

MANGROVE BIODIVERSITY AND CONSERVATIONS: FOUNDATION TOWARD ECOTOURISM IMPLEMENTATION IN BINTAN ISLAND, INDONESIA

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Abstract

Tourism is one of the rapid development sectors on small islands that are abundant with natural resources. However, tourism development is a potential threat and may deplete environmental resources. This paper aims to describe the recent tourism development in Bintan Regency, Indonesia, one of the small islands abundant with mangrove resources. Data were collected on Bintan Island through visitation and observation. The mangrove ecosystem document and the potential impact of tourism development on the mangrove ecosystem were empirically reviewed. Studies confirm that tourism is recently growing in Bintan and significantly contributes to and supports local development. The mangrove ecosystem has abundant resources that are crucial for sustainable tourism development programmes on Bintan Island. Some strategic approaches exist to enhance the link between mangrove conservation and tourism on Bintan Island, including mangrove biodiversity conservation, ecotourism development, nature-based tourism programme development, and community participation in mangrove-based tourism. With a proper management approach, mangroves are a potential resource to attract tourists and promote sustainable tourism development on small islands.

Keywords: *Small Island; Ecotourism; Bird watching; Wet lands*

Introduction

Tourism has recently been viewed as a potential machine to support local economic growth, especially on small islands. Many luxurious tropical countries view tourism as a potential economic machine for income and development support. The Maldives, Cook Islands, Caribbean countries, Marshall Islands, and Singapore are small island countries using tourism as a machine for economic earnings. Scholars point out that tourism development on small islands provides opportunities for numerous local economic activities. In the limited available opportunities for jobs, tourism on small islands plays an important role in opening new job opportunities [1–3].

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Tourism development on small islands in developing countries offers spectacular landscapes to attract tourists. The combination of climates, biodiversity, and geomorphology is the main source for numerous nature-based tourism programmes on small islands. Some species are endemic to the particular island and add attraction to the island to be visited. The abundant underwater resources are the principal resources for diving and snorkeling. Moreover, tropical coral reefs have been recognised as one of the biodiversity hotspots on earth. Underwater landscapes and their biodiversity are interesting tourism objects limited to tropical regions. Thus, tropical regions have advantages in resource competitiveness for tourism development [4, 5].

The biodiversity of a small island is unique. Many species are endemic to a particular small island due to the impact of biological processes, including long-term population isolation. In Indonesia, many small islands are habitats for endemic species. Komodo, Rinca, and Gili Motang islands are the habitats for Komodo dragons (*Varanus komodoensis*). The Bawean island, with an area of about 197km² is the habitat for the Bawean deer *Axis kuhlii*; [6] and the Bawean serpent-eagle *Spilornis baweanus* [7]. Moreover, the Siberut macaque (*Macaca siberu*) is endemic to Siberut Island (3.838km²). Birds and endemism on small islands have been studied by numerous authors, confirming that many islands are crucial habitats for endemic birds [8]. The fauna of small islands is also a flagship for tourism. The Komodo dragon is one of the icons that can attract tourists [9]. Tourism on small islands, especially mass tourism with less visitor control, potentially disturbs wildlife on small islands. Thus, changes in habitat, including mangroves, lead to a decline in habitat quality.

Many studies have been conducted to evaluate tourism development on small islands. Land use changes occur rapidly due to infrastructure development. Development has been reported to destroy crucial habitat for wildlife. Complex problems were noted for their economic and sociocultural attributes, which contribute to the sustainability of local dwellers on small islands. Tourism, however, contributes to the economy, but developmental challenges lie in the strategy to integrate the local economy and the social and cultural aspects of tourism development into the development scenario. The tourism industry on small islands is also at risk from global disturbances, including the pandemic. The pandemic will contribute to the local community's survival and social-economic development [2, 4, 10].

Many small islands in Indonesia are characterised by abundant and luxurious mangrove ecosystems, which are crucial ecosystems. Mangroves provide significant economic and ecological benefits. It contributes to global carbon sequestration and therefore plays an important role in climate change mitigation. Moreover, it is a crucial habitat for numerous terrestrial and aquatic species. Furthermore, mangroves protect the coastal ecosystem and are important for coastal soil conservation. The degradation and loss of the mangrove ecosystem led to numerous environmental and economic problems. Furthermore, rapid coastal development leads to mangrove degradation. A comprehensive plan for tourism development on small islands with abundant mangroves is therefore important [11–14].

Bintan is one of the small islands with an abundant mangrove ecosystem. The political and economic views of the Indonesian government led to the recent rapid development of Bintan. With an increase in development activity, the mangroves are one of the ecosystems with a high risk of disturbance and degradation. In Indonesia, study reports conclude that the conversion of the mangrove ecosystem to numerous forms and types of land uses, including shrimp, fishing docks, settlements, tourism facilities, and industrial areas, occurring in many mangrove hotspots, is especially relevant [15, 16]. A similar situation seems to potentially occur in Bintan, where island development potentially destroys the mangrove ecosystem.

The Bintang Regency in Indonesia provides significant issues for tourism development on small islands. Located close to Singapore and Malaysia, tourism in Bintan has been viewed

as one potential sector for increasing economic income to support local development. Critics of small island development are often concerned with the issues of lack of development policy support, lack of infrastructure, and poor human resources and economic access [17, 18]. With a poor approach, tourism development is far from the vision of local prosperity and biodiversity preservation. First, this paper aims to describe the recent tourism development on Bintan Island. Second, this study aims to assess the mangrove ecosystem's potential diversity as a resource for tourism development. Third, this paper provides a recommendation for a strategy for sustainable tourism development in Bintan, an area with an especially high abundance of mangrove ecosystems.

Methods

A field survey entitled "*Developing Mangrove Ecolodge through community-based Tourism in Ekang Mangrove Park, Bintan*," was conducted from September to October 2021 as part of the Matching Fund Project funded by the Ministry of Education, *Culture, Research, and Technology*. Mangrove biodiversity was assessed through the identification of mangrove plant species, birds, mammals, and reptiles.

Data were collected by visiting and observing Bintan Island. In the Ekan Mangrove Park, mangrove and bird species were observed and identified as crucial biodiversity resources, supporting the argument that the mangrove ecosystem is an important habitat on Bintan Island. Mangrove corridors were explored by following mangrove forest roads and river corridors. Mangrove trees were identified through the recognition of plant habitus as well as generative and vegetative (flower and fruit) organs. Morphological data were collected and identified following the Mangrove Identification Handbook. The observation of birds was done by walking along forest corridors. Birds were observed through direct observation using binoculars. Moreover, the birds were identified using direct species morphology and bird-voice recognition. Furthermore, the birds' field guide identification was used to verify the species' names.

The mangrove ecosystem document and the potential impact of tourism development on the mangrove ecosystem were empirically reviewed. Secondary data were collected from numerous sources, including data and information presented at a post-COVID-19 seminar related to the Bintan Tourism Development Programme, held virtually in Bintan using the internet, published journals, and relevant official documents provided by the office of Bintan Regency. The data were analysed descriptively.

Results and discussion

Tourism in Bintan Islands

Administratively, the Bintan Regency, with a total area of about 74.200,94km², belongs to Kepulauan Riau Province, Indonesia. Approximately 3.265 of the area is land (ca. 2.418,79km²) and 96.74% of the area is seawater (71.782km²). The regencies of Bintan consist of 272 islands, with Bintan Island (60.057km²) being the biggest of these island groups. Only 39 of the 272 islands are inhabited by the local community, with agriculture as the main activity on the islands [19].

Geographically, Bintan Island is located in the Straits of Malacca, close to Singapore and Kuala Lumpur, in Southeast Asia (Fig. 1). Singapore has been known as one of the world's modern cities and hubs of global airline movements. Changi, the Singapore international airport, serves approximately ten million global airline passengers annually. In 2019, approximately 68.300.000 passengers used Changi Airport, which is an increase from

65.630.000 in 2018. The COVID-19 pandemic in 2020 affected global travel and led to a decrease in passengers in Changi. Consequently, the number of passengers in 2020 dropped to 11.800.000 and 2.240.000 in November 2021 [20].

Additionally, Singapore offers a significant tourism market, which is important to support nature-based tourism in the Bintan Islands.

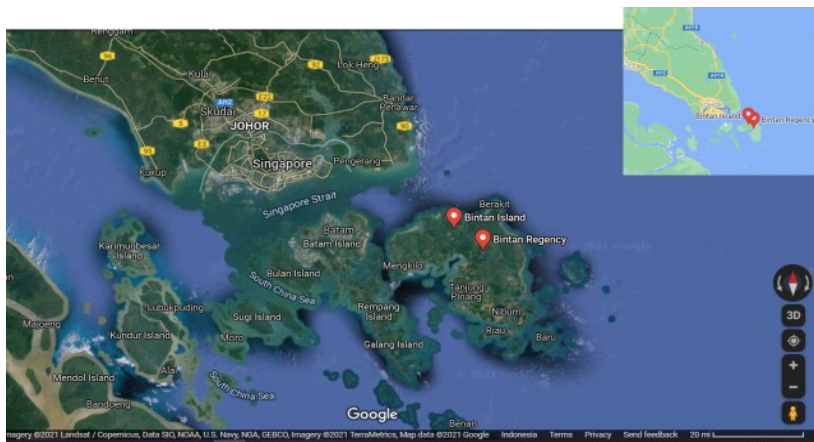


Fig. 1. Bintan Regency is composed of some small islands, with Singapore and Malaysia as important neighbouring countries with a potential international tourism market

Bintan has been recognised as a tropical island abundant with natural attractions. Considering the natural resources and potential tourism market of Singapore, tourism has been developed as a new economic machine for development. Tourism infrastructure and facilities have been developed to attract tourists to Bintan. In 2017, 34 hotels with a total of 2.292 rooms and 19 villas with a total of 439 rooms were available in Bintan. The island is one of the favourite nature-based tourist destinations among Indonesia's neighbouring countries, especially tourists from Singapore and Malaysia [19]. The absence of natural resources in Singapore leads Singaporeans to travel to Indonesian islands, including Bintan, as the nearest nature-based neighbouring island. Tourism accommodation and its facilities have been set up according to international standards. Moreover, Singapore is the crucial entry point for global tourists to access Bintan (Table 1).

Table 1. International arrivals to Bintan in 2019 via Singapore

ASEAN countries	Tourist arrivals
Singapore	241.921
Malaysia	27.894
Philippines	16.893
Thailand	2.074
Vietnam	1.857
Other ASEAN countries	5.549
Total ASEAN countries	296.188
Asia	
Hong Kong	3992
India	64233
Japan	18478
South Korea	9305
Taiwan	6379
China	146968
Other Asia countries	3670
Total Asia	253.025

A total of 15.513 European visitors arrived in Bintan via Singapore, with 16.300 from England, France (10.499), Germany (6.183), the Netherlands (2.378), Russia (1.537), and other European countries (15.513). Singapore significantly contributed to Bintan tourism arrivals from American countries (12.398), Australia and Pacific countries (18.289), and Middle East-African countries (1.782).

Tourism development is one of the focuses of the Regency's development. The local government allocated 22.307,22ha of land area (14.89% of the total area) for tourism-area development. Nature-based tourism development is one of the crucial tourism development programmes that is especially relevant to the status of land use patterns in the Bintan Regency. The area is abundant with natural resources and is a potential resource for future sustainable tourism development (Table 2). Agricultural land and plantations with local community settlements are integral ecosystems that can develop into agrotourism, rural tourism, or other forms of special interest tourism programmes.

Table 2. Land use classification in the Bintan Regency

No	Land uses types	Area (ha)		%
		Lands	Waters	
A.	Protected area	34.935,06	15.519,42	33.68
1	Protected forest	4.781,97		3.19
2	Local protected area	21.026,12		14.04
3	Marine protection area		333,62	0.22
4	Lakes	1.083,38		0.72
5	Reservoirs area	607,59		0.41
6	Sea grass area		2.304,85	1.58
7	Coral reefs		12.820,95	8.56
8	Mangrove	7.435,99		4.96
B.	Cultivation and other usage area	97.910,14	2.951,55	67.33
1	Production forest	9.236,41		6.17
2	Agricultural lands	22.237,63		14.84
3	Plantations	9.284,78		6.20
4	Mining area	7.029,12		4.69
5	Industrial area	8.831,67		5.90
6	Tourism area	22.307,22		14.89
7	Human settlements	12.524,04		8.36
8	Airport area	107,06		0.07
9	Capital city of the Regency area (Bandar Seri Bentan)	4.843,21		3.23
10	Seaport zone		2.951,55	1.97
11	Landfill sites	4,70		0.004
	Total	131.340,92	18.470,97	100.00
		149.811,88		

Sources: RTRW Kabupaten Bintan 2020–2024

A trend of tourism growth exists in Bintan, as observed by the rapid development of tourism facilities, the growth in the number of accommodations, and the increase in the number of tourism attractions. This optimism is also shared by Mr. Sulaiman, the marketing manager of VTO Singapore, at the tourism seminar event in October 2021. The head of the Tourism Office in Bintan also said that the number of tourists increased and that opportunities for Singaporean and international tourists to visit Bintan exist (interview in December 2021). One of the resort managers also said that future challenges for tourism in Bintan are to attract Singaporeans to promote programmes related to natural attractions, including luxurious mangroves in Bintan.

Mangrove biodiversity

Mangroves are one of the crucial ecosystems on Bintan Island. The ecosystem is characterised by vegetation composed of mangroves, including *Avicennia officinalis*, *Brugueira gymnorhiza*, *Campostemon schultzii*, *Rhizophora apiculata*, *Rhizophora mucronata*, *Rhizophora stylosa*, *Sonneratia alba*, *Sonneratia caseolaris*, and *Xylocarpus granatum*. Species associated with the main mangrove plants also exist, including *Acrosticum speciosum*, *Deris trifoliata*, *Gymnathera* sp., *Pandanus odoratissima*, *Scaevola taccada*, and *Thespesia populnea* [21]. Moreover, mangroves are crucial habitats for numerous fish, birds, and invertebrates.

Three wild mammals, i.e., *Macaca fascicularis*, *Presbytis natunae*, and *Dugong dugong*, were recorded in the Ekan mangrove. A survey conducted at the end of 2021 found 32 bird species (belonging to eight orders and 20 families) in the Ekan mangrove area. The eight recorded orders include Accipitriformes (hawks, eagles, and relatives), Apodiformes (swifts), Columbiformes (pigeons, doves, and relatives), Coraciiformes (kingfishers and relatives), Cuculiformes (cuckoos, anis, and relatives), Gruiformes (cranes, rails, and relatives), Passeriformes (perching birds), and Pelecaniformes (pelican and fish-eating birds). The checklist of birds observed in the mangrove ecosystem of the Ekan mangrove centre is shown in Table 1.

Table 3. Bird diversity and its conservation status observed in Ekan mangrove park

Family	Species	Local name	Regional status	Conservation status (IUCN)
Accipitridae	<i>Haliastur indus</i>	Elang bondol	Resident	Least concern
	<i>Haliaeetus leucogaster</i>	Elang laut perut putih	Resident	Least concern
Apodidae	<i>Colocalia fuchiphaga</i>	Walet sarang hitam	Resident	Least concern
	<i>Colocalia maxima</i>	Walet sarang putih	Resident	Least concern
Columbidae	<i>Geopelia striata</i>	Perkutus jawa	Resident	Least concern
	<i>Streptopelia chinensis</i>	Tekukur Biasa	Resident	Least concern
	<i>Treron vernans</i>	Punai gading	Resident	Least concern
Alcedinidae	<i>Halcyon coromanda</i>	Cekakak merah	Resident	Least concern
	<i>Halcyon smyrnensis</i>	Cekakak belukar	Resident	Least concern
Coraciidae	<i>Eurystomus orientalis</i>	Tiong-lampu biasa	Resident	Least concern
	<i>Todiramphus chloris</i>	Cekakak sungai	Resident	Least concern
Meropidae	<i>Merops</i> sp.	Kirik-kirok sp.	(-)	(-)
Cuculidae	<i>Centropus bengalensis</i>	Bubut alang alang	Resident	Least concern
	<i>Phaenicophaeus sumatranus</i>	Kadalan sumatera	Resident	Least concern
Rallidae	<i>Amaurornis phoenicurus</i>	Kaero padi	Resident	Least concern
Dicaidae	<i>Dicaeum</i> sp.	Cabai sp.	(-)	Least concern
Cisticoliidae	<i>Orthotomus sutorius</i>		Resident	Least concern
Corvidae	<i>Corvus macrorhyncos</i>	Cinene pisang	Resident	Least concern
Hirundinidae	<i>Hirundo tahitica</i>	Layang-layang batu	Resident	Least concern
Laniidae	<i>Lanius christatus</i>	Bentet coklat	Resident	Least concern
Muscicapidae	<i>Cyornis turcosus</i>	Sikatan melayu	Resident	Near threatened
Nectariniidae	<i>Anthreptes malaccensis</i>	Butung-madu kelapa	Resident	Least concern
	<i>Aethopyga separaja</i>	Burung-madu separaja	Resident	Least concern
Pycnonotidae	<i>Pycnonotus plumosus</i>	Merbah belukar	Resident	Least concern
	<i>Pycnonotus goaivier</i>	Merbah cerukcuk	Resident	Least concern
Ploceidae	<i>Passer montanus</i>	Burung gereja	Resident	Least concern
Sturnidae	<i>Acridotheres tristis</i>	Kerak Ungu	Resident	Least concern
	<i>Acridotheres javanicus</i>	Kerak kerbau	Resident	Vulnerable
	<i>Aplonis payanensis</i>	Perling kumbang	Resident	Least concern
Timaliidae	<i>Macronus gularis</i>	Ciung-air coreng	Resident	Least concern
Ardeidae	<i>Egretta garzetta</i>	Kuntul kecil	Resident	Least concern
	<i>Butorides striata</i>	Kokokan laut	Resident	Least concern

As birds are the most crucial resource for bird watching, which is one of the ecotourism programmes favourites, the popularity of bird watching is still growing, with areas with a high number of birds and bird endemism receiving significant tourism. With proper management, bird watching provides a significant economic impact on the local community in areas with high bird diversity [22, 23].

The biodiversity of the mangrove ecosystem has been studied, and mangroves have been confirmed as crucial sites on the conservation agenda in Bintan. Statistical data show that the mangrove covers an area of about 16.998ha, distributed in several mangrove areas on Bintan Island (Table 4). In Bintan, the mangrove is one of the dominant ecosystems in the area (the eastern and northern parts of the island).

Table 4. Mangrove distribution in Bintan Island

No	Sites	Area (ha)
Northern area of the island		
1.	Tanjung Uban	1.845
2.	Tanjung Siambang	936
3.	Teluk Sumpat	1.218
4.	Busung	1.020
5.	E Kang Anculai	2.520
Eastern area of the island		
6.	Sungai Gesek	1.780
7.	Tanjung Tangkap	760
8.	Pulau Dompok	520
9.	Sungai Dompok	1.140
10.	Pulau Buton	300
11.	Kijang	1.888
12.	Pulau Angkut	143
13.	Pulau Kelong	720
14.	Pulau Koyan	683
15.	Air Palong/P.Mantang	927
16.	Tanjung Paku	598

The combination of plants, animals, rivers, estuaries, and landscapes of mangroves provides opportunities for nature and environmental education for tourists. Environmental education has recently been the focus of nature-based tourism, especially ecotourism programs. The need to increase the awareness of the young generation about the environment by travelling to nature programmes has been reported to be crucial. These will be the segments of education tourism, with the target group including the young generation, students, teachers, and other groups [24, 25]. Thus, mangrove conservation is important for educational purposes.

Understanding the ecological aspects of the ecosystem to support sustainable tourism development is crucial. Furthermore, it is especially important because mangrove is a complex ecosystem that is fragile to disturbance. Consequently, changes in vegetation structure and composition lead to systemic disturbance [11]. Mangroves are habitats for aquatic animals, including fish, shrimp, and other invertebrates. Moreover, mangrove forests are crucial habitats and natural nurseries for the world's seafood supply. Scholars point out that the productivity of fisheries is related to mangrove quality [25, 26]. Changes in species diversity, structure, and composition significantly change food webs in the mangrove ecosystem. Numerous human activities in mangroves have been reported to contribute to the changes.

Opportunities for ecotourism development

The ecotourism development in Bintan is relevant to the attempt to support local economic development through the optimal use of a high amount of biodiversity. Ecotourism provides opportunities for the sustainable use of abundant natural resources. It is especially relevant in the effort to promote sustainable uses of natural resources and increase local economic benefits from natural resources. Ecotourism has been promoted as one of the instruments for local economic development in areas with abundant natural resources [5, 9, 14, 27].

Biodiversity conservation is a crucial issue in ecotourism planning and implementation. Conservation is principally crucial to ensuring the sustainability of natural attractions, including mangrove biodiversity [11, 27]. In Bintan, conservation action is an interesting issue that contributes to the basic foundations of sustainable tourism. Conservation action can also attract tourists to Bintan.

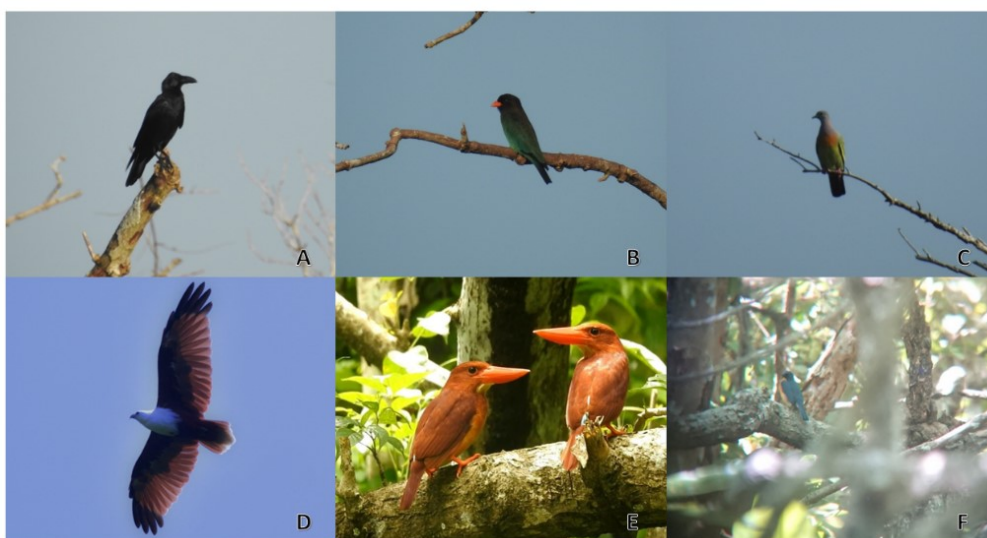


Fig. 2. Observed birds from Ekang Anculai Mangrove Park observation point:

- (A) *C. macrorhynchos*; (B) *E. orientalis*; (C) *T. vernans*;
(D) *H. indus*; (E) *H. coromanda*; (F) *C. turcosus*

Some strategic approaches exist to enhance the link between mangrove conservation and tourism on Bintan Island, including:

➤ *Biodiversity conservation*

Biodiversity conservation should be considered a principal aspect of tourism development. Bintan contains significant biodiversity, including the diversity of birds (Fig. 1). The proper management of birds and their habitats is the key to the development of bird watching, a tourist programme that has recently become a favourite in many nature-based tourism destinations. Promoting significant biodiversity value and how to conserve and use tourism should be implemented by the local government, private sector, tourism stakeholders, and local community in Bintan. In light of the lack of issues concerning sustainable mangrove conservation and the need for conservation to support future tourism development, enhancing the capacity of the government to issue a regulation to strengthen the protection and sustainable use mechanisms of mangroves for tourism development is needed. In Bintan, awareness among

tourism stakeholders about mangrove conservation issues is also crucial and brings mangrove conservation to any agenda of tourism development. Mapping recent mangrove distribution, assessing the level of mangrove biodiversity, and identifying factors that contribute to degradation are the main initial programmes in mangrove conservation [13]. Poor data on such information contributes to poor mangrove management, leading to rapid mangrove degradation in Bintan.

➤ *Developing ecolodge*

Developing ecolodges, both in private and community ownership, is important to support the ecotourism programme in Bintan. Tourists currently in accommodations which are established following ecological principles are significantly growing, representing the significant reason for ecolodge development. Scholars report that the recent increase in ecologically sustainable tourism accommodation is an impact of tourist awareness of environmental issues [27, 28]. Opportunities for the development of community homestays, operated by the local community, were also noted. The ecological accommodation, however, is crucial to implementing homestays owned by the local community. It should be able to provide guests with an experience of the nature and culture of the local community. Ecolodge in the mangrove ecosystem is one of the innovative strategies to provide tourists with a deep experience of mangrove ecosystems.

➤ *Strengthening nature-based tourism programs*

Nature-based tourism seems to be the most powerful programme to attract tourists to visit Bintan. Learning about nature and improving tourists' knowledge about biodiversity have recently become the focus of ecotourism programmes [29, 30]. In Bintang, possible interesting tourism programmes based on biodiversity resources include bird watching, mangrove forest trekking, and canoeing in the mangrove ecosystems. To support such a plan, ecological data is required for nature-based attraction development. The development of biodiversity centre points and trekking corridors should be done following environmental guidelines. The safety issue is an ultimate factor to be considered, especially in minimising human-wildlife contact. Nature-based tourism products should be able to increase visitor satisfaction and provide safe programmes, especially when in a wildlife area.

➤ *Community participation*

Problems with tourism in Bintan are closer to the issue of less community participation, which is especially common in developing countries, including Indonesia [31, 32]. In the context of ecotourism, efforts to involve the local community in tourism are crucial. Problems of community participation are often related to human resources, skills, and knowledge. In such a case, governmental policy and commitment to supporting community participation are crucial. Some nongovernment organisations have the knowledge, skills, and comprehensive methodology to support local community participation programmes in tourism. Private sectors are also crucial groups to support funding and technical assistance for local community participation. In Bintan, these multiparty approaches should be embraced in local community participation planning, scenarios, and implementation.

Conclusions

Bintan has the potential to develop ecotourism in mangrove areas to optimise the use of mangrove resources sustainably for the tourism industry. The biodiversity of the mangrove ecosystem in Bintang is a crucial resource for ecotourism development. With the increase in tourism in the natural area, managing mangroves to support sustainable practices is crucial.

Some crucial issues were noted towards sustainable tourism in the area with abundant mangrove ecosystems, including promoting biodiversity conservation, ecotourism development, strengthening nature-based tourism products and programmes, and supporting community-based tourism implementation. The involvement of the local people is crucial and should be the main consideration for ecotourism implementation.

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