



Strategy to Strengthening Forest Farming for Sustainable Mangrove Forest Management in the Coastal Area, Deli Serdang, Indonesia

Christofel Limbong^{1,2}, Samsuri^{2}, Alfian Gunawan Ahmad²*

¹North Sumatra Provincial Forestry Service, Jl. Sisingamangaraja, Medan Amplas, Medan City, North Sumatra 20217 Indonesia

²Forestry Graduated Study Program, Faculty of Forestry, Universitas Sumatera Utara, Kampus 2 USU Bekala, Simalingkar A, Pancur Batu, Deli Serdang, North Sumatra 20353, Indonesia

Abstract. Mangrove forests can be used directly or indirectly by communities/farmer groups around the coast. However, with the rampant forest destruction that occurs, the community or farmer groups need to be equipped with capacity building about the importance of the mangrove ecosystem and its impact on their livelihood. This study aims to identify the condition of mangrove forests in the research area and determine strategies for institutional development of forest farmer groups in coastal areas at the Production Forest Management Unit. The research method used is a qualitative method with interviews; while the analytical method used is the SWOT analysis. Based on the results of the analysis of the Internal Factor Analysis Summary (IFAS) with a strength factor value of 0.054 and a weakness value of 0.47. From the calculation of the internal environment score (IFAS) value, namely the strength factor minus the weakness factor, the value of x was obtained as the horizontal axis $0.054 - 0.47 = -0.416$. Based on the External Factor Analysis Summary (EFAS) analysis results, the opportunity factor had a value of 0.054 with threats having a value of 0.047. The results showed that the external calculation score (EFAS), namely the opportunity factor (opportunities) reduced by the threat factor, obtained the Y value as the vertical. The identification of internal (IFAS) and external (EFAS) factors indicated that the position of institutional development of forest farmer groups in coastal areas was in quadrant one (I) or in an aggressive position that supports the SO development strategy (aggressive development strategy).

Keyword: Deli Serdang, Forest Farming, Forest Management, Mangrove Forest, Strengthening Strategy

Received 08 July 2022 | Revised 11 December 2022 | Accepted 31 January 2023

1 Introduction

Forest conservation, biodiversity, and forest ecosystem restoration are the hottest topics and have become an issue in various parts of the world, especially in Indonesia [1]-[3]. Forests

*Corresponding author at: Forestry Graduated Study Program, Faculty of Forestry, Universitas Sumatera Utara, Jalan Kampus 2 USU Bekala, Kecamatan Pancur Batu, Kabupaten Deli Serdang, Sumatera Utara 20353, Indonesia
E-mail address: samsuri@usu.ac.id

become catchment areas upstream and downstream of rivers as hydrology cycles and are not immune to various damages [4]-[5]. Economic, cultural, and social factors contribute to the destruction of forest areas. Along with the reduction in the function of forest areas in watersheds, flood disasters often occur and become one of the most frequent disasters [6]-[8]. Many losses also appeared along with the emergence of these disasters.

Law No. 19 of 2004 which emerged as a replacement for Law No. 41 of 1999 has regulated various matters regarding forests, obligations, and rights of communities in forest conservation. Communities within the scope of forestry can be protectors of forest sustainability, but can also be perpetrators of forest destruction due to economic, social, or cultural factors [9]. The rapid population growth in Indonesia can trigger the destruction of forest areas, including mangrove forest areas [10]-[12]. Over time, humans desire to convert forest areas into areas with other uses, which can lead to overexploitation and damage coastal ecosystems [13].

The development of mangrove ecosystems is currently being discussed widely, especially as a tourist location [14]-[16]. Ecotourism can play a role in one of the conservation efforts. Ecotourism found in mangrove forest areas is seen as one thing that can synergize with the real forest ecosystem conservation efforts [17]. The ecological functions of mangrove forests are very diverse. Mangrove forest areas provide environmental services in the form of protecting coastal areas from abrasion caused by waves, protection from strong winds, preventing seawater intrusion, regulating microclimate, absorbing harmful heavy metals, and as filters for pollutants as well as carbon storage. With the many benefits and functions of mangrove forests, their existence is very important for the environmental conditions of coastal areas [18].

One of these is forest management at the lower level, namely the Forest Management Unit (FMU). In North Sumatra as a research case study, the Production Forest Management Unit (PFMU/KPHP) V Deli Serdang there are fifteen (15) Forest Farmer Groups (FFG/KTH) which can be divided into three major groups, namely groups that already have management permits consisting of Independent Fishermen KTH, Bakti KTH Real, KTH Alam Lestari, and Muara Indah Jaya groups.

The mangrove ecosystem management system needs to be considered by making adjustments to the conditions and local wisdom of each region [19]-[21]. Indirectly, the destruction of ecosystems that occur in coastal areas can cause hydrometeorological disasters. Thus, a strategy is needed in forest management so that natural sustainability can be maintained and can minimize natural disasters that may occur [22]. Based on this, a study on the strategy of strengthening forest farmer institutions for sustainable mangrove forest management in Deli Serdang Regency needs to be encouraged, especially in matters related to the function of the forest as a water catchment area so that coastal communities can continue to utilize mangrove forests in a sustainable manner. And willing to participate in maintaining the sustainability of

the sustainable mangrove forest ecosystem. This study aims to identify the condition of mangrove forests in the research area and determine strategies for institutional development of forest farmer groups in coastal areas at the Production Forest Management Unit.

2 Research Method

This research was conducted in and around the mangrove forest area of Deli Serdang Regency which is included in several administrative areas of the nearest village.

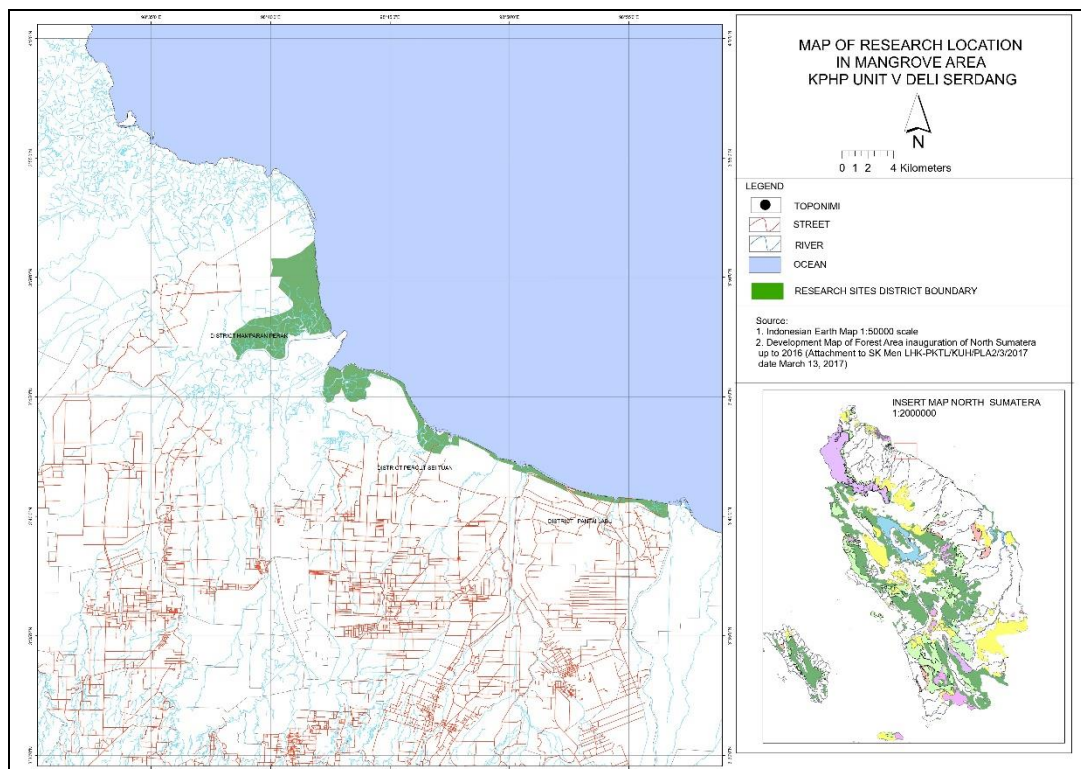


Figure 1 Research Site Map

2.1 Population and data collection techniques

The population determined in this study is the people who live in the forest area of the Deli Serdang Regency. The population is 15 Forest Farmer Groups spread over the Deli Serdang Regency. This study uses a census technique where technique is a technique for making decisions that are carried out randomly regardless of the strata that exist in the population [23]. Based on the distribution of the data obtained, there are 15 KTHs with 373 members. Interviews and questionnaires were conducted physically as well as the use of land in the research location.

2.2 Technical Data Analysis

A. *Mangrove ecosystem analysis*

Mangrove land that has lost its function can be categorized as critical land like experiencing damage and loss of function physically, chemically, hydrologically, and socio-economically [24]. Based on existing information and studies, damaged mangrove forests are generally caused

by socio-economic factors of the surrounding community as well as environmental biophysical factors. The collection of primary data and secondary data is needed to determine the environmental biophysical factors that affect the damage to mangrove forests. Qualitative descriptive methods with surveys can be carried out to find out this. The various parameters needed by the survey are data on the area, type of land cover, type of land use, and local community livelihoods related to the use of mangrove forests [25].

Geographic Information System (GIS) technology and satellite imagery were used to assess the criticality of land by using data on changes in land cover and mangrove area in Deli Serdang Regency as an effort to collect data. Types of land use can be classified and divided into three categories, namely forested areas which can be categorized as forests, plantations, and natural ponds, while areas that are classified as non-forest vegetation can be in the form of industry, settlements, rice fields, vacant land and ponds that are not accompanied by intercropping.

B. SWOT analysis

SWOT analysis is used to determine the right strategy for managing mangrove ecosystems. SWOT to determine various internal and external factors that will determine the future. Consists of internal factors, namely strengths and weaknesses can include culture, organizational structure, resources in the form of assets, skills or human resources, knowledge, and so on. Furthermore external factor namely opportunities and threats which including social, political, technological, and economic.

This study has a basic concept of comparison of external and internal conditions. It aims to get the right and clear strategy for planning the management of coastal areas in the future. After the concept is compiled, the results obtained in the form of strengths and weaknesses are translated into a matrix that will describe conditions that are related to each other.

INTERNAL FACTORS	EXTERNAL FACTORS	Opportunity 1. 2.	Threat 1. 2.
Strength 1. 2. 3.		STRATEGY ALTERNATIVE (SO) 1. 2. 3.	STRATEGY ALTERNATIVE (ST) 1. 2.
Weakness 1. 2. 3. 4.		STRATEGY ALTERNATIVE (WO) 1. 2. 3.	STRATEGY ALTERNATIVE (WT) 1. 2. 3. 4.

Figure 2 SWOT Matrix

The appropriate handling strategy, especially related to the concept of mangrove ecosystem sustainability, will be ranked to determine the strategic priorities to be used, the rating, and the ranking of alternative strategies. The weighting and SWOT ratings are as follows.

- a. SWOT factor weighting: Scale 1 – 2 – 3 – 4 – 5 Very Unimportant – Somewhat Important – Moderately Important – Important – Very Important
- b. Rating/SWOT factor rating: Scale 1 – 2 – 3 – 4 Very Small– Medium – Large - Very Large

Alternative strategies resulting from the SWOT analysis consist of SO (strength and opportunity) strategies, ST (strengths and threats) strategies, WO (weaknesses and opportunities) strategies, and WT strategies (weaknesses and threats).

3 Result and Discussion

3.1 Mangrove Forest Condition

The land cover of an area will continue to experience changes, both adding and reducing areas, as will the coastal area of Production Forest Management Unit V Deli Serdang.

Table 1 Changes in Land Cover in Coastal KPHP V Deli Serdang 2006-2019

No	Land Cover	Area 2006 (Ha)	Area 2019 (Ha)	Rate of Change (Ha)
1	Water	21.61	21.21	-0.03
2	Scrub	24.02	-	-1.85
3	Swamp Scrub	582.66	386.29	-15.11
4	Secondary Mangrove Forest	1236.85	944.09	-22.52
5	Secondary Swamp Forest	148.74	99.09	-3.82
6	Settlement	0.88	41.23	3.10
7	Plantation	831.32	1303.22	36.30
8	Dryland farming	101.107	38.83	-4.79
9	Rice field	-	9.55	0.73
10	pond	1875.95	2084.50	16.04
11	Open Ground	253.99	10.34	-18.74
	Total	5134.71	5134.71	

From the data above, the analysis of the percentage change in land cover is described in the image below.

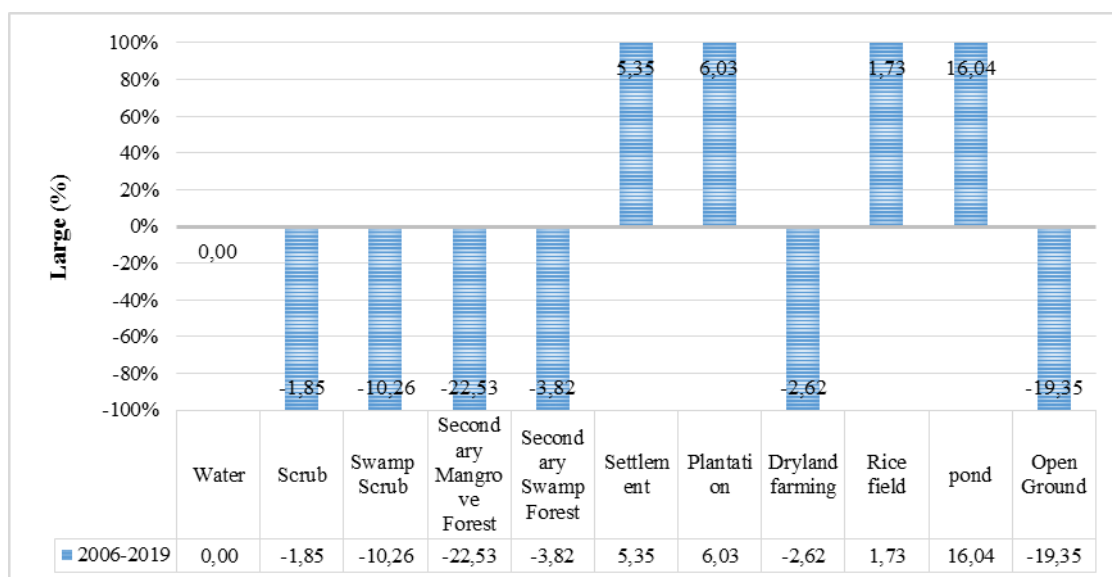


Figure 3 Percentage of Change in Coastal Land Cover

Changes in the land cover area into other land covers of an area can be known by comparing the land cover map of the area from one year to another. The biggest change that occurred on the coast of KPHP Unit V Deli Serdang from 2006 to 2019 was plantations with a rate of change of 36.30 Ha per year, while the smallest change was water with a rate of change of - 0.03 Ha per year. According to [26], several cases show that if land function changes, the surrounding land will also change function gradually over time. Identification of land cover changes is necessary for monitoring the occurrence of land cover changes and avoiding land degradation [27].

Changes in land cover also occur in mangrove forest areas with a rate of change of -22.52 Ha per year, which means that the mangrove forest area has decreased by 22.52 Ha per year. To minimize the greater impact of the pressure on mangrove resources, it is necessary to empower communities in coastal areas so that the community can become the main component that moves and participates in developing mangrove plants. On the other hand, a low community understanding of the role and function of mangrove plants can lead to a decrease in the quality of life of local communities and coastal resources [28].

3.2 Potential and Constraint Analysis (SWOT)

SWOT analysis (Strengths, Weaknesses, Opportunities, and Threats) is used to formulate goals to be achieved and strategies for achieving these goals. The results of the SWOT analysis conducted on farmer groups are based on an analysis of the internal environment’s strengths and weaknesses and an analysis of the external environment for opportunities and threats. The analysis and discussion activities resulted in the following internal and external factors.

A. Internal factors

Internal factors are existing internal conditions, whether biophysical, social, or infrastructure characteristics. The KPHP Unit V area has a working area of ± 38,047.06 hectares based on the

Decree of the Minister of Environment and Forestry Number: SK.1076/MENLHK-PKTL/KUH/PLA.2/3/2017. The area consists of a Protected Forest (HL) area of $\pm 8,808.91$ hectares, a Permanent Production Forest (HP) of $\pm 26,227.10$ hectares, and a Limited Production Forest (HPT) of $\pm 3,011.05$ hectares (RPHJP KPH area I Stabat). The forest area is only $\pm 2,762.49$ hectares (7.26%) which has a land cover in the form of the forest but has great potential that can be utilized/managed optimally. Improving the human resource capacity of forest farmer groups is needed to make human resources professional and competent to manage and take advantage of existing potential opportunities.

The KPHP Unit V area has the potential for natural resources and biodiversity within the KPHP Unit V management area, including the potential for timber forest products, non-timber forest products, and environmental services (ecotourism, water potential, beautiful landscapes, unique flora, and fauna). Socialization regarding KPHP Unit V needs to be carried out so that the community is aware of the existence of the KPH and the management components in it, including the management area. In addition, coordination must also be carried out between KPHP Unit V Deli Serdang and related parties, namely the community around the forest area, local government, central government, forest utilization permit holders, and forest area borrow-to-use permit holders.

The availability of accessibility in the KPHP Unit V to the forest area will make it easier for other parties to invest in the utilization and management of natural resources such as timber forest products, non-timber forest products, environmental services, and ecotourism. Most of the KPHP Unit V management areas have not yet been demarcated, which can result in tenure conflicts, in which potential KPH areas have been controlled and utilized by the community.

B. *External factors*

External factors that surround the KPHP Unit V management area are support from the local government for the development of Forest Farmer Groups, the development of environmental services (tourism, ecotourism, research), and the existence of boundary conflicts between the community and the government regarding mangrove forest areas.

Table 2 Internal Factors and External Factors

Internal factors		External factors	
<i>Strength</i>	<i>Weakness</i>	<i>Opportunity</i>	<i>Threats</i>
There was an increase in mangrove forest cover from 2015 to 2019 which had an impact on fish, shrimp, and crab populations	Funding for mangrove planting is not yet independent (it still relies dominantly on the government	Support from local government for KTH development	There is a boundary conflict between the community and KTH
Some community groups have been able to process products from mangroves (mangrove batik, syrup	Community human resources are still low in mangrove management/managerial not well organized	Alternative food from mangroves	The conversion of mangrove areas into oil palm plantations is suspected to be masterminded by

Internal factors		External factors	
<i>Strength</i>	<i>Weakness</i>	<i>Opportunity</i>	<i>Threats</i>
from mangroves).			unscrupulous investors
A total of three KTHs already have Hkm permits and have a Main Work Plan/Annual Work Plan	The still low percentage of mangrove area in forest area (<15% regulation \geq 30%)	Training in mangrove management adds insight to the community so that they can use mangrove areas sustainably	There are land claims from other farmer groups outside KTH
Periodically, the mangrove area becomes a haven for migratory birds	Low public knowledge of migratory birds	There are opportunities for collaboration with migratory bird watchers, both nationally and internationally	The community still hunts migratory birds
There are four KUPS formed (Pokdarwis, Fishermen's Group, Pokdagang, and Serai Wangi	There are still internal conflicts between KTH members	The existence of regulations regarding social forestry opens up opportunities for communities to manage forests in collaboration with KPH and Ministry of Environment and Forestry	There is abrasion caused by illegal sand mining

3.3 Forest Farmer Group Development Strategy for Sustainable Mangrove Ecosystem Management

The strategic decision-making process is always related to the development of the mission, goals, strategies, and policies of the institution. Therefore, in strategic planning, it is necessary to analyze the factors of institutional strategy. Sustainable forest management refers to the sustainability of ecological, economic, and sociocultural functions. Sustainable forest management needs to include the participation of the community around the forest. Community-based Forest resource management in principle places them as the main actors as well as the main actors in the decision-making process in forest management [29].

The forest farmer group development strategy is carried out by analyzing internal and external strategic factors, which are then made into IFAS (Internal Factor Analysis Summary) and EFAS (External Factor Analysis Summary) tables. Internal factors relate to the condition of potential resources contained in managed forest areas, management institutions (organizations and supporting regulations), human resources, and conditions of funding support. Meanwhile, external factors relate to the socioeconomic and cultural conditions of the surrounding community, the input-output market, and related agencies as well as formal and informal stakeholders with an interest in the management.

Table 3 Weighting and Rating of Internal Factors (Internal Factor Analysis Summary)

Internal factors	Weight	Rating	Score
Strength = S			
There was an increase in mangrove forest cover from 2015 to 2019 which had an impact on fish, shrimp, and crab populations	0.123	0.122	0.015

Internal factors	Weight	Rating	Score
Some community groups have been able to process products from mangroves (mangrove batik, syrup from mangroves)	0.114	0.115	0.013
A total of three KTHs already have Hkm permits and have a Master Work Plan/Annual Work Plan	0.103	0.104	0.011
Periodically, the mangrove area becomes a haven for migrant birds	0.088	0.082	0.007
There are four KUPS formed (Pokdarwis, Fishermen's Group, Pokdagang, and Serai Wangi)	0.089	0.092	0.008
Sub-Total			0.054
Weakness = W			
Funding for mangrove planting is not yet independent (it still relies dominantly on the government)	0.106	0.106	0.011
Community human resources are still low in mangrove management/managerial not well organized	0.107	0.106	0.011
The still low percentage of mangrove area in forest area (<15% regulation $\geq 30\%$)	0.097	0.100	0.010
Low public knowledge of migratory birds	0.077	0.081	0.006
There are still internal conflicts between KTH members	0.096	0.092	0.009
Sub-Total			0.047
Total	1.00		0.102

Based on the results of the Internal Factor Analysis Summary (IFAS) in Table 3, it can be seen that the strength factor has a value of 0.054 with a weakness of 0.047. The results of the calculation of the score of internal environmental factors in the strategy of strengthening forest farmer institutions for sustainable mangrove forest management at KPHP Unit V Deli Serdang Regency, namely the strength factor (s trend) minus the weakness factor, the X value as the horizontal axis is $0.054 - 0.047 = 0.007$, so the X-axis value in the SWOT diagram is 0.007.

Based on the results of the External Factor Analysis Summary (EFAS) in Table 3, it can be seen that the opportunity factor has a value of 0.054 with threats (threats) having a value of 0.047. From this value, it can be interpreted that the strengthening of forest farmer institutions for sustainable mangrove forest management in KPHP Unit V Deli Serdang Regency has a higher chance of 0.054 percent compared to the threat of 0.047 percent so that the development of strategies for strengthening forest farmer institutions still needs to be carried out and developed by agricultural skills that can be produced to improve people's welfare.

Table 4 Weighting and Rating of External Factors (External Factor Analysis Summary)

External Factors	Weight	Rating	Score
Opportunity = O			
Support from local government for KTH development	0.119	0.121	0.014
Alternative food from mangroves	0.108	0.096	0.010
Training in mangrove management can add insight to the community so that they can use mangrove areas sustainably	0.111	0.104	0.012
There are opportunities for collaboration with migrant bird watchers, both nationally and internationally	0.091	0.082	0.007
There are regulations regarding social forestry that open up opportunities for communities to manage forests in collaboration with Forest Management Unit and Ministry of Environment and Forestry	0.096	0.107	0.010

External Factors	Weight	Rating	Score
Sub-Total			0.054
Threats = T			
There is a boundary conflict between the community and KTH	0.101	0.095	0.010
The conversion of mangrove areas into oil palm plantations, which is suspected to be masterminded by unscrupulous investors	0.099	0.109	0.011
There are land claims from other farmer groups outside KTH	0.108	0.106	0.011
The community still hunts migrant birds	0.065	0.074	0.005
There is abrasion caused by illegal sand mining	0.102	0.105	0.011
Sub-Total			0.047
Total	1.00		0.102

Each internal and external factor has a different weight and rating value due to their different effects on people's lives in managing forest areas. According to a statement [30], strategy can fulfill the objectives to be achieved, which in its implementation is influenced by limited resources. This implies that all these strategies can be implemented together or separately, depending on the capabilities and resources possessed in implementing the strategy to achieve the objectives.

The results of the external environmental factors score calculation in the strengthening forest farmer institutions strategy, namely the opportunity factor minus the threat factor, the Y value as the vertical axis is $0.054 - 0.047 = 0.007$. Thus, the value of the Y axis in the SWOT diagram is 0.007. The results of the calculation of internal factors (Internal Strategic Factor Analysis Summary) and external factors (External Strategic Factor Analysis Summary) which produce the X-axis value are the results of subtraction between the strength factor (0.054) and the weakness factor (0.047) from the internal environment, which is 0.007 and the Y-axis value is the result of the reduction between the opportunity factor (0.054) and the threat factor (0.047) from the external environment that is equal to 0.007.

The results of the internal and external identification factors based on the SWOT diagram in Figure 3 show that the position of forest farmer institutional development for sustainable mangrove forest management in KPHP Unit V Deli Serdang Regency on strategic environmental analysis mapping (internal and external environment) is in quadrant one (I) or aggressive in favor of an SO development strategy (aggressive development strategy). This indicates that the opportunity for developing forest farmer institutional strategies for sustainable mangrove forest management in KPHP Unit V Deli Serdang Regency despite facing various threats, the strength of internal factors is still quite high. The strategy that must be applied is to use strength to take advantage of long-term opportunities.

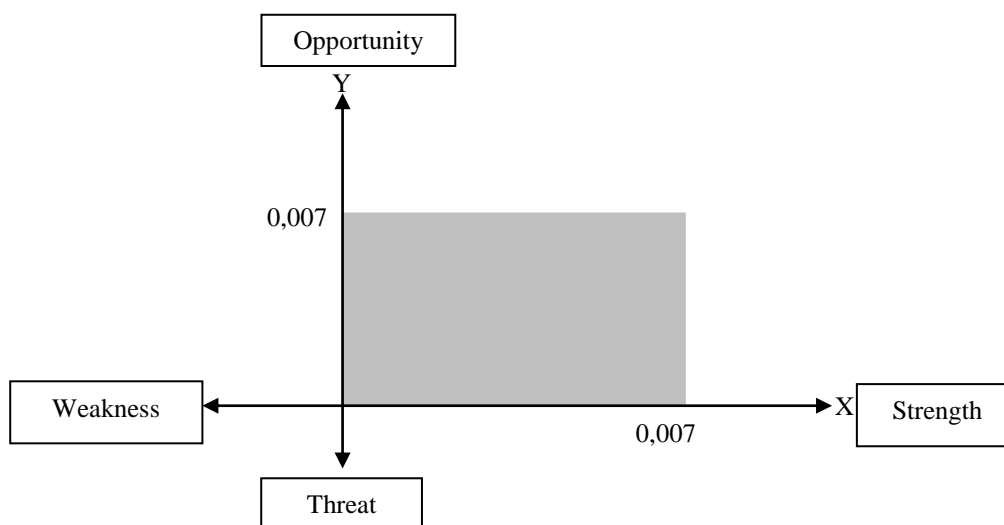


Figure 4 The strategic position of forest farmer institutions for sustainable management of mangrove forests

Table 5 SWOT Analysis Matrix Diagram

<p>Internal factor</p>	<p>Strength (S)</p> <p>There was an increase in mangrove forest cover from 2015 to 2019 which had an impact on fish, shrimp, and crab populations Some community groups have been able to process products from mangroves (mangrove batik, syrup from mangroves) A total of three KTHs already have Hkm permits and have a Master Work Plan/Annual Work Plan Periodically, the mangrove area becomes a haven for migrant birds There are four KUPS formed (Pokdarwis, Fishermen's Group, Pokdagang, and Serai Wangi</p>
<p>External factor</p> <p>Opportunities (O)</p> <p>Support from local government for KTH development</p> <p>Alternative food from mangroves</p> <p>Training in mangrove management can add insight to the community so that they can use mangrove areas sustainably</p> <p>There are opportunities for collaboration with migrant bird watchers, both nationally and internationally</p> <p>There are regulations regarding social forestry that open up opportunities for communities to manage forests in collaboration with Forest Management Unit and Ministry of Environment and Forestry</p>	<p>SO Strategy</p> <p>Increased community participation in mangrove rehabilitation activities and proposals for area management permits</p> <p>Improvement of KTH HR through training activities facilitated by relevant agencies</p> <p>Building cooperation with donor institutions, higher education institutions related to strengthening forest farmer institutions in managing mangroves</p> <p>Development of utilization of non-timber forest products as an alternative food</p> <p>Socialization of the high economic value of NTFPs and NTFPs compared to other material management</p>

Based on the SWOT matrix diagram in Table 5, in developing a forest farmer institutional strategy for sustainable mangrove forest management in KPHP Unit V, Deli Serdang Regency, the SO Strategy is used by carrying out operational activities.

A. Increased community participation in mangrove rehabilitation activities and proposals for area management permits

The mangrove forest is a complex and distinctive ecosystem that has a large carrying capacity for the surrounding environment [31]. It is undeniable that various human activities can also affect coastal areas. Thus, coastal areas must be managed by paying attention to interrelated ecosystems, which can affect changes in coastal areas [32].

The rampant exploitation and conversion of mangrove forest areas have indeed provided many benefits, especially in increasing the income of the community and the state. However, these benefits can only be felt for a while because the natural ecosystem has been damaged. If the natural ecosystem has been damaged, losses will be obtained in the future. If the mangrove ecosystem is damaged, it will affect changes in other ecosystems. For this reason, an active role in coastal communities is needed in maintaining and preserving them [33].

In 2016 the government through regulation P.83/MENLHK/SETJEN/KUM.1/10/2016 opened up opportunities for forest communities to manage forest areas with the Social Forestry pattern. People who are members of forest farmer groups propose a permit to the Ministry of Environment and Forestry. After the farmer group gets approval from the Ministry of Environment and Forestry, the community can manage the mangrove forest in the form of ecotourism (environmental services). With the direct benefits felt by the community, it is hoped that public awareness will grow of mangrove conservation.

B. Improvement of KTH HR through training activities facilitated by relevant agencies

The activities facilitated by the Forestry Service of North Sumatra Province are by providing training and assistance for the utilization of biodiversity in the mangrove area. By providing training, it is hoped that the community can take advantage of the biodiversity in the mangrove area which will later provide benefits to the community.

C. Build cooperation with Donor Institutions, Higher Education Institutions related to strengthening forest farmer institutions in managing mangroves

Some coastal forest farmer groups in Deli Serdang Regency have collaborated with NGOs, for example, the Forest Farmers Group (KTH) Real Bakti in Tanjung Rejo Village, Percut Sei Tuan District, Deli Serdang Regency, and Independent Fishermen Forest Farmers Group (KTH) Sei Tuan Village, Pantai Labu District Deli Serdang Regency cooperates with the Yagasu NGO regarding mangrove planting and institutional strengthening, while the Independent Fisherman Forest Farmers group also collaborates with the Islamic University of North Sumatra in the management and distillation of citronella into lemongrass oil and its marketing.

D. Development of utilization of non-timber forest products as an alternative food

The utilization of NTFPs is in the form of making crackers, luntheads, syrup, and other products derived from mangroves. Mangrove fruit that can be processed into food products includes the type of pedada (*Sonneratia* spp) which can be processed into syrup, jam, and lunthead. Api-api species (*Avicennia alba*) and lindur fruit (*Bruguiera gymnorrhiza*) can be processed into sponge cakes, pastries, and mangrove crackers [34].

E. Socialization of the high economic value of NTFPs and NTFPs compared to the management of other materials.

Communities and local communities have strong ties to their regions so management activities will be carried out and endeavored to make the area better. Not only is an ecological system, the mangrove ecosystem also a social system. The socialization of high economic value in developing natural resources that pay attention to the social-ecological system is an important way to do it. Local fisheries managers who have and are supported by local knowledge will encourage coastal economic growth [35]. Forests and mangrove ecosystems must be managed by involving all components related to stakeholders. Success and failure in managing mangrove forests cannot be separated from the participation of the community and government [36].

The results of the SWOT analysis above are still a big picture in developing forest farmer institutional strategies for sustainable mangrove forest management in KPHP Unit V, Deli Serdang Regency. By the statement [37], SWOT identifies various factors in the group of strengths, opportunities, weaknesses, and threats but does not provide which group is the most significant. In addition, SWOT does not assess the suitability of SWOT factors with decision alternatives and is primarily based on qualitative analysis and the expertise of people participating in the decision-making process.

4 Conclusions

The results of the identification of internal and external SWOT factors indicate that the position of institutional development of forest farmer groups in coastal areas at KPHP Unit V Deli Serdang is in quadrant one (I) or in an aggressive position that supports the SO development strategy (aggressive development strategy). This means that the opportunity for developing forest farmer institutional strategies for sustainable mangrove forest management despite facing various threats, the strength of internal factors is still quite high. The strategy that must be applied is to use strength to take advantage of long-term opportunities.

Acknowledgment

The author would like to thank those who have helped in this research. Special thanks to Forest Management Unit V Deli Serdang for providing research input, data, and field guidance. The authors also greatly appreciate their cooperation during this research.

REFERENCES

- [1] Djalante R, Garschagen M, Thomalla F, Shaw R, “Introduction: Disaster risk reduction in Indonesia: Progress, challenges, and issues”, *Disaster risk reduction in Indonesia*, pp. 1-17. 2017.
- [2] Silva-Castañeda L, “A forest of evidence: third-party certification and multiple forms of proof—a case study of oil palm plantations in Indonesia”, *Agriculture and human values*, vol. 29, no. 3, pp. 361-370. 2012.
- [3] Fisher M, Dhiaulhaq A, Alif M, “The politics, economics, and ecologies of Indonesia's third generation of social forestry: an introduction to the special section”, *Forests and Society*, vol. 3, no. 1, pp. 152-170. 2019.
- [4] Jactel H, Petit J, Desprez-Loustau M. L, Delzon S, Piou D, Battisti A, Koricheva J, “Drought effects on damage by forest insects and pathogens: a meta-analysis”, *Global Change Biology*, vol. 18, no. 1, pp. 267-276. 2011.
- [5] Bladon KD, Emelko M. B, Silins U, Stone M, “Wildfire and the future of water supply”, *Environmental Science & Technology*, vol. 48, pp. 8936–8943. 2014.
- [6] Pawar K.V & Rothkar R.V, “Forest conservation & environmental awareness”, *Procedia Earth and Planetary Science*, vol. 11, pp. 212-215. 2015.
- [7] Acosta L. A, Eugenio E. A, Macandog PB M, Magcale-Macandog D. B, Lin, EK H, Abucay, E. R, Primavera, M. G, “Loss and damage from typhoon-induced floods and landslides in the Philippines: community perceptions on climate impacts and adaptation options”, *International Journal of Global Warming*, vol. 9, no. 1, pp. 33-65. 2016.
- [8] Islam R, Kamaruddin R, Ahmad SA, Jan S, and Anuar AR, “A Review on Mechanism of Flood Disaster Management in Asia”, *International Review of Management and Marketing*, vol. 6, no. 1, pp. 29-52, 2016.
- [9] Hadi S. P, “*Environmental Dimensions of Development Planning*”, Yogyakarta, Gadjah Mada University Press. 2005.
- [10] Austin K. G, Schwantes A, Gu Y, Kasibhatla P. S, “What causes deforestation in Indonesia?”, *Environmental Research Letters*, vol. 14, no. 2, pp. 024007. 2019.
- [11] Tsujino R, Yumoto T, Kitamura S, Djamiluddin I, Darnaedi D, “History of forest loss and degradation in Indonesia”, *Land use policy*, vol. 57, pp. 335-347. 2016.
- [12] Supriatna J, Dwiyahreni A. A, Winarni N, Maria S, Margules C, “Deforestation of primate habitat on Sumatra and adjacent islands, Indonesia”, *Primate Conservation*, vol. 31, pp. 71-82.
- [13] Buwono R. Y, “Identification and Density of Mangrove Ecosystems in Pangpang Bay Area, Banyuwangi Regency. Samakia”, *Journal of Fisheries Science*, vol. 8, no. 1, pp. 32-37. 2017.
- [14] Hakim L, Siswanto D, Makagoshi N, “Mangrove conservation in East Java: the ecotourism development perspectives”, *Journal of Tropical Life Science*, vol. 7, no. 3, pp. 277-285.
- [15] Friess D. A, “Ecosystem services and disservices of mangrove forests: insights from historical colonial observations”, *Forests*, vol. 7, no. 9, pp. 183. 2016.
- [16] Fisu A. A, Ahmad A, Hidayat A, Marzaman L. U, “Potential of mangrove ecosystem as a tourism object development in Kaledupa Island”, *Edutourism Journal of Tourism Research*, vol. 2, no. 1, pp. 11-17. 2020.
- [17] Mulyadi E, Fitriani N. 2010, “Conservation of Mangrove Forests as Ecotourism”, *Scientific Journal of Environmental Engineering*, vol. 2, no. 1, pp. 11-18. 2010.
- [18] Martuti NK T, Setyowati D. L, Nugraha S. B, “Mangrove Ecosystems (Diversity, Phytoremediation, Carbon Stocks, Roles, and Management)”, Institute for Research and Community Service, Semarang State University, Semarang, Indonesia. 2019.
- [19] Zamzami L, Nursyiwani E, “The Local Wisdom In Marine Resource Conservation In Indonesia: A Case Study Of Newcomers In Pariaman West Sumatra”, In *2nd International Conference on Social and Political Development (ICOSOP 2017)*, pp. 391-400). Atlantis Press. 2017.

- [20] Limba R. S, Lio A, Husain Y. S, "Shifting cultivation system of indigenous moronene as forest conservation on local wisdom principles in Indonesia", *Journal of Sustainable Development*, vol. 10, no. 4, pp. 121-129. 2017.
- [21] Basyuni M, Rouf R. A, Saragih M, Asbi A. M, Yuriswan W, "Local wisdom and mitigation action to maintain secondary mangrove forest: a case study of Jaring Halus village in Langkat, North Sumatra, Indonesia", In *1st International Conference on Social and Political Development (ICOSOP 2016)*, pp. 551-555, Atlantis Press. 2016.
- [22] Khairullah S, Indra, Fatima E, "Community Perceptions of Mangrove Forest Functions in Disaster Risk Reduction Efforts", *Journal of Disaster Science (IF)*, vol. 3, no. 3, pp. 110-119. 2016.
- [23] Sugiyono 2013. *Statistics for Research*, Alfabeta, Bandung.
- [24] Mildrexler D. J, Zhao M, Cohen W. B, Running S. W, Song X. P, Jones M. O, "Thermal anomalies detect critical global land surface changes", *Journal of Applied Meteorology and Climatology*, vol. 57, no. 2, pp. 391-411. 2018.
- [25] Islam M. M, Sunny A. R, Hossain M. M, Friess D. A, "Drivers of mangrove ecosystem service change in the Sundarbans of Bangladesh", *Singapore Journal of tropical geography*, vol. 39, no. 2, pp. 244-265. 2018.
- [26] Kailola F. Y, Kaban I. K, "2015 Book of Environmental Status Reports for North Sumatra Province", North Sumatra Province Environmental Agency. Medan. 2015.
- [27] Yulius, Tanto T. A, Ramdhan M, Putra A, Salim H. L, "Land Cover Change in the Bungus Coast of Kabung Bay, West Sumatra, 2003 – 2013 Using Geographic Information Systems", *Journal of Tropical Marine Science and Technology*, vol. 6, no. 2, pp. 311-318. 2014.
- [28] Sutrisno, "Empowerment and Participation of Coastal Communities in Mangrove Development in Pati Regency", *Journal of Bina Praja*, vol. 7, no. 1, pp. 63-73. 2015.
- [29] Gisisi D. E, Walangitan H. D, Tamod Z. E, "Management Strategy of Production Forest Management Unit (KPHP) Unit V (Regency of Minahasa Regency, Tomohon City, Southeast Minahasa Regency and South Minahasa Regency)", *Journal of Agri-Socio-Economic Sam Ratulangi University*, vol. 15, no. 1, pp. 207-216. 2019.
- [30] Abdurrahim MF H, Daryanto A, Nurmalina R, "Strategy for the Development of the Indonesian Plantation Biotechnology Research Institute", *Journal of Management and Agribusiness*, vol. 11, no. 3, pp. 199-208. 2014.
- [31] Lisna, Malik A, Toknok B, "Vegetation Potential of Mangrove Forests in the Coastal Area of Equator Village, South Tinombo District, Parigi Moutong Regency", *Journal of Warta Rimba*, vol. 5, no. 1, pp. 63-70. 2017.
- [32] Kandari A. M, Kasim S, Siwi L. O, Surya R. A, Mando LOA S, Yasin A, Hidayat H, Pristya TY R, "Environmental Improvement with Community-Based Mangrove Planting to Support Coastal Tourism in Tapulaga Village", *Journal of Devotion on Society*, vol. 5, no. 1, pp. 88-103.2021.
- [33] Dahuri R, *Integrated coastal resource management*. Pradnya Paramita. Jakarta. 1999.
- [34] Patanda M, Ernarningsih D, Rahmani U, "Utilization of Processed Mangrove Fruit in Ketapang Village, Mauk District, Tangerang Regency", *Journal of Abdimas Satya Widyakarya (JASW)*, vol. 1, no. 1, pp. 1-9. 2020.
- [35] Harahab N, Raymond G, "Analysis of the Main Indicators of Community-Based Mangrove Forest Management in Curahsawo Village, Gending District, Probolinggo Regency", *Journal of Maritime Affairs and Fisheries Socio-Economic*, vol. 6, no. 1, pp. 29-37. 2011.
- [36] Fithria D, Hidayat R, "Revitalization of Mangrove Management through the Government's Role in Coastal Area Conservation in Aceh Jaya District", *Journal of Agrotek Lestari*, vol. 1, no. 1, pp. 81-88. 2015.
- [37] Gallego-Ayala J, Juizo D, "Strategic Implementation of Integrated Water Resources Management in Mozambique: An A'WOT Analysis", *Physics and Chemistry of the Earth*, vol. 36, pp. 1103-1111. 2011.