Journal of Tropical Biodiversity and Biotechnology
Volume 07, Issue 03 (2022): jtbb72243
DOI: 10.22146/jtbb.72243

Research Article

Management Strategies of Mangrove Biodiversity and the Role of Sustainable Ecotourism in Achieving Development Goals

Prima Wahyu Titisari[1]*, Elfis[1], Indry Chahyana[2], Nadiatul Janna[3], Haliza Nurdila[3], Ranti Sri Widari[1]
1) Department of Agrotechnology, Faculty of Agriculture, Universitas Islam Riau, Jl. Kaharuddin Nasution No. 113, Marpoyan, Pekanbaru 24284, Riau, Indonesia
2) Magister of Biomangement, School of Life Sciences and Technology, Institut Teknologi Bandung, Jl, Ganesa No.10, Bandung 40132, West Java, Indonesia
3) Department of Biology Education, Faculty of Teaching and Education Training, Universitas Islam Riau, Jl. Kaharuddin Nasution No. 113, Marpoyan, Pekanbaru 24284, Riau, Indonesia.
* Corresponding author, email: pw.titisari@edu.uir.ac.id, pw.titisari@gmail.com

Keywords:
ecotourism
management strategy
Mangrove
SDGs
Submitted:
14 January 2022
Accepted:
20 June 2022
Published:
19 September 2022
Editor:
Miftahul Ilmi

ABSTRACT

Mangrove forest is a unique and vulnerable ecosystem. This ecosystem serves both ecological and economic purposes. The Siak government has begun to develop the Sungai Apit District mangrove area, which has potential. The goal of this research was to develop a sustainable mangrove ecotourism strategy through five research goals: (1) identification of mangrove species diversity; (2) identification of ecotourism supply; (3) identification of ecotourism demand, (4) development strategy of mangrove ecotourism, and (5) development of the potential for mangrove ecotourism to increase the SDGs value. This research was conducted from January to April 2020. The supply and demand of natural tourism objects and attractions were assessed using ADO-ODTWA criteria analysis. The IFAS/EFAS and SWOT analysis was used to develop a mangrove ecotourism development strategy based on the valuation of ADO-ODTWA aspects. The contribution of mangrove ecotourism to UNESCO's SDG indicators for sustainable development. According to research, there are 35 species of mangroves on the Sungai Apit coast. The outcomes demonstrated that the feasibility level of tourism attractions (204 points) and supporting elements (472 points) met high-level criteria. It indicated that the area had a high potential for development as a mangrove ecotourism area. Based on IFAS/EFAS, SWOT analysis and the grand strategy selection matrix, the position of mangrove ecotourism strategy was in Quadrant I (Strength-Opportunity). The strategy that could be developed included (1) developing special interest mangrove ecotourism product; (2) increasing facilities; (3) improving the quality of human resources; (4) developing a network on the website and (5) increasing coordination with the Government. By implementing ecotourism strategy, the SDGs can be achieved, including: no poverty (goal 1); decent work and economic growth (goal 8); climate action (goal 13); life below water (goal 14); life on land (goal 15); and partnerships to achieve goals (goal 17).

INTRODUCTION

Mangrove areas serve a variety of ecological and socioeconomic functions in addition to being physically functional. One of mangroves' ecological functions is to maintain and stabilize shorelines and riverbanks, as well as to pro-

tect them from crashing waves and currents. The biological function of mangroves includes various types of fish, birds, monitor lizards and other types of primates, while the economic function of mangroves is one of the natural tourism areas, the results of which can be developed in the form of tourism industrial products as foreign exchange earners (Abdullah et al. 2014; Goh 2015; Hakim et al. 2017).

The permanent development of mangroves areas into ecotourism areas is a very rational alternative use in coastal areas because it can provide economic benefits and environmental services without exploitation of mangroves. The use of environmental services, such as ecotourism, will encourage the preservation of the mangrove ecosystem as a buffer zone for conservation areas (Kathiresan 2012; Elliott 2012; Cheia 2013; Malik et al. 2015; Kenny 2017; Susilo et al. 2017; Tracey et al. 2017).

The mangrove area on the coast of Siak Regency's Sungai Apit District has the potential to be developed as an ecotourism area and become one of the natural tourism destinations for the people of Siak Regency and its surroundings. On the other hand, the mangrove area on the coast of Sungai Apit District has the potential to be developed into an object of ecotourism attraction, but on the other hand, this mangrove area does not yet have an ecotourism development strategy. This is due to the fact that potential supply and demand for ecotourism in the coastal mangrove area of Sungai Apit District have not been identified as a basis for management planning and development strategies for ecotourism in mangrove areas.

The mangrove area on the coast of Sungai Apit District is one of the areas for regional development in the context of spatial use for regional tourism activities, according to Siak Regency Government policies. Regional development aspects, tourism product development, supporting transportation development, tourist market development, marketing and promotion development, human and institutional development, investment development and other supporting infrastructure development are all part of Siak regency tourism (Bappeda Siak 2019).

Ecotourism in the coastal mangrove area of Sungai Apit District can be an alternative development to mangrove ecotourism. Based on the potential of the mangrove area on the coast of Sungai Apit District, it is necessary to identify internal and external factors in the development of ecotourism, namely the strengths, weaknesses, opportunities and threats to formulate a coastal mangrove ecotourism development strategy. Sungai Apit District coast in a sustainable manner in this regard, the purpose of this research was to develop a strategy for developing ecotourism in the coastal mangrove areas of Sungai Apit District, as well as to explore the potential for mangrove ecotourism to increase the value of SDGs (Bappeda Siak 2019).

MATERIALS AND METHODS

Materials

The study was conducted in the coastal area of Sungai Apit Subdistrict,

which covers three villages (Kampung), Kampung Mengkapan, Kampung Sungai Rawa and Kampung Rawa Mekar Jaya (Figure 1) The study lasted four months, from January to April 2020. The equipment used is a 1: 50,000 scale work map, camera, binoculars, Global Position System (GPS) as well as the Dharmawan et al. (2020) and Melana et al. (2000). The Mangrove Lovers Group in Kampung Mengkapan, Kampung Sungai Rawa, and Kampung Rawa Mekar Jaya, as well as government leaders, community informal leaders, and the community in the three villages, participated in the research.

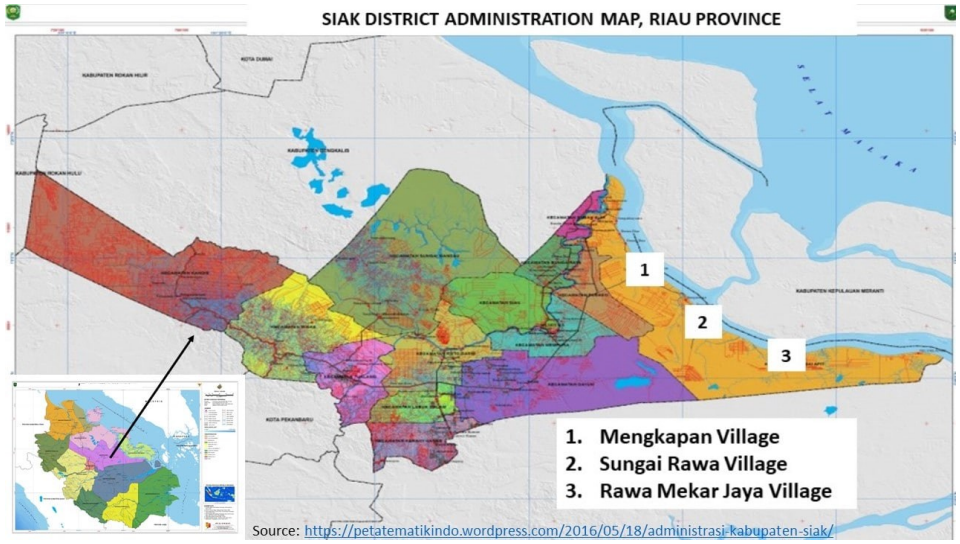


Figure 1. Map of Study area.

Methods

The survey method was used for the research, which included field observations and interviews. The potential for an area to be developed into an ecotourism attraction necessitates an evaluation of several elements required as a potential supply. The analysis of potential ecotourism offers employs a scoring and weighting system based on the Analysis of Operational Areas for Natural Tourism Objects and Attractions (ADO-ODTWA) guidelines (PHKA 2003) with the ecotourism planning criteria modified. These elements include object attractiveness, infrastructure, facilities and services, market potential, security, community socioeconomic conditions, institutional elements, environmental quality and accommodation. The potential supply of ecotourism in the development of mangrove ecotourism on the coast of Sungai Apit District, Siak Regency is classified as high, medium, or low. Meanwhile, the indicators along with the SDGs targets developed by the United Nations, are used as a tool in this study to determine the SDGs values that will be achieved if this ecotourism development strategy is implemented.

The descriptive analysis of ecotourism demand is based on tabulated data that has been processed, compiled and presented into important information based on visitor characteristics, visiting patterns, motivation, perceptions, preferences and expectations. In addition, an ADO-ODTWA analysis was conducted to support the IFAS/EFAS and SWOT analysis of all internal and external factors in developing ecotourism in the coastal mangrove area

of Sungai Apit District, Siak Regency.

IFAS/EFAS and SWOT analysis were used to develop strategies in the coastal mangrove area of Sungai Apit District, Siak Regency. IFAS/EFAS and SWOT analyses are used to identify various factors in order to develop a mangrove ecotourism development strategy. The stages of IFAS/EFAS and SWOT analysis are as follows:

a. identification and weighting of internal and external factors
b. analysis of internal and external factors

Weights and ratings can be assigned to each of the predetermined parameters based on the internal and external matrices that have been created to obtain a weighted value. This value will then be used to provide guidance on the prospects for ecotourism development in mangrove areas along the coastline of Sungai Apit District, Siak Regency.

These elements are then linked together in the form of a matrix to generate a number of strategic options. This matrix will produce four potential strategies for developing mangrove ecotourism along the coast of Siak Regency's Sungai Apit District. The creation of a grand strategies matrix to determine the strategy for developing mangrove ecotourism on the coast of Sungai Apit District, Siak Regency, followed the formulation of alternative strategies for developing mangrove ecotourism.

The outcomes of the IFAS/EFAS and SWOT analysis are then incorporated into the development plan formula's synthesis. The quantitative synthesis findings will guide the development of ecotourism in the coastal mangrove area of Sungai Apit District, Siak Regency based on the potential and conditions of the ecotourism object.

RESULTS AND DISCUSSION

Mangrove Diversity on the Coastline of Sungai Apit District, Siak Regency

According to the findings of surveys and interviews, 35 species of Mangrove plants can be found in various coastal areas of the Sungai Apit. The various types of mangroves are depicted in Table 1.

Ecotourism Attraction

Based on the information in Table 2, the mangrove area on the coast of Sungai Apit Subdistrict, Siak Regency, has a high classification of attractiveness which includes natural beauty, uniqueness of mangroves, cleanliness and comfort of the area, and variations in High-value tourism activities.

The mangrove area on the coast of Sungai Apit District, Siak Regency has the potential for limited (exclusive) ecotourism development. Limited ecotourism development in mangrove forest areas is a method of using mangrove areas as ecotourism objects without disturbing or degrading the quality of mangrove forests.

The analysis of the elements of attraction and support for ecotourism activities and support for ecotourism activities is used to determine the po-

Table 1. Mangrove diversity on the coastline of Sungai Apit.

No	Species	Local Name	Location
1	*Acanthus ilicifolius* Linn	Jeruju/Bakau Kurap	2
2	*Acrostichum aureum* Linn	Paku Laut/ Piai Raya	1,2,3
3	*Acrostichum speciosum* Wild	Piai Lasa	1,2
4	*Aegiceras corniculatum* Linn	Gedangan	2
5	*Avicennia alba* Blume	Api-api	1,2,3
6	*Avicennia marina* Vierch	Api-api Putih	2,3
7	*Bruguiera cylindrical* Blume	Tumu Putih	2
8	*Bruguiera gymnorhiza* Linn	Tumu Mera	2,3
9	*Bruguiera parviflora* Rosch	Lenggadai	3
10	*Bruguiera sexangular* Lour	Temusing/ Lindur	2,3
11	*Calophyllum inophyllum* Linn	Mentagur	2
12	*Cerbera mangas* Linn	Bintaro	1,2
13	*Ceriops decandra* Graff	Tengau	2
14	*Ceriops tagal* Pers	Tengar	2,3
15	*Derris trifolia* Lour	Ambung	2
16	*Excoecaria agallocha* Linn	Buta-buta	1,2,3
17	*Heritiera littoralis* Aiton	Dungun	2
18	*Hibiscus tiliaceus* Linn	Waru Laut	1
19	*Heritiera globose* Aiton	Dungun	3
20	*Knadelia candel* Steud	Berus-berus	3
21	*Lumnitzera littorea* Wild	Sesop	1,2
22	*Melastoma candidum* Blume	Senduduk	2
23	*Nypa fruticans* Wumb	Nipah	2,3
24	*Osbornia octodonta* F.v. Muell	Baru-baru	2
25	*Pandanus odoratissima* Forssk	Pandan Hutan	1,2
26	*Rhizophora apiculata* Blume	Bakau	1,2,3
27	*Rhizophora mucronate* Lam	Belukap/ Bangka Hitam/ Merah	1,2,3
28	*Rhizophora stylosa* Griff	Bakau Merah	1,2,3
29	*Scyphiphora hydrophyllacea* C.F. Gaegtn	Cingam	2,3
30	*Sonneratia alba* Sm	Pedada	1,2,3
31	*Sonnertia caseolaris* Lam	Perepat	1,2,3
32	*Sonneratia ovate* L.F	Kedabu	1,2
33	*Terminalia catappa* Linn	Ketapang	2
34	*Xylocarpus granatum* K.D. Koening	Nyirih	2
35	*Xylocarpus moluccensis* Lam	Nyireh	2

Description:

1: Mengkapan Mangrove area

2: Sungai Rawa Mangrove area

3: Rawa Mekar Jaya Mangrove area

tential supply of ecotourism in the coastal area of Sungai Apit District, Siak Regency. Furthermore, Figure 2 also demonstrates that the value of the element of ecotourism offering, which includes the value of the element of ecotourism attraction, is 220, while the value of the supporting elements is 470, indicating that the area has the potential to be developed as a mangrove ecotourism area according to the ODTWA analysis classification. Visitors to the coastal mangrove area of Sungai Apit District, Siak Regency can be seen based on their characteristics, visit patterns, motivation, preferences, perceptions and expectations to the development of ecotourism in the coastal mangrove area of Sungai Apit District, Siak Regency.

IFAS/EFAS and SWOT analysis were used to develop a limited ecotourism development strategy in the coastal mangrove area of Sungai Apit

Table 2. Assessment of elements attractiveness of ecotourism at coastline of Sungai Apit District, Siak Regency.

No	Attractiveness element	Value	Category
1	Tourist attraction	220	high
2	Market potential	230	high
3	Access to locations	350	moderate
4	Conditions around the area	125	moderate
5	Safety of the site	425	moderate
6	Management and services	320	moderate
7	Climate	200	moderate
8	Accommodation	330	moderate
9	Supporting facilities and infrastructure	350	moderate
10	Availability of clean water	310	moderate
11	The relationship between tourist objects around	395	moderate
12	Carrying capacity of the area	435	high
13	Visitor settings	330	moderate
14	Marketing	360	moderate
15	Market share	380	moderate

District, Siak Regency. The management of the area, namely the Mangrove Lovers Group, Kampung Mengkapan, Kampung Sungai Rawa, and Kampung Rawa Mekar Jaya, serves as the unit of analysis. The management of the area manager and the condition of the mangrove forest area located on the coast of Sungai Apit District, Siak Regency, which includes positive aspects (strengths) and negative aspects (weaknesses) are seen as internal factors while factors outside the management Mangrove areas that are threats (negative) and opportunities (positive) are considered external factors.

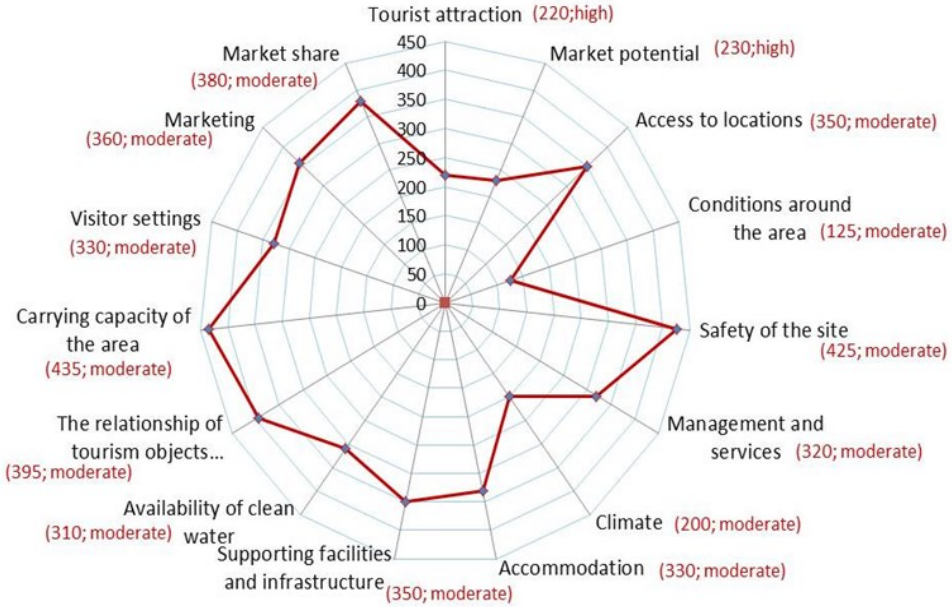


Figure 2. Assessment of elements attractiveness of ecotourism at coastline of Sungai Apit District, Siak Regency.

Identification of Internal and External Factors

Internal and external strategic factors for ecotourism development in Sungai Apit District, Siak Regency are determined using the ADO-ODTWA development criteria method (PHKA 2003) which is modified based on local ecotourism planning criteria.

Analysis of Internal and External Factors

Internal and external factor analysis includes IFAS-EFAS matrix and internal -external matrix analysis. The internal-external matrix positioning strategy is based on the number of weighted values of internal and external factors.

IFAS and EFAS Matrix

The IFAS Matrix was created based on the results of internal factors identification (Table 3), as shown in Table 4. The EFAS Matrix was also created based on the results of external factor identification (Table 4), as shown in Table 5.

The strengths and weaknesses of the Mangrove Lovers Group in Kampung Mengkapan, Kampung Rawa Mekar Jaya, Kampung Sungai Rawa as

Table 3. Matrix identification and weighting of internal factors.

No	Internal factor	Value of ADO-ODTWA	Weighting
I. Strengths			
1	Cleanliness of mangrove areas; Free of industrial and household waste, noise, sting odor and dust	25	0.07
2	Characteristic and uniqueness of mangrove vegetation and wild life	55	0.15
3	The natural beauty and physical shape of the beach area	46	0.12
4	Existing planning and management of tourist zone	20	0.05
5	Safety of the region	24	0.06
6	The existence of tourist facilities (Restaurant, worship facilities, toilets, clinic parking lot; fishing rig, interpretation boards, shelters, canoe /boat)	50	0.13
7	Availability of infrastructure (Roads, clean water and telecommunications networks and the Internet)	145	0.36
	Total I	361	
II. Weaknesses			
1	Human resource to manage mangrove tourism is not available, no tour guide /no interpreter	5	0.01
2	Interpretation facilities is minimal	12	0.03
3	No detail concept of mangrove ecotourism	5	0.01
	Total II	22	
	Total number (I+II)	383	1.00

Remarks : Weighted value based on the results of ADO-ODTWA

Table 4. Matrix identification and weighting of external factors.

No	External factor	Value of ADO-ODTWA	Weighting
I. Opportunities			
1	Support for ecotourism development policy	23	0.21
2	The support of the local government of Siak Regency	23	0.21
3	Position close to the downtown area of the district	23	0.21
4	The site is in priority of tourist destination development in Siak Regency	20	0.17
	Total I	89	
II. Threats			
1	Degradation of environmental quality	7	0.05
2	Site security impaired	7	0.05
3	Changes in site status	7	0.05
	Total II	21	
	Total number (I+II)	110	1.00

Remarks : Weighted value based on the results of ADO-ODTWA

Table 5. Ecotourism development of mangrove IFAS matrix coastline of Sungai Apit District, Siak Regency.

Code	Internal factor	Weighting	Rating	Weighted point
Strength factor				
S1	Cleanliness of mangrove areas; Free of industrial and household waste, noise, sting odor and dust	0,07	3	0,21
S2	Characteristic and uniqueness of mangrove vegetation and wild life	0,14	4	0,60
S3	The natural beauty and physical shape of the beach area	0,12	4	0,48
S4	Existing planning and management of tourist zone	0,05	4	0,20
S5	Safety of the region	0,06	3	0,18
S6	The existence tourist facilities) (Restaurant, worship facilities, toilets, clinic parking lot; fishing rig, interpret ation boards, shelters, canoe /boat	0,13	3	0,39
S7	Availability of infrastructure) (Roads, clean water and telecommunications networks and the Internet	0,36	3	1,08
	Total A			**3,14**
Weaknesses factor				
W1	Human resource to manage mangrove tourism is not available) (no tour guide /no interpreter	0,01	4	0,04
W2	Interpretation facilities is minimal	0,03	3	0,09
W3	No detail concept of mangrove ecotourism	0,01	4	0,04
	Total B			**0,17**
	Total number (A + B)	1,00		3,31

Table 6. Ecotourism Development of Mangrove EFAS matrix coastline of Sungai Apit District, Siak Regency.

Code	Internal factor	Weighting	Rating	Weighted point
Opportunities				
O1	Support for ecotourism development policy	0,21	4	0,84
O2	The support of the local government of Siak Regency	0,21	3	0,63
O3	Position close to the downtown area of the district	0,21	3	0,63
O4	The site is in priority I of tourist destination development in Siak Regency	0,17	4	0,68
	Total A			2,61
Threats				
T1	Degradation of environmental quality	0,05	4	0,20
T2	Site security impaired	0,05	4	0,20
T3	Changes in site status	0,05	4	0,20
	Total B			0,60
	Total number (A + B)	1.00		3,21

area managers are internal factors in the development of ecotourism in the coastal mangrove area of Sungai Apit Subdistrict, Siak Regency. Internal factors in the strength aspect have a weighted value of 3.14 whereas external factors in the weakness aspect have a weighted value of 0.17.

Table 6 displays that the external factors are external factors that contribute to the development of ecotourism in the coastal mangrove area of Sungai Apit District, Siak Regency. External factors that are opportunities have a weighted value of 2.64 whereas threats that may arise from ecotourism activities have a weighted value of 0.60.

Internal External Matrix

The ecotourism development strategy in the coastal mangrove area of Sungai

Apit District, Siak Regency is positioned in cell 1, namely the growth strategy with the expansion or diversification of ecotourism activities. This cell is intended to achieve growth in terms of product, marketing and assets. This condition can be achieved by creating new ecotourism products, improving human resources quality of services, and facilities.

SWOT analysis

By examining the combination of internal and external strategic factors, a SWOT analysis was used to determine the ecotourism development strategy in the coastal mangrove area of Sungai Apit District, Siak Regency (Table 7).

Table 7. Mangrove ecotourism development strategy formulation at coastline of Sungai Apit District, Siak Regency.

Internal	**Strengths/S**	**Weaknesses/W**
External	1. Cleanliness of mangrove areas; Free of industrial and household waste, noise, sting odor and dust 2. Characteristics and uniqueness of mangrove vegetation and wildlife 3. The natural beauty and physical shape of the beach area 4. Existing planning and management of tourist zone 5. Safety of the region 6. The existence of tourist facilities; Restaurant, worship facilities, toilets, clinic parking lot; fishing rig, interpretation boards, shelters, canoe /boat 7. Availability of infrastructure; Roads, clean water and telecommunications networks and the Internet	1. Human resource to manage mangrove tourism is not available; no tour guide /no interpreter 2. Interpretation facilities is minimal 3. No detail concept of mangrove ecotourism
Opportunities/O	**Strategy SO**	**Strategy WO**
1. Support for ecotourism development policy 2. The support of the local government of Siak Regency 3. Position close to the downtown area of the district 4. The site is in priority of tourist destination development in Siak Regency	1. Developing ecotourism products of special interest mangrove 2. Adding facilities and mangrove ecotourism activities 3. Improve the quality of competent human resources in the mangrove ecotourism activities 4. Make networking through special interest mangrove ecotourism website 5. Coordination with the Government of Siak regarding preservation and cleanliness of mangrove areas	1. Develop technical design and mangrove eco-tourism package as part of the management of mangrove areas in Siak Regency 2. Building mangrove areas as ODTWA in local government development program 3. Training as a travel interpreters 4. Improve the means of supporting eco-tourism in the region and outside the region structuring region)
Threats/T	**Strategy ST**	**Strategy WT**
1. Degradation of environmental quality 2. Site security impaired 3. Changes in site status	1. Conducting socialization of ecotourism mangrove 2. Raise awareness of the importance of environmental education 3. Prioritize the tourist zone with border village 4. Monitoring and evaluation of the impact of ecotourism activities 5. Improving the ecological benefits of mangrove areas and environmental services	1. Improve forest security with relevant agencies 2. Enhance training/education as a force travel interpreters 3. Increase supervision and services to the visitors 4. Adding interpretation boards

Position of Ecotourism Development Strategy in the coastal area of Sungai Apit District, Siak Regency

Based on the space matrix analysis and the grand strategy selection matrix, the position of the ecotourism development strategy in the coastal mangrove area of Sungai Apit District, Siak regency was determined. The space matrix is used to fine-tune the strategy analysis based on ecotourism's internal and external factors.

The ordinate position of the grand strategy for development of ecotourism in the coastal mangrove area of Sungai Apit District, Siak Regency is at [3,36; 1,92], which is in quadrant I, according to the space matrix analysis. The vector line in Figure 3 is positive for both internal and external factors. This means that the strategy can be developed to support an aggressive growth policy (growth-oriented strategy) by leveraging existing strengths to capitalize on existing opportunities. Quadrant I suggests an aggressive strategy, which includes leveraging internal strength to capitalize on external opportunities, overcoming internal weaknesses, and avoiding external threats (Majiol et al. 2016; Masud et al. 2017).

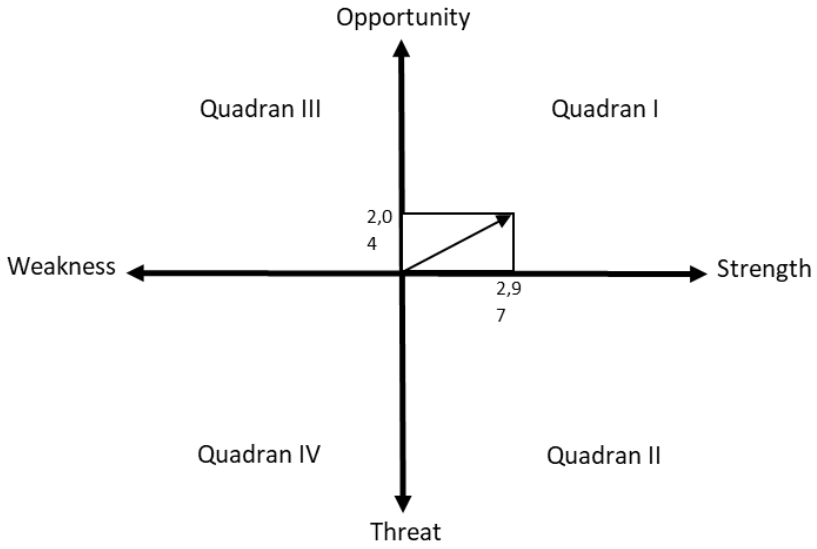


Figure 3. Grand strategy selection matriks of Mangrove ecotourism at coastline of Sungai Apit District, Siak Regency.

The quadrant strategy I have a better strategic position, and it is recommended that I pursue an alternative strategy that includes product diversification. A SWOT analysis was used to study the potential of the mangrove ecosystem on the coast of Sungai Apit District, Siak Regency. The highest strength of this ecosystem is the factor of environmental attractiveness around the mangroves, and its weakness is that no effort has been made to procure ecotourism products (Liu et al. 2014; Mojiol et al. 2016; Kenny 2017; Masud et al. 2017). Ecosystem potential in mangrove areas is expected to be developed through the implementation of strategies, specifically optimizing potential and minimizing existing obstacles to achieve the goals of mangrove ecosystem conservation. Strategic recommendations for the development of

ecotourism in the coastal mangrove areas of Sungai Apit District, Siak Regency are as follows:

Developing Mangrove Special Interest Ecotourism Products

The development of ecotourism products in the Sungai Apit District, Siak Regency coastal mangrove area is based on the cleanliness of the mangrove area, the uniqueness of the vegetation and animals of the mangrove ecosystem, facilities, infrastructure, area security, area status as an effort to support sustainable mangrove preservation in Siak Regency. Ecotourism products offered in the mangrove area must be safe and comfortable, in accordance with the potential of attractive, beautiful, and natural resources, facilities and road conditions to tourist objects that are easy to reach, and can fulfill and provide the desired satisfaction and experiences that are difficult to measure by visitors (Hussin et al. 2014; Hakim et al. 2017).

The development of ecotourism products in the coastal mangrove areas of Sungai Apit District, Siak Regency, is aimed at special interest ecotourism that includes elements of mangrove conservation efforts as well as tourism destinations. Bird and other animal watching, enjoying the beauty of mangrove vegetation via a wooden platform (boardwalk), fishing, boating among the mangrove vegetation (canoeing), and photography with the beauty and uniqueness of the vegetation and mangrove animals as an interesting object are some of the special interest ecotourism programs that can be developed in the coastal mangrove area of Sungai Apit District, Siak Regency. Mangrove education tours and tracking, bird watching, fishing, mangrove tree plantation or adoption, canoeing and boating are some of the ecotourism programs with a special interest in mangroves that have been developed in various locations based on the potential of mangrove areas as tourist attractions as well as efforts to rehabilitate and conserve mangrove areas. The mangrove education tour and tracking program is the most popular among visitors. Bird watching programs are only popular with a select group of people because they necessitate a specific amount of time and equipment (Jaafar 2012; Kathiresan 2012; Liu et al. 2014; Jaafar et al. 2015; Mojiol et al. 2016; Kenny 2017; Masud et al. 2017).

Development of distinctive tourism products in accordance with the potential of tourist objects and activities

The attraction is its natural beauty and local wisdom, as well as customs and local community culture developed in the coastal areas of Sungai Apit District, Siak Regency, but there is no special packaging in the form of programs. A fairly traditional community culture can be added attraction. The potential that can be developed are as follows:

a) Beauty of Nature

The view of the mangrove forest is one of the natural attractions or beauty that we can enjoy when visiting these tourist objects in Sungai Apit District, particularly those in Kampung Sungai Rawa and Kampung Rawa Mekar Jaya,

which are located at the estuary and along the banks of the Sungai Rawa. Green water, river water, and cool sea breezes lead directly to the Danau Zamrud National Park which consists of 2 (two) adjacent lakes. The two lakes are side by side with each other, namely the *Tasik Besar* and the *Tasik Bawah*.

Table 8 depicts the various types of Flora and Fauna in Zamrud Lake National park, which contains 38 species of aves or birds, 12 of which are protected species, including the White stork (*Ciconia ciconia*), Enggang dua warna, Enggang palung, Enggang benguk, dan Enggang ekor hitam. Spesies aves lain yaitu Finches (*Pycnonotus aurigaster*), Celepuk (*Otus spp.*), Bubut (*Cuculus spp.*), Murai batu (*Copsychus malabarius*), Layang-layang (*Delichon dasypus*), Rangkong gading (*Buceros virgil*), Rangkong papan (*Buceros bocrnis*), Punai (*Treron spp.*), Srigunting (*Dicrurus macrocercus*), Serindit (*Loriculus galgulus*), and Tekukur (*Geopelia striata*). Meanwhile, the types of fish that inhabit the lakes and rivers in this area are known to consist of 14 species with 8 species that have high economic value. Several types of fish that can be found in this area are Arwana (*Scleropages forosus*) which is an iconic ornamental fish, catfish (*Pangasius hypothalmus*), Gabus (*Channa striata*), and Limbat (*Clarias batrachus*).

Table 8. Various types of Flora and fauna in Zamrud Lake National Park.

No.	Family	Species	local name
	Flora		
1	Anacardiaceae	*Gluta wallichii* (Hook.f.) Ding Hou	Rengas burung
2		*Gluta aptera* (King) Ding Hou	Rengas paya
3		*Gluta renghas* L.	Rengas
4	Anisophylleaceae	*Combretocarpus rotundatus* (Miq.) Danser	Perepat
5	Apocynaceae	*Alstonia spatulata* Blume	Pulai
6	Aquifoliaceae	*Ilex cymosa* Blume	Kelat
7		*Ilex wallichii* Hook.f.	Mengkulat
8	Burceraceae	*Santiria laevigata* Blume	Balam
9	Calophyllaceae	*Calophyllum pisiferum* Planchon & Triana	Bintangur
10		*Calophyllum sclerophyllum* Vesque	Bintangur
11		*Calophyllum canum* Hook.f. ex T.Anderson	Bintangur
12	Chrysobalanaceae	*Parastemon urophyllus* (Wall. ex A.DC.) A.DC	Kelat
13	Clusiaceae	*Garcinia rostrata* Hassk. ex Hook.f.	Manggis hutan
14	Dipterocarpaceae	*Anisoptera marginata* Korth.	Mersawa
15		*Dipterocarpus coriaceus* Slooten	Keruing
16		*Shorea balangeran* Burck	Belangiran
17		*Shorea hemsleyana* King ex Foxw.	Meranti rawang
18		*Shorea macrantha* Brandis	Meranti kunyit
19		*Shorea platycarpa* F.Heim	Meranti kait
20		*Shorea teysmanniana* Dyer ex Brandis	Meranti lilin
21		*Shorea uliginosa* Foxw.	Meranti paya
22	Ebenaceae	*Diospyros maingayi* (Hiern) Bakh.	Asam kelat
23	Elaeocarpaceae	*Elaeocarpus griffithii* (Wight) A.Gray	Merawa

Table 8. Contd.

No.	Family	Species	local name
	Flora		
24	Fabaceae	*Dialium indum* L.	Keranji
25		Koompassia malaccensis Benth.	Mengeris
26	Hypericaceae	*Cratoxylum arborescens* (Vahl) Blume	Geronggang
27	Lauraceae	*Litsea grandis* (Nees) Hook.f.	Medang
28		*Litsea machilifolia* Gamble	Medang
29	Lecythidaceae	*Barringtonia reticulata* (Blume) Miq	Putat
30	Sapotaceae	*Madhuca motleyana* (de Vriese) J.F.Macbr	Nyatoh
31		*Palaquium burckii* H.J.Lam	Nyatoh
32		*Palaquium ridleyi* King & Gamble	Nyatoh
33	Thymelaeaceae	*Gonystylus bancanus* (Miq.) Kurz	Ramin
	Fauna		
1		*Panthera tigris sumatreansis*	Harimau sumatera
2		*Neofelis nebulosa*	Harimau dahan
3		*Helarctos malayanu*	Beruang madu
4		*Tragulus napu*	Napu
5		*Tragulus javanicus*	Kancil
6		*Macaca fascicularis*	Monyet ekor panjang
7		*Macaca nemestrina*	Beruk
8		*Presbytis melalophos*	Kokah
9		*Presbytis thomasi*	Ungko
10		*Tapirus indicus*	Tapir
12		*Muntinacus muntjak*	Kijang
13		*Felis spp*	Kucing hutan
14		*Hylobates syndactylus*	Siamang
15		*Manis javanica*	Trenggiling

b) Mangrove Forest

According to the findings of surveys and interviews, mangroves are abundant in Sungai Apit District, Siak Regency, and can be found on nearly every riverbank. Mangroves are owned in the following varieties: *pedada, bebetak, serokan, cingarn, piyoe (paku laut), selada, parepat, kedabu senoh, segamit, bulukap, pandan, jeruju, nipah*. There are several fruits from the mangrove tree that can be consumed such as nipah fruit (kolang-kaling), buah lindur fruit (*Bruguiera gymnorrhiza*), api-api fruit (*Avicennia alba*), pedada fruit (*Sonneratia alba*).

c) Mangrove Planting

Efforts to protect and preserve the mangrove forest area have included nurseries or the planting of mangrove seedlings, all planting and facility development activities are carried out independently in groups with the members of the community in the surrounding area. Other activities besides planting mangrove seeds include learning mangrove crab cultivation, *kelulut* bee cultivation, and fishing for fish and giant prawns.

d) Indigenous *Anak Rawa*

The Anak Rawa Indigenous People are inland communities who live in the Kampung Sungai Rawa area and a portion of Kampung Rawa Mekar Jaya. The state of a very traditional society that lives as a coastal community,

reliant on the waters of rivers, estuaries, lakes and sea. The Anak Rawa Tribe has generally accepted various religions, including Christianity, Hinduism-Buddhism, Konghuchu and Islam. Despite the fact that several religions have spread among the people, belief in ancestral spirits and persists to this day.

The Indigenous *Anak Rawa* tribe is still living in a time when tribal customs are prevalent. The *Anak Rawa* Tribe's origin, which first inhabited the Sungai Lancur Darah (Kampung Sungai Rawa) today, is due to a large number of *Anak Rawa* Tribe newcomers moving to Kampung Penyengat, the majority of whom now inhabit Mata Rimba and Sungai Mungkal. Because of its trustworthiness and honesty, the *Anak Rawa* Tribe once held a special place in the Siak Kingdom.

e) Traditional Dance and Music

This Gong dance performance has existed since the ancestors of the indigenous swamp tribe; however, the Gong dance, particularly in Sungai Apit sub-district, is not well known by the larger community and has received little attention needed in order to preserve this culture. So, in this case, it is possible that this dance will disappear because those who can dance it are elderly, with a few young people learn it, and there is a general lack of interest in the Gong dance.

Tradition is the nation's cultural heritage that, from time to time, requires attention in the direction of cultural development and is passed down from generation to generation. The gong dance resurfaced and was introduced by the Siak Regency Government in 2010 through a traditional festival art event of the Rawa Tribe. The Gong has a mystical meaning based on ancient story that if the Gong is struck, his voice will touch the hearts of the indigenous people. Indigenous people who are currently employed can resign. This is still going on in the area where the swamp children live today. Gong has its own set of meanings. Following the story of the Gendong dance, the Orang Rawa Indigenous people invented the Gong dance. The Gendong dance is based on legend held by the Anak Rawa Tribe.

Improvement of Mangrove Ecotourism Facilities

The development of ecotourism in Sungai Apit District, Siak Regency, cannot be separated from the provision of facilities for ecotourism activities with special interest in mangroves. Improved facilities for mangrove ecotourism activities must be based on conservation, spatial, safety, and comfort aspects, and must be tailored to the ecotourism activities offered in order to achieve a high level of visitor satisfaction (Ramli et al. 2018; Aye et al. 2019; Musa et al. 2020). The mangrove area is said to be optimal as an ecotourism object if the location and type of activity can be determined, the order and harmony of facilities and infrastructure are adjusted to the condition of the object, and visitors comfort and safety are guaranteed (Yeo et al. 2013; Susilo et al. 2017; Tracey et al. 2017; Situmorang 2018; Sofian et al. 2019).

Additional facilities are required to support ecotourism activities in the Sungai Apit District, Siak Regency, including the construction of wooden

platforms (board walks), viewing towers (for bird and animal watching activities), shelters, information huts, interpretation boards, nursery areas and wooden boats. Facilities must reflect the nature of the mangrove ecosystem while remain comfortable, unique and adapted to the ecotourism activities of special interest in mangroves that are being developed (Liu et al. 2014; Aye et al. 2019).

The layout of the facilities still takes into account the needs and aesthetics of the area. Visitors are not only interested in the quality of natural attractions, but also in the quality of facilities, beginning with the moment they depart from the visitor's origin to the destination of their destination, and throughout their tour, visitors get satisfaction and convenience.

Improving the Quality of Competent Human Resources in Mangrove Ecotourism Activities

Ecotourism products must be offered in conjunction with a certain level of competence from the manager and the availability of skilled personnel. Area managers must own competency standards in the development of ecotourism activities, which include knowledge, skills and attitudes in carrying out an activity (Ramli et al. 2018; Situmorang 2018; Aye et al. 2019). Training and education for officers involved in ecotourism activities in the coastal mangrove areas of Sungai Apit District, Siak Regency can be organized in collaboration with government agencies, universities or competent institutions by providing ecotourism management training and education. Training and education in support of ecotourism development activities, with a focus on mangroves, including interpretation planning techniques, ecotourism activity implementation, visitor management, ecotourism guides, and evaluation of the prevention and control of ecotourism impacts.

Ecotourism education and training not only demonstrate that the products offered have no negative impact on the environment, but also provide added value to visitor satisfaction, managers' ability to compete in the global ecotourism market, and all forms of ecotourism activities in accordance with utilization norms. In order to conserve the area, sustainable forest environmental services must be provided (Kathiresan 2012; Liu et al. 2014; Kenny 2017; Aye et al. 2019).

Mangrove Special Interest Ecotourism Website

In accordance with the development of exclusive ecotourism, the development of coastal mangrove ecotourism, Sungai Apit District, Regency by creating a network through ecotourism websites has piqued the interest of visitors, particularly middle to upper class visitors. This website offers interesting information about the natural beauty, comfort of the area, the uniqueness of mangrove plants and endemic animals, as well as ecotourism activities with a focus on mangroves. The success of tourism development in Bangladesh's Sundarbans mangrove area is supported via a more widely accessible website, particularly for visitors who are interested in visiting with exclusive infor-

mation about facilities (Liu et al. 2014; Kenny 2017; Tracey et al. 2017).

Coordination with the Siak Regency Government regarding Mangrove Areas

Cooperation and coordination between the area management and the Siak Regency government, as well as other related parties, is required in the development of ecotourism in the coastal mangrove area of Sungai Apit District, Siak Regency, in order to realize the development of mangrove ecotourism and the conservation of sustainable mangrove areas. Based on current environmental, political, and economic policies, this is the primary foundation for supporting the development of conducive and sustainable mangrove ecotourism (Liu et al. 2014; Kenny 2017; Tracey et al. 2017; Basyuni et al. 2018).

Coordination between the local government and management to support the preservation of mangrove areas and maintain the area's quality and cleanliness in developing ecotourism in coastal mangrove areas, Sungai Apit District, Siak Regency is as follows:

1) Equal perceptions of mangrove ecosystems environmental protection in order to maintain the attractiveness of ecotourism objects, including regulations on the use of environmental resources
2) Integration of land use related to the development plan of ecotourism objects in the mangrove area of Siak Regency
3) Improved coordination and outreach to stakeholders in tourism institutions strengthening by facilitating and expanding the network of tourism groups and organizations
4) Increase research and development of biodiversity in the coastal mangrove area of Sungai Apit District, Siak Regency in supporting efforts to conserve endemic vegetation and animals in the mangrove area
5) Assessing and monitoring the impact of mangrove ecotourism activities.

An ecotourism area is said to be good and successful if it can achieve three goals: 1) environmental preservation 2) ensuring visitor satisfaction and 3) increasing the integration of community development around the area and its development zone (Arriagada et al. 2012; Arkwright 2018; Adegboyega et al. 2019).

Based on several strategies proposed in the development of Mangrove ecotourism Sungai Apit, Siak Regency, it is expected to establish a system for utilizing environmental services that at the very least contributes to the regional economy, particularly local communities. Sustainable ecotourism, as discussed in Fennell's book (2015), is a nature-based tourism activity that contributes to the improvement and capacity building of local communities, provides knowledge and experience, and can be morally and socially aggravated. This ecotourism development could be one of the activities that contribute to the achievement of sustainable development goals.

Results should be clear and concise. The discussion should explore the significance of the results of the work. Avoid extensive citations and discussion of published literature. If appropriate, Results can be written in a sepa-

rate section from Discussion. This is especially if the Discussion is extensive and includes all the Results of the study.

SDGs Value

Mangrove ecotourism developed in Sungai Apit, Siak Regency, can help to achieve several Sustainable Development Goals (SDGs), as shown in Table 9.

According to the study's findings, the development of sustainable ecotourism can aid in the achievement of several priority SDGs, namely:

Goal 1 (No Poverty)

Essentially, all living things on this planet have values that can be used for humans, in addition to the resources' own survival. Ecotourism, according to Boo (1992), has the potential to benefit the economy. They can develop various types of businesses particularly for local communities, such as developing mangroves products as souvenirs, providing transportation services, lodging, and so on. Based on the results of the study, mangroves have been tentatively estimated at an average of US$ 4185 per hectare per year (Brander et al. 2012). Nobi et al. (2021) through a study in Bangladesh found that the estimated annual economic contribution of tourism in the Sundarban mangroves to Bangladesh economy is USD 53 million. Ecotourism provides several economic benefits, including 1) funding for protected areas; and 2) job creation for people living near the area. Furthermore, Boo (1990) and Lindberg (1991) state that ecotourism is viewed as a means of generating income and employment in areas that have not been impacted by development. So this activity is able to reduce the number of poor people.

Goal 8 (Decent Work and Economy Growth)

One of SDG 8's targets is to create jobs and promote local culture through sustainable tourism by 2030. Based on the potential discovered in the Sungai Apit Mangrove area, there are the *Anak Rawa* Native tribes, whose distinct culture and customs have been preserved to this day. Tourists, particularly foreign tourists, will be drawn to this. According to Wirakusuma (2014) and Muktaf and Zulfiana (2018), the uniqueness of traditional culture (such as traditional rituals, the uniqueness of the local community, culinary or traditional food) is what attracts foreign tourists to Indonesia., in addition to natural beauty. According to Sedarmayanti (2005), ecotourism activities that attract a large number of tourists have helped the country's foreign exchange while also creating job opportunities in the surrounding community. Communities not only gain jobs and income, but also create new jobs to support tourism activities. Furthermore, Purnamasari et al. (2015) and Fistiningrum and Harini (2021), argue that mangrove ecotourism can be an alternative to optimize the potential by constantly emphasizing the ecosystem sustainably and creating an economically valuable area.

Goal 13 (Climate Action)

Mangrove ecosystems have enormous carbon storage potential, allowing them to play a role in climate change mitigation. The term Blue Carbon refers to the

Table 9 Achievable Goals of Sustainable Development.

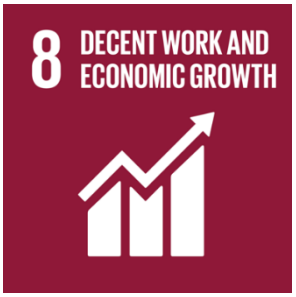
Goals		Target
	1.4	Ensure that all men and women, in particular the poor and the vulnerable, have equal rights to economic resources, as well as access to basic services, ownership and control over land and other forms of property, inheritance, natural resources, appropriate new technology and financial services, including microfinance
	1.5	Build the resilience of the poor and those in vulnerable situations and reduce their exposure and vulnerability to climate-related extreme events and other economic, social and environmental shocks and disasters
	1.a	Ensure significant mobilization of resources from a variety of sources, including through enhanced development cooperation, in order to provide adequate and predictable means for developing countries, in particular least developed countries, to implement programmes and policies to end poverty in all its dimensions
	1.b	Create sound policy frameworks at the national, regional and international levels, based on pro-poor and gender-sensitive development strategies, to support accelerated investment in poverty eradication actions
	8.2	Achieve higher levels of economic productivity through diversification, technological upgrading and innovation, including through a focus on high-value added and labour-intensive sectors
	8.3	Promote development-oriented policies that support productive activities, decent job creation, entrepreneurship, creativity and innovation, and encourage the formalization and growth of micro-, small- and medium-sized enterprises, including through access to financial services
	8.6	Substantially reduce the proportion of youth not in employment, education or training
	8.9	By 2030, devise and implement policies to promote sustainable tourism that creates jobs and promotes local culture and products
	8.10	Strengthen the capacity of domestic financial institutions to encourage and expand access to banking, insurance and financial services for all
	13.3	Improve education, awareness-raising and human and institutional capacity on climate change mitigation, adaptation, impact reduction and early warning
	14.7	Increase the economic benefits to small island developing States and least developed countries from the sustainable use of marine resources, including through sustainable management of fisheries, aquaculture and tourism
	15.1	Ensure the conservation, restoration and sustainable use of terrestrial and inland freshwater ecosystems and their services, in particular forests, wetlands, mountains and drylands, in line with obligations under international agreements
	15.2	Promote the implementation of sustainable management of all types of forests, halt deforestation, restore degraded forests and substantially increase afforestation and reforestation globally
	15.b	Mobilize significant resources from all sources and at all levels to finance sustainable forest management and provide adequate incentives to developing countries to advance such management, including for conservation and reforestation

Table 9 Contd.

Goals		Target
	17.14	Enhance policy coherence for sustainable development
	17.16	Enhance the Global Partnership for Sustainable Development, complemented by multistakeholder partnerships that mobilize and share knowledge, expertise, technology and financial resources, to support the achievement of the Sustainable Development Goals in all countries, in particular developing countries
	17.17	Encourage and promote effective public, public-private and civil society partnerships, building on the experience and resourcing strategies of partnerships

use of environmental services provided by the mangrove ecosystem as a form of mitigation in the face of climate change. Blue Carbon was introduced as a metaphor to highlight coastal ecosystems, which have a greater impact on organic carbon (C) than terrestrial forests (green carbon) (Manafe et al. 2016). About 22% of mangrove forests in Indonesia are preserved in conservation areas and provide 0.82–1.09 PgC hectare^{-1} of carbon storage (Sidik et al. 2018). As a result, mangrove conservation efforts are required to ensure the long-term viability of the area's mangrove ecosystem. Conservation efforts can be carried out by improving the quality of coastal waters and creating alternative sources of income, such as ecotourism and non-wood mangrove products (Sidik et al. 2018).

Goal 14 (Life Below Water)

Goal 14 requires the ability to use and conserve oceans and marine resources in a sustainable manner in order to achieve sustainable development. Mangroves play an important ecologically and physically role. Physically, mangroves have the role of protecting the coast from the intrusion of seawater into freshwater sources and tidal waves, preventing abrasion also. Meanwhile, mangroves play an ecological role as a source of organic matter in food chain. Furthermore, mangroves play an ecological and economic role in shrimp and fish spawning and rearing, so the presence of mangroves boosts the productivity of coastal and offshore fisheries. This is where the mangrove forest area is developed and managed to ensure the sustainability of the existing resources. According to Tuwo (2011), coastal and marine ecotourism almost never exploits natural resources, but instead relying on natural and community services to meet physical and psychological needs, as well as tourist knowledge. Furthermore, conservation is one of the goals of ecotourism, specifically through the sustainable use of mangrove ecosystem services to help provide effective funding or economic incentives to conserve, increase biodiversity, and protect the natural heritage that exists on this planet (Fennel 2015).

Goal 15 (Life on Land)

One of the goals of ecotourism development is to reduce pressure on forests as resources (Flamin & Asnaryati 2013), so the possibility of disturbance from visitors must be considered. To minimize environmental damage, the number of visitors must be limited in accordance with the carrying capacity of the ar-

ea. It should be noted, however, that this will create a conflict between conservation and economic interest. As a result, an economic strategy, such as the use of a price mechanism as a solution to economic and conservation problems, is required. When the number of visitors does not exceed the carrying capacity, the price can be set to the standard rate. However, if the number of visitors exceeds the carrying capacity, the policy adopted is to maintain a normal number of visitors while increasing the price proportionally.

Goal 17 (Partnership for the Goals)

According to Yoeti (2008), one of the positive effects of ecotourism, from a macroeconomic standpoint, is that it can encourage increased investment from the tourism industry sector and other economic sectors. Ecotourism will attract foreign tourists, resulting in financial resource partnerships for developing countries like Indonesia. In this case, however, it is necessary to anticipate the occurrence of leaks in tourism development. Import leakage typically occurs when there is a demand for international standard equipment used in the tourism industry, as well as imported food and beverage ingredients that cannot be supplied by local or domestic communities. The amount of revenue generated by the tourism industry is accompanied by the high costs that must be incurred in order to import products that meet international standards. Meanwhile, export leakage is common in the development of tourist destinations, especially in poor or developing countries which tend to require large capital and investment to build infrastructure and other tourist facilities. Conditions like these will entice foreign investors with deep pockets to build resorts or hotels as well as tourism facilities and infrastructure. In exchange, their business and investment profits will flow freely back into their home country (Istiqomah et al 2021; Tampubolon & Wulandari 2021). To prepare for this, the government will need to regulate investment policies and partnership patterns that support sustainable ecotourism.

CONCLUSION

According to the research findings, the Sungai Apit area has a relatively high diversity of mangrove species and has the potential to be developed as an ecotourism area. This area can be developed as an ecotourism destination by creating traditional mangrove products, improving facilities and human resources, and establishing networks with both the government and the private sector. As a result, it can help to achieve a number of sustainable development goals (SDGs).

AUTHORS CONTRIBUTION

P.W.T. designed the research, supervised all the process and wrote the manuscript, E. analyzed the data and wrote the manuscript, I.C. collected the data and wrote the manuscript, N.J.H.N., and R.S.W. collected the data.

ACKNOWLEDGMENTS

The authors thank all parties who have played a role in this research, especially

the Universitas Islam Riau (UIR). This research would not have been possible without the financial support from UIR.

CONFLICT OF INTEREST

We have no conflicts of interest to disclose.

REFERENCES

Abdullah, M. et al., 2013. Local community participatory process and intervention procedure in mangrove ecotourism of Marudu Bay, Sabah. *Pertanika Journal Tropical Agriculture Science*, 36, pp.173-180.

Adegboyega et al., 2019. Evaluation of unsustainable land use/land cover change on ecosystem services in coastal area of Lagos State, *Nigeria. Applied Geomatics*, 11(1), pp.97-110.

Arkwright, D. & Kaomaneng, I.S., 2018. Mangrove ecotourism development on Kakaralamo Island North Halmahera: Community perception, participation and development strategies. *IOP Conference Series: Earth and Environmental Science*, 175(1), pp.22-32. doi: 10.1088/1755-1315/1/012232.

Arriagada, R.A. et al., 2012. Dopayments for environmental services affect forest cover? a farm-level evaluation from Costa Rica. *Land Econ*., 88(2), pp.382–399.

Aye, N.W. et al., 2019. Contribution of mangrove forest to the livelihood of local communities in Ayeyarwaddy region, Myanmar. *Forest*, 10(5), 414. doi: 10.3390/f10050414.

Bappeda Siak, 2019. *Peta Jalan Siak Menuju Kabupaten Hijau,* Sedagho Siak & Pemerintah Kabupaten Siak.

Basyuni, M. et al., 2018. Developing community-based mangrove management through eco-tourism in North Sumatra, Indonesia. *IOP Conference Series: Earth and Environmental Science*, 126, pp.12-19. doi: 10.1088/1755-1315/126/1/012109.

Boo, E., 1990. *Ecotourism: The Potentials and Pitfalls*, Washington, DC: World Wildlife Fund.

Boo, E., 1992. *The Ecotourism Boom: Planning for Development and Management*, Washington, DC: Wildlands and Human Needs, World Wildlife Fund.

Brander, M.L. et al., 2012. Ecosystem service values for mangroves in Southeast Asia: A meta-analysis and value transfer application. *Ecosistem Services*, 1(1), pp.62-69.

Cheia, G., 2013. Ecotourism: Definition and Concepts. *Journal of Tourism*,15, pp.46-59.

Dharmawan, I.W.K. et al., 2020. *Panduan Monitoring Struktur Komunitas Mangrove di Indonesia*, PT Media Sains Nasional.

Elliott, J., 2012. An Introduction to sustainable development. 4thed. Abingdon, Oxon: Routledge

Flamin, A. & Asnaryati, 2013. Ecotourism potential and strategy development of Tahura Nipa-Nipa, Kendari City, Southeast Sulawesi. *Jurnal Penelitian Kehutanan Wallacea*, 2(2), pp. 154-168.

Fennell, D.A., 2015. *Ecotourism-fourt edition,* New York.

Fistiningrum, W. & Harini, R., 2021. The impacts of mangrove ecotourism management on the socio-economic conditions of people in kulonprogo regency. *IOP Conf. Series: Earth and Environmental Science*, 683, 012116. doi:10.1088/1755-1315/683/1/012116

Goh, H.C., 2015. Nature and community-based tourism (CBT) for poverty alleviation: A case study of Lower Kinabatangan, East Malaysia. *Geografia-Malaysian Journal of Society and Space*, 11(3), pp.42-52.

Hakim, L., Siswanto, D. & Makagoshi, N., 2017. Mangrove conservation in East Java: The ecotourism development perspective. *Journal of Tropical Life Science*, 7(3), pp.277-285.

Hussin, R., Mohd. Yassir, S. & Kunjuraman, V., 2014. Potential of homestay tourism based on seaweed cultivation from the views of seaweed cultivators in district of Semporna Sabah, East Malaysia. *SHS Web of Conferences*, 12(01005), pp.1-11.

Istiqomah et al., 2021. Does ecotourism contribute to sustainable development? A case at in Banyuwangi. *E3S Web of Conference 232*, 04009. doi: 10.1051/e3sconf/202123204009

Jaafar, M. & Maideen, S.A., 2012. Ecotourism-related products and activities, and the economic sustainability of small and medium island chalets. *Tourism Management*, 33(3), pp.683-691.

Jaafar, M. et al., 2015. Development of ecotourism products in Kilim Geopark based on tourist perceptions. *Journal of Sustainability Science and Management*, 10(1), pp.1-18.

Kathiresan, K., 2012. Importance of Mangrove Ecosystem. *International Journal of Marine Science*, 2(10), pp.70-89.

Kenny, L., 2017. The Road Less Travelled: A Case Study on Ecotourism and Sustainable Developmentinthe Sundarbans, Bangladesh. Thesis Department of Sociology. Lund University. http://lup.lub.lu.se/luur/downloadfunc=downloadFile&recordOId=8912611&fileOId=8912628

Lindberg, K., 1991. *Policies for Maximising Nature Tourism's Ecological and Economic Benefits*, Washington, DC : World Resources Institute.

Liu, J. et al., 2014. The role of social capital in encouraging residents' pro-environmental behaviours in community-based ecotourism. *Tourism Management*, 41, pp.190-201.

Malik, A., Fensholt, R. & Mertz, O., 2015. Mangrove exploitation effects on biodiversity and ecosystem services. Biodiversity and Conservation, 24 (14), pp.3543-3557.

Manafe G., Kaho, M.R. & Risamasu, F. 2016. Estimasi Biomassa Permukaan dan Stok Karbon pada Tegakan Pohon Avicennia marina dan Rhizophora mucronata di Perairan Pesisir Oebelo Kabupaten Kupang. *Jurnal Bumi Lestari*, 16(2), pp.163-17

Masud, M.M. et al., 2017. Community-based ecotourism management for sustainable development of marine protected areas in Malaysia. *Ocean & Coastal Management*, 136, pp.104-112.

Melana, D.M. et al., 2000. *Mangrove Management Handbook*, Department of Environment and Natural Resources, Manila, Philippines through the Coastal Resource Management Project, Cebu City, Philippines

Mojiol, A.R. et al., 2016. Contribution of mangrove forest and socio-economic development of local communities in Kudat district, Sabah Malaysia. *International Journal of Agriculture, Forestry and Plantation*, 2, 122-129.

Muktaf, Z.M. & Zulfiana, E.R., 2018. Persepsi Wisatawan Asing terhadap Wisata Indonesia. *Cakrawala Jurnal Penelitian Sosial*, 7(1), pp.83-106.

Musa, F., Fozi, N.M. & Hamdan, D.D.M., 2020. Coastal communities' willingness to pay for mangrove ecotourism in Marudu Bay, Sabah, Malaysia. *Journal of Sustainability Science and Management*, (15)4, pp.130-140.

Nobi, M.N. et al., 2021. Economic valuation of tourism of the Sundarban Mangroves, Bangladesh. *Journal of Ecology and Natural Environment,* 13(4), pp.100-109.

Perlindungan Hutan danKonservasiAlam (PHKA), 2003. Pedoman Analisis Daerah Operasi Obyek dan Daya Tarik Wisata Alam (ADO-ODTWA). Direktorat Jenderal Perlindungan Hutan dan Konservasi Alam. Bogor.

Purnamasari, R, Suprapto, D. & Purwanti, F., 2015. Pengembangan Ekowisata Mangrove Desa Karangsong, Kabupaten Indramayu. *Diponogoro Journal of Maquares,* 4(4), pp.146-154.

Ramli, F., 2018. Factors affecting user's perception towards conservation of biodiversity in Matang Mangrove Forest Reserve (MMFR), Perak, Malaysia. *International Journal of Business and Society*, 19(SI), pp.26-36.

Sedarmayanti, 2005. *Membangun Kebudayaan dan Pariwisata (Bunga Rampai Tulisan Pariwisata)*, Bandung (ID): Penerbit Mandar Maju.

Sidik et al., 2018. Mangrove conservation for climate change mitigation in Indonesia. *Wiley Interdisciplinary Reviews: Climate Change*, 9(5).

Situmorang, R.O., 2018. Social capital in managing mangrove ecotourism by the Muara Bambai community. *Indonesian Journal of Forestry Research*, 5(1), pp.21-34.

Sofian, A. et al., 2019. Ecosystem services-based mangrove management strategies in Indonesia: a review. *Aquaculture, Aquarium, Conservation & Legislation*, 12(1), pp.151-166.

Susilo, H., Takahashi, Y. & Yabe, M., 2017. The opportunity cost of labour for valuing mangrove restoration in Mahakam Delta, Indonesia. *Sustainability*, 9(12), 2169. doi, 10.3390/su9122169.

Tampubolon, N. & Wulandari, C., 2021. The importance of community-based ecotourism sustainability and its supports to the SDGs: goals number 8 and 17. Journal of Tourism & Sports Management (JTSM), 4(1), pp.928 -933.

Tracey, L.C. et al., 2017. Achieving the national development agenda and the Sustainable Development Goals (SDGs) through investment in ecological infrastructure: A case study of South Africa. *Ecosystem Services,* 27, pp.253–260.

Tuwo, A., 2011. *Pengelolan Ekowisata Pesisir dan Laut*. Surabaya: Brilan Internasional.

Wirakusuma, R.M., 2014. Analisis Karakter Wisatawan Mancanegara terhadap Fasilitas Wisata Kawasan Prawirotaman. *Jurnal Pariwisata,* 1(1), pp.42-52.

Yeo, S.C., Noor, A.G.A. & Lee, P.C., 2013. The estimation of economic benefits of urban trees using contingent valuation method in Tasik Perdana, Kuala Lumpur. *Pertanika Journal of Tropical Agricultural Science*, 36(1), pp.99-114.

Yoeti, O.A., 2008. *Ekonomi Pariwisata: Introduksi, Informasi, dan Implementasi*, Jakarta (ID): Kompas.