

# *The Effort to Maintain Mangrove Forest through the Development of Silvofishery Pond*

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**Abstract**—The objective of this study was to find out the perception and utilization of mangrove forest by the sylvofishery fish farmers to maintain mangrove ecosystem in Desa Tanjung Rejo, Sub-district Percut Sei Tuan, Deli Serdang Regency. The study was conducted through questionnaires and field observations on twenty-two ponds populations that have been applied silvofishery model in Desa Tanjung Rejo, Sub District Percut Sei Tuan, Deli Serdang Regency. The method used in this study was descriptive analysis with a qualitative approach. The results of a study on the effort to maintain mangrove forest through the development of sylvofishery pond showed that fish farmers' perception about the function of mangrove forest has average 90% and the utilization of mangrove forest, which existed in their pond, has average 80%. Furthermore, on the management of mangrove forest, sylvofishery farmers were involved together to protect and evaluate the mangrove.

**Keywords**—*silvofishery pond, fish farmer, the function of mangrove, mangrove utilization, community empowerment*

## I. INTRODUCTION

Mangrove forest is one of the natural resources in the coastal area that has a function for production, protection and conservation where is a unique forest ecosystem as an interface between terrestrial and marine ecosystems. The existence of a mangrove forest determines and supports the level of social and economic development of coastal communities. Mangrove forest is a source of various products that have economic values, such as wood, food sources, cosmetics, colours material, tanners and food source for animals.

The present condition of mangrove forest is under pressure due to the mangrove utilization and management of those who have to lack attention to sustainability aspects. Expansion of settlements and agricultural land, as well as uncontrolled logging, have proven that land use is not by its designation and exceeds over the carrying capacity, resulting in damage to mangrove forest ecosystems and degradation of coastal environments. This condition is further aggravated by the occurrence of pollution of river/sea water and the exploitation of marine

resources that are not environmental friendly. This condition requires a comprehensive action to maintain the sustainable mangrove forest ecosystem.

Efforts to maintain the existence of mangrove forests need strategies on conservation, management and mangrove restoration. Purnobasuki states that sustainable use of mangroves will reduce mangrove damage [1]. Therefore there are several actions in sustainable use of mangroves, including: silvofishery, which combines farms with mangrove plantation; community forest, which is the management of mangrove forests in a sustainable manner with a cutting cycle of 15-30 years or according to the purpose of planting; the culture of using mangroves to get products other than wood and the simultaneous combination of mangrove utilization.

Based on the interpretation from Yagasu map about land use in Tanjung Rejo showed that silvofishery pond model which commonly developed by the community is ditch model [2]. The total area that has been activated become sylvofishery pond is 564,537 hectares. Furthermore, the pattern of silvofishery pond management that applied by some fish farmers is combining various patterns such as milkfish cultivation and fattening mangrove crabs, milkfish and tiger shrimp, tilapia and fattening mangrove crab. Besides the two types of cultivation carried out in the ponds, the natural catch results in pairs are an economic benefit in the application of this silvofishery model.

Silvofishery is pond management with technical approaches consists of a series of integrated activities between fish farming activities and planting, maintaining, managing and preserving mangrove forests with a simple technology system without destroying the existing mangrove and carried out as intermittent activities while trying to reforest the green belt in the coastal area [3].

## II. METHOD OF RESEARCH

This study was conducted in Tanjung Rejo, Sub district of Percut Sei Tuan, Deli Serdang Regency, from

June to September 2018. Consideration of the study location was based on the coastal areas that utilized the mangrove ecosystem for silvofishery ponds.

Population in this study was fish farmers who managed the silvofishery ponds located in Tanjung Rejo. The sampling method was conducted by purposive sampling where silvofishery farmers have been applied culture pattern between fish, shrimp and crab fattening simultaneously combined with a natural non-cultivation catch at the full moon tide occurred on twenty-two ponds.

Technique for collecting the data was conducted by directly observing the research location, distributing the questionnaires to respondents for the closed answers after initial observation to determine mangrove management in the research area, continued with in-depth interviews by face-to-face then organized FGD meeting with respondents. All field data were analyzed with descriptive analysis.

### III. RESULTS AND DISCUSSION

Fish farmers perception about the function of mangrove forest stands in the pond which managed by silvofishery models showed on the table below.

**TABLE I. FISH FARMERS PERCEPTION ABOUT THE FUNCTION OF MANGROVE FOREST**

No	Description	Fish farmers' perception	
		Score	%
1	Mangrove forest is forest which lives in the environment of brackish water that strongly affected by sea tides	22	100
2	Sea tides strongly influence mangrove forest	20	91
3	The existence of mangrove forest, especially in areas which has sedimentation and accumulation of organic matter	20	91
4	The most important function of the mangrove forest ecosystem is to maintain the stability of the coastline	18	82
5	Mangrove forest also has a function to hold sediments then continuously can create new land or expand the land	21	95
6	Silvofishery pond is a conservative mangrove forest management by maintaining the forests and its function in a pond with a combination between fish farming and crab fattening activities.	22	100
7	Mangrove forest absorbs carbon higher than other forest ecosystems because mangrove has more leaves that can affect the carbon quantity, also releases less carbon into the atmosphere	16	73
8	Mangrove forest serves to neutralize toxic substances that come from waste disposal	18	82
9	Mangrove forests also have functioned as a nurturing or spawning areas for species that commonly breed and grow in areas of mangrove forests such as shrimp, fish, crabs, shellfish, etc.	21	95
10	The function of mangrove forests in coastal areas is as a barrier from abrasion and the intrusion of seawater	20	91
Average		19.8	90

*Source: Primer data analysis*

Based on the results of the data presented in table 2, the average percentage data of the scores agreed to approve 90% of silvofishery farmers. It shows that farmers carry out silvofishery activities with a combination of mangrove forests and mangrove cultivation in the ecosystem. Local communities living in the vicinity of mangrove ecosystems have a direct impact on mangrove forests because it involves mangroves directly understood by local communities including silvofishery farmers who manage ponds in the area of mangrove ecosystems. The vital role of mangroves felt by the local community is a supporting factor to maintain mangrove support in its area [4].

There are two fish farmers' perceptions with a very high percentage value reaching 100%. First, fish farmers understand that mangrove forest lives well in a brackish water environment that affected by the sea tides. If there is a changing function in the mangrove area, the coastal ecosystem will be disrupted. It is by the statement of Wibowo and Handayani that mangrove forests are also called brackish forests, tidal forests, coastal forests or mangrove forests is one of the potential natural resources and has a unique ecosystem between four important components such as land, water, flora and fauna [5].

Second, fish farmers understand that silvofishery model is a conservative management technique by maintaining the existence of mangrove forest and its functions in the pond area with a combination of fish farming and crab fattening activities. Silvofishery uses sustainability principles to optimize various functions of mangrove including conservation, protection and production functions for achieving the sustainable balanced of environmental, social and economic benefits [5].

The lowest percentage of fish farmers' perception compared to other perceptions only 73% was the understanding of the ability of mangrove forests to absorb more carbon than other types of the forest because mangrove has more leaves that can support the carbon absorption release less carbon into the atmosphere. From the interview of twenty-two fish farmers, only sixteen people answered the question correctly. This percentage is still in the high category if refers to the percentage proposed by Sarwono by grouping the percentages into [6]:

- (a). 0% <20%: Very small percentage
- (b). 21% - 40%: Small percentage
- (c). 41% - 60%: Medium percentage
- (d). 61% - 80%: High percentage
- (e). 81% - 100%: Very high percentage

The low understanding about mangrove ability to absorb carbon is caused by the lack of information dissemination to the fish farmers. Mangrove has more number of leaves so that carbon can be stored more than other plants [1]. The results from the assessment of

mangrove utilization in silvofishery pond provided in Table 2.

**TABLE II. ASSESSMENT ON THE UTILIZATION OF MANGROVE FOREST IN SYLVOFISHERY POND**

No	Description	Fish farmers perception	
		Score	%
1	The existence of mangrove in the pond gives benefits to fish farming and crab fattening simultaneously	22	100
2	Mangrove that grows in ponds provides added value to crops from cultivation and non-cultivation	22	100
3	Maintain the growth of the mangrove affects the period of crab fattening	20	91
4	Protect the stands mangrove in the pond can increase the number of natural crabs	18	82
5	Mangrove that grows in ponds are useful for wood needs in households	18	82
6	The utilization of mangrove forest inside and around the pond as a habitat of various biota can support the sources of food for fish, shrimp and crab cultivation	20	91
7	The utilization of mangrove forest inside and around the pond to create mangrove foods	11	50
8	The utilization of mangrove forest inside and around the pond as a source of medicinal materials	11	50
9	The utilization of mangrove forest inside and around the pond for maintaining the water quality	16	73
10	The utilization of mangrove forest inside and around the pond protects the pond embankment from abrasion	18	82
Average		17.6	80

*Source: Primer data analysis*

The result from the assessment of perception about the utilization of mangrove forests in silvofishery pond showed average value on 80%. There is two high percentage of perception that reach 100% where local community take cares of mangrove stands in ponds because this can give benefit to fish farming and crab fattening simultaneously. The fish farmers also let the mangrove grow well in the pond because it can provide benefit to cultivation and non-cultivation production. This perception showed that fish farmers make mangrove as the key to the successful management of ponds with silvofishery model. The density of mangrove is the main factor and as an indicator of the development of silvofishery. The high density of mangroves affects the quality of the waters and allows the function of the area to be categorized as optimal [7]. Furthermore, the ratio of mangroves in silvofishery ponds is positively correlated with nutrient content contained in mangrove litter. The more significant the mangrove ratio, the higher the nutrient content so that the growth of the plankton population as fish/shrimp natural food is increasing [8].

The lowest percentage of mangrove utilization by silvofishery farmers is that community groups have used mangroves in and around the ponds for mangrove-based

food ingredients and the use of mangroves in and around ponds as a source of medicinal materials by the community (50%). This statement shows that the use of mangroves for alternative and medicinal uses has not been maximally utilized in the village of Tanjung Rejo. From the results of discussions conducted in depth that some of the farmers who claimed to have known and used mangrove fruit to become food and medicine from several extension workers who came from the Forestry Service and Institutions engaged in environmental programs conducted counseling and training on the benefits of mangroves for various snacks and traditional medicines from mangrove plants.

The community empowerment approach that has been carried out in Tanjung Rejo Village, Percut Sei Tuan Subdistrict as an effort to maintain the mangrove ecosystem in a good category, can be seen from the entire statement of silvofishery farmers on average above 80% overall. Knowledge of mangrove functions, participation in maintaining the existence of mangrove ecosystems in ponds and surrounding areas, motivation in maintaining mangroves and utilization of mangroves has a high percentage average. The need for a community empowerment approach in mangrove management is reinforced by Graziano which states that to prevent more severe damage to mangrove forest ecosystems in Indonesia efforts to develop community empowerment in the implementation and supervision of policies on mangrove management must always be carried out and in line with that community involvement in the development and management of mangrove forest ecosystems is a strategic and appropriate step [9].

Community empowerment through the implementation of restoration should start from planning, implementation and maintenance the mangrove plants. It is a manifestation of the management strategy for implementing the mangrove restoration activities in Tanjung Rejo, Percut Sei Tuan. It is parallel with Erwiantono's opinion that conservation strategies should involve local communities will more effective than one-way conservation that only involves the government [10]. By increasing public awareness of the importance of the preservation function in an area, it will be able to maintain the ecosystem balance function and economic function of the area for the local community, so that the balance of environmental ecosystems is expected to be achieved. Graziano says that the management of mangrove forest ecosystems with the involvement of the community is a dynamic and sustainable process that brings together various interests (government and community) [9].

From the interview showed that community involved maintaining the mangroves inside and around the silvofishery pond. This response comes from the understanding of benefits and functions of mangroves in the Tanjung Rejo, subdistrict of Percut Sei Tuan as their residence. In line with the opinion of Indrawadi, if the mangrove forests grow well with the supervision from the

local community, they will protect the forest as their own and put it as collective needs. So for the evaluation phase, the role of silvofishery farmers who maintain the mangrove forest in their pond can optimise the production then actively communicate with fish farmer groups for information dissemination [11].

The community empowerment approach carried out in Tanjung Rejo, Subdistrict of Percut Sei Tuan is the key to success to maintain the existence of mangrove forest around the ponds. It is in line with Karsidi's opinion that developing community awareness and involving them on the management of mangrove forest ecosystems can be used as an approach and strategy in community empowerment [12].

#### IV. CONCLUSION

The understanding of silvofishery farmers on the function of mangroves has an average percentage of 90%, behaviour towards the utilization of mangrove forests located in ponds and around the ponds on average 80% in the village of Tanjung Rejo, Percut Sei Tuan. To maintain mangrove forests, silvofishery farmers are involved in activities to maintain and maintain mangrove forests around the ponds and participate in evaluating together.

#### SUGGESTION

The silvofishery model can provide extra economic value as well as an effort to maintain the mangrove forests. The key to success the sustainable pond production is through the involvement of silvofishery farmers and multi-stakeholder on the participatory forest management.

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