West-Africa. *Sustainability* 14 (4): 2438. DOI: 10.3390/su14042438.
- Graça M, Queirós C, Farinha-Marques P, Cunha M. 2018. Street trees as cultural elements in the city: Understanding how perception affects ecosystem services management in Porto, Portugal. *Urban For Urban Green* 30: 194-205. DOI: 10.1016/j.ufug.2018.02.001.
- Indonesian Ministry of Environment and Forestry. 2012. Indonesian Ministry of Environment and Forestry Law No P.4/MENHUT-II/2012. IMEF, Jakarta. [Indonesian]
- Khan MM, Siddique M, Yasir M, Qureshi MI, Khan N, Safdar MZ. 2022. The significance of digital marketing in shaping ecotourism behavior through destination image. *Sustainability* 14 (12): 7395. DOI: 10.3390/su14127395.
- Kusmana C, Sukristijono S. 2016. Mangrove resource uses by local community in Indonesia. *J Nat Resour Environ Manag* 6 (2): 217-217. DOI: 10.29244/jpsl.6.2.217.
- Kusmana C. 2015. Technique of *Guludan* as Method of Planting of Mangrove on Land Flooded with Deep Water. [Scientific Oration of Professor of IPB]. Institut Pertanian Bogor, Bogor. [Indonesian]
- Kusmana, C. 2014. Distribution and current status of mangrove forests in Indonesia. In: Faridah-Hanum I, Latiff A, Hakeem KR, Ozturk M (Eds). *Mangrove Ecosystems of Asia: Status, Challenges and Management Strategies*. DOI:10.1007/978-1-4614-8582-7\_3.
- Kusnandar VB. 2022. (Revised) Comparison of GRDP Per Capita in Java Island, This is the Lowest Province in 2021. <https://databoks.katadata.co.id>
- Mehvar S, Filatova T, Dastgheib A, van Steveninck ERD, Ranasinghe R. 2018. Quantifying economic value of coastal ecosystem services: A review. *J Mar Sci Eng* 6 (1): 5. DOI: 10.3390/jmse6010005.
- Musa F, Fozi NM, Mohd DD. 2020. Coastal communities' willingness to pay for mangrove ecotourism in Marudu Bay, Sabah, Malaysia. *J Sustain Sci Manag* 15 (4): 130-140. DOI: 10.46754/jssm.2020.06.013.
- Osman T, Shaw D, Kenawy E. 2018. Examining the extent to which stakeholder collaboration during ecotourism planning processes could be applied within an Egyptian context. *Land Use Policy* 78: 126-137. DOI: 10.1016/j.landusepol.2018.06.043.
- Parker C, Scott S, Geddes A. 2019. *Snowball Sampling*. SAGE Research Methods Foundations, Thousand Oaks, California. DOI:10.4135/.
- Purnomo H, Sulistyantara B, Gunawan A. 2013. Ecotourism business opportunities in the Sempu Island nature reserve area, East Java. *J For Soc Econ Res* 10 (4): 247-263. DOI: 10.20886/jpsek.2013.10.4.247-263. [Indonesian]
- Purwanto S, Syaufina L, Gunawan A. 2014. Study of the potential and carrying capacity of the Bukit Kelam Natural Tourism Park for an ecotourism development strategy. *J Nat Resour Environ Manag* 4 (2): 119-119. DOI: 10.29244/jpsl.4.2.119. [Indonesian]
- Rahayuningsih T, Aminsyah A. 2021. Identification of stakeholders and their roles in ecotourism hazard management in Mount Rinjani National Park. *Media Konservasi* 26 (1): 28-35. DOI: 10.29244/medkon.26.1.28-35.
- Rangkuti F. 2013. *SWOT-Balanced Scorecard*. Gramedia Pustaka Utama, Jakarta. [Indonesian]
- Ranjith M. 2020. To examine the potential and scope of ecotourism in Kerala with a special focus on tourists to ecotourism destinations in Trivandrum. *J Tour Hosp* 9 (433): 2167-0269. DOI: 10.35248/2167-0269.20.9.433.
- Reed MS, Graves A, Dandy N, Posthumus H, Hubacek K, Morris J, Stringer LC. 2009. Who's in and why? A typology of stakeholder analysis methods for natural resource management. *J environ manag* 90 (5): 1933-1949. DOI: 10.1016/j.jenvman.2009.01.001.
- Rizal A, Dewanti LP. 2017. Using economic values to evaluate management options for fish biodiversity in the Sikakap Strait, Indonesia. *Biodiversitas* 18 (2): 575-581. DOI: 10.13057/biodiv/d180218.
- Saidmamatov O, Matyakubov U, Rudenko I, Filimonau V, Day J, Luthe T. 2020. Employing ecotourism opportunities for sustainability in the Aral Sea Region: Prospects and challenges. *Sustainability* 12 (21): 9249. DOI: 10.3929/ethz-b-000451359.
- Sangpikul A. 2017. Ecotourism impacts on the economy, society, and environment of Thailand. *J Rev Glob Econ* 6: 302-312. DOI: 10.6000/1929-7092.2017.06.30.
- Sentanu IGEPS, Prabowo A, Kumalasarri K, Galih AP, Wismanu RE. 2021. Stakeholder collaboration model for ecotourism development in Indonesia: Case study from Batu City East Java Province. *J Gov Civ Soc* 5 (2): 214-236. DOI: 10.31000/jgcs.v5i2.4420.
- Sihombing VS, Karlina E, Garsetiasih R, Rianti A, Sawitri R. 2022. Environment carrying capacity of ecotourism in Aek Nauli Research Forest, Simalungun Regency, North Sumatera. *Indones J For Res* 9 (2): 147-163. DOI: 10.20886/ijfr.2022.9.2.147-163.
- Sobhani P, Esmailzadeh H, Sadeghi SMM, Marcu MV. 2022. Estimation of ecotourism carrying capacity for sustainable development of protected areas in Iran. *Intl J Environ Res Public Health* 19 (3): 1059. DOI: 10.3390/ijerph19031059.
- Sumarga E, Suwandhi I, Haitaunnisa Nurahman AY, Susilowardani D, Shadida A. 2021. Disturbances-based plan of delineating protected area's buffer zone: A case study in Masigit Kareumbi Mountain, West Java, Indonesia. *Biodiversitas* 22 (11): 5115-5122. DOI: 10.13057/biodiv/d221150.
- Sumarga E, Syansudin TS, Rahman SP. 2022. Maintaining carbon storage does not reduce fish production from mangrove-fish pond system: A case study in Coastal Area of Subang District, West Java, Indonesia. *Forests* 13 (8): 1308. DOI: 10.3390/f13081308.
- Swangjang K, Kornpiphat P. 2021. Does ecotourism in a mangrove area at Klong Kone, Thailand, conform to sustainable tourism? A case study using SWOT and DPSIR. *Environ Dev Sustain* 2021: 1-26. DOI: 10.1007/s10668-021-01313-3.
- Yulianda F. 2019. *Aquatic Ecotourism: A Concept of Suitability and Carrying Capacity of Marine Tourism and Freshwater Tourism*. IPB Press Publisher PT, Bogor. [Indonesian]
- Yusnikusumah TR, Sulystiawati E. 2016. Evaluation of ecotourism management in the Tangkahan ecotourism area, Gunung Leuser National Park, North Sumatra. *J Reg Urban Plan* 27 (3): 173-189. DOI: 10.5614/JRCP.2016.27.3.1.