Utilization of Rhizophora Mangrove Plants as a Potential Source for Agribusiness Development in the Coastal Area of Pematang Kuala, Serdang Bedagai

Mila Ariska Dewi*[1], Edi Azwar Nasution[2],Yusri Refiani[3]
Islamic University of North Sumatera, Indonesia[123].
ariskadewimila@gmail.com

Keywords:
Agribusiness potential, Community empowerment, sustainable coastal econom, utilization of Rhizophora.

Abstract

This study evaluates the environmental physical conditions and economic value of Rhizophora mangrove species in Hamlet V, Pematang Kuala Village, Teluk Mengkudu District, Serdang Bedagai Regency, an area characterized by well-maintained and sustainable mangrove ecosystems. Environmental parameters assessed include air temperature, soil pH, salinity, substrate type, and the morphological characteristics of three Rhizophora species: Rhizophora stylosa, Rhizophora mucronata, and Rhizophora apiculata. The research also examines the economic potential of Rhizophora, particularly its use as construction material and fuelwood, as well as the utilization of leaves, fruits, and flowers as traditional medicinal resources that support local livelihoods. Vegetation structure was analyzed using density, frequency, Dominance Ratio (SDR), and Importance Value Index (IVI). Results show that the highest relative density occurred at Station III with 79.5% for R. stylosa, while the highest relative frequency (40%) was recorded at Stations I and III. Station III also exhibited the highest IVI value of 119.5 and the highest SDR of 59.75. Hamlet V contains an extensive mangrove forest, with an estimated 22,000 Rhizophora individuals. The physical environment of the mangrove area shows air temperatures ranging from 30.2°C to 30.5°C, substrates consisting of mud, fine mud, and sand, soil pH ranging from 3.5 to 6.0, and salinity levels between 18 and 20 ppm. Morphological identification revealed distinct leaf, fruit, and floral characteristics among the three species, while all shared similar prop root structures. Rhizophora apiculata wood was found to be the most suitable for construction due to its dense and durable texture.

INTRODUCTION

Indonesia is a maritime nation, or a country with extensive waters. This gives Indonesia extensive coastal areas and diverse mangrove species that thrive. An example of a mangrove plant that is very dominant in coastal areas is the mangrove tree, with the Latin name Rhizophora or the genus Rhizophora. In general, mangrove forests function as barriers to erosion, waves, and strong winds. One of the economic functions of Rhizophora plants is that their bark acts as a natural brown dye that can be used as an alternative production material for the batik industry (Lutfianna Fatma Dewi, Delianis Pringgenies, and Ali Ridho, 2018).

*Rhizophora*Plant species are grouped into agribusiness processes where Rhizophora plants have higher economic value and utilization resources, where the fruit is used for processed foods such as syrup, dodol, and flour. The wood is used as fuel and building materials, as well as the potential to extract tannins and phytochemicals for traditional medicines and health products. In this case, the economic value of mangroves is a source of income for communities, industry, and the state. Calculating the economic value of mangrove resources is an effort to see the benefits and costs of resources in monetary terms that take the environment into account (Arief, 2003). Calculating the economic value of mangrove forest commodities aims to provide an overview of the economic potential of mangrove forests that can be used directly for life and can be used as a reference in utilization activities and provide an overview of future management patterns. The economic value of direct use also indicates the level of

optimization of utilization that has been carried out in mangrove forest areas, so that mangrove utilization does not cause negative impacts and mangrove degradation in the future (Qodrina et al., 2012).

Rhizophora is one of the three Rhizophora species found along the mangrove coast, especially in Hamlet V, Pematang Kuala Village, Teluk Mengkudu Regency, Serdang Bedagai Regency. The largest number of this species lives along the mangrove coast of Pematang Kuala Village. This species is also a halophytic tropical plant, or salt tolerant (Irwanto, 2008). Mangrove ecosystems are known to have various economic benefits, one of which is as a basic material for dyeing in the textile industry (Ilman et al., 2011). By utilizing mangroves as a natural dye in its batik production, Batik Zie can generate an average turnover of IDR 20 million per month (Martuti et al., 2017).

Pematang Kuala Village, Teluk Mengkudu District, Serdang Bedagai Regency, has five hamlets and a population of approximately 2,500. The primary livelihoods of the villagers are farming and fishing. The hamlet, which boasts a mangrove forest with preserved plants such as Rhizophora, is located in the mangrove forest area of Hamlet V of Pematang Kuala Village. Rhizophora mangrove species is one of the most important in the mangrove ecosystem because it has many economic functions for the community, therefore researchers will look for the economic value or function of Rhizophora plants in Pematang Kuala Village, Teluk Mengkudu District, Serdang Bedagai Regency because in the village based on the knowledge of the residents there, they develop Rhizophora plants by planting new seeds of approximately 100,000 new nurseries located in Hamlet I, while Rhizophora plants that have developed in Hamlet V are around 2000 thousand in front of the mangrove forest area and behind the mangrove forest area are approximately 20,000 thousand with an area of approximately 10,000 Ha (Hectares). With the large number of Rhizophora plants, there are more potential economic functions in Hamlet V of Pematang Kuala Village for Rhizophora plants and calculate Density, Frequency, Dominance, Important Value Index, then describe the morphology of Rhizophora plants in the mangrove forest area of Pematang Kuala Village, Teluk Mengkudu District, Serdang Bedagai Regency.

METHODS

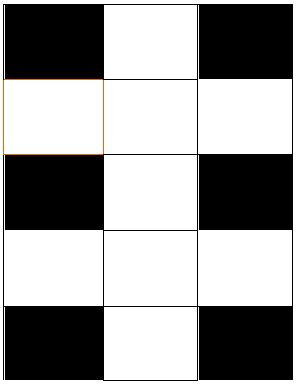
This research was conducted in the mangrove forest area in Hamlet V, Pematang Kuala Village, Teluk Mengkudu District, Serdang Bedagai Regency, North Sumatra Province with an area of Rhizophora plants of around 10,000 Ha (Hectares) in Pematang Kuala Village, Teluk Mengkudu District, Serdang Bedagai Regency has an area of 10.6 km2 with a distance from the Islamic University of North Sumatra to Pematang Kuala Village which is 67.6 km. With the many Rhizophora plants in the mangrove environment of Hamlet V Pematang Kuala, researchers will analyze the economic value of Rhizophora plants, both from wood, fruit, leaves, flowers of the three species of Rhizophora plants. This research was conducted from the end of June to the end of July 2024 with the aim of analyzing the agribusiness economic value of the mangrove environment, especially regarding the economic function of Rhizophora plants.

The population in this study was all Rhizophora plants that produce economic value in the mangrove forest area of Pematang Kuala Village, Teluk Mengkudu District, Serdang Bedagai Regency. The samples in this study were Rhizophora plants and the economic value of Rhizophora plants which were utilized as an agribusiness opportunity in the mangrove forest area of Pematang Kuala Village, Teluk Mengkudu District, Serdang Bedagai Regency.

Research Methods and Design

The method used in this study was a questionnaire, which is a method of collecting data by asking respondents to answer a series of questions or written statements. This technique is efficient if the researcher knows exactly which variables will be measured (Sugiyono, 2017).

This research design is interpreted as steps to solve the problem being studied by determining the condition of the mangrove forest, especially the Rhizophora plants that will be utilized for business, and the physical condition of the environment in Pematang Kuala Village. Data collection for Rhizophora plants was carried out using a purposive sampling technique with a 5x5 m2 plot with a distance of 10 m. (Smith.RT and Smith.TM, 2001)



Information:

=Square Plot/Land Area 5×5m2

=Distance between plots/plots 10m

ST = Station

1. Station 1 is located in the mangrove forest pond area
2. Station 2 is located in the coastal area of the mangrove forest.
3. Station 3 is located in the mangrove forest area

RESULTS AND DISCUSSION

Research Results

Economic Potential of Rhizophora Plants

Based on the results of research conducted in the Mangrove Forest Coast area in Hamlet V, Pematang Kuala Village, Teluk Mengkudu District, Serdang Bedagai Regency. The research area is divided into 3 stations. Each station is divided into 2 plots measuring 5 × 5m2 to obtain wood, leaves, flowers, fruit that can be a business or economic function in Rhizophora plants. The results of respondents from the surrounding community for agribusiness opportunities that have existed in Pematang Kuala Village in Rhizophora plants are dominant in wood from the species of Rizhophora apiculata which is used as a building material because of its dense and sturdy wood texture which has agribusiness business opportunities for the surrounding community in Hamlet V Pematang Kuala. Meanwhile, the leaves, flowers, and fruit have very minimal economic value because they are rarely used as agribusiness fields and are only often used for traditional medicine by the local community.

Table 1. Potential of Mangrove Plants Rhizophora.

NO	Direct Commodities	Frequency Respondents	Economic Value
1	Wood species Rhizophora apiculata	6	123,250,000

2	Wood species Rhizophora Mucronata	4	78,134,000
3	Wood of the species Rizhophora Stylosa	6	72,145,000
4	Rhizophora leaves	4	35,000,000
5	Rhizophora flower	5	32,000,000
6	Rhizophora fruit	5	41,000,000

Market price assessment. Mangrove forest commodities in Pematang Kuala Village that have market value include:Wood from the plant species Rhizophora apiculata, Mucronata, Stylosa as well as leaves, flowers, fruit from the Rhizophora plant. The table shows that wood from the Rhizophora Apiculata species is a mangrove forest commodity with the highest economic value, which is Rp. 123,250,000/year, because the Rhizophora apiculata species is very easy to find and has a dense wood texture and is good for use as a building material. Meanwhile, flowers from all Rhizophora plant species are commodities with the lowest value, which is Rp. 32,000,000/year because they are very rarely used as a business opportunity for medicines for the community.

Results of Measurement of Physico-Chemical Parameters of Rhizophora Plants That Are Suitable to Meet Economic Value

The results of measuring the physical condition of the Rhizophora plant to observe whether the Rhizophora plant is suitable or not for economic business due to unsuitable physical conditions in the Rhizophora plant which causes the Rhizophora plant to not reproduce well. Because the community must observe the suitability of the plant before using the wood of the Rhizophora mangrove tree as a business field and making it a building material and fuel. The fruit of the Rhizophora mangrove plant is sometimes used by residents as herbal medicine in Hamlet V, Pematang Kuala Village, Teluk Mengkudu District.

Table 2 Results of Measurement of Physico-Chemical Parameters in Rhizophora Plants in Pematang Kuala Village, Hamlet V

NO	**Parameter**	**STATION**					
		I		**II**		**III**	
	Physics	**Plot 1**	**Plot 2**	**Plot 1**	**Plot 2**	**Plot 1**	**Plot 2**
1	Temperature	30.3 degrees Celsius	30.5 degrees Celsius	30.2 degrees Celsius	30.3 degrees Celsius	30.5 degrees Celsius	30.4 degrees Celsius
2	Substrat	Mud Land	Mud Land	Fine Mud	Fine Mud	sandy	sandy
	Chemistry	**Plot 1**	**Plot 2**	**Plot 1**	**Plot 2**	**Plot 1**	**Plot 2**
3	Ph	4.5	4.5	3.5	5.5	6.0	6.0
4	Salinity	19 ppm	19 ppm	20 ppm	20ppm	18 ppm	18ppm

1) Air temperature

The air temperature at the observation station ranges from 30.2°C to 30.5°C, a small difference in temperature, as the temperature at each station is nearly identical. This mangrove forest vegetation environment, with this temperature, is still optimal for mangrove growth, and it also supports the growth of Rhizophora.

2) Substrat

Based on research conducted in the coastal area of the mangrove forest in Hamlet V, Pematang Kuala Village, it was found that the substrate at each observation station was different. The first station had a muddy soil texture, while the second station had a fine muddy soil texture because it was located in a coastal area that was sometimes flooded during high tide, while the third station had a sandy texture. Wood from the Rhizophora plant in sandy soil is easy to use as fuel and building, because the stem is dry and not exposed to standing water, while in muddy soil, the stem of the Rhizophora plant is damp and wet.

3) Soil Acidity (pH)

Based on measurements from three observation stations in the mangrove forest of Hamlet V, Pematang Kuala Village, soil acidity (pH) ranges from 3.5°C to 6.0°C. The highest pH was found at the third station, which is the coastal area of the mangrove forest, while the lowest pH was found at the second station in plot 1, which was 3.5°C and at the first station, soil acidity or pH was 4.5°C. This level of acidity did not affect the growth of Rhizophora.

4) Salinity

Based on salinity measurements at three observation stations in the mangrove forest of Hamlet V, Pematang Kuala Village, the salinity ranged from 18 ppm to 20 ppm. At the first station, the salinity level was 19 ppm, while at the second station on the coast it was 20 ppm because the coastline is sometimes still exposed to coastal waters due to the ebb and flow of sea water. At the third station, the inland area had a salinity of 18 ppm. Salinity levels ranging from 18 ppm to 20 ppm also did not significantly impact the growth of Rhizophora.

Calculation of Relative Density, Relative Frequency, Importance Value Index, Summed Dominance Ratio and Results of the Number of Rhizophora Plants

Table 3 Types of Rhizophora Mangrove Plants Found at the Research Location at Each Station in Hamlet V, Pematang Kuala Village, Teluk Mengkudu District, Serdang Bedagai Regency for the Economic Value of Rhizophora Wood Plan.

NO	Rhizophora Plant Species	STATION								
		I			II			III		
		PLOT								
		1	2	Amount Individual	1	2	Amount Individual	1	2	Amount Individual
1	Rhizophora Stylosa	18	10	28	7	6	13	18	21	39
2	Rhizophora Mucronata	–	3	3	3	2	5	–	1	1
3	Rhizophora Apiculata	7	4	11	5	5	10	5	4	9
Totalnumber		25	17	42	15	13	28	23	26	49

Based on the table above, the large number of Rhizophora plants at the 3 stations makes it very possible for the local people to have a great opportunity to utilize Rhizophora plants as a source of economic value, both in the form of wood which is used as building materials and

leaves, flowers, and fruit which can be used as traditional medicine.There are three types of Rhizophora in the mangrove forest and the number of types of Rhizophora mangrove plants found in the mangrove forest area of this hamlet was 11 individuals at station I.

Station II of the coastal mangrove forest area obtained three types of Rhizophora plants with the number of Rhizophora plants found as many as 28 individuals, of which Rhizophora Stylosa was still dominant at 13 individuals, while Rhizophora Mucronata was only found at 5 individuals at station II and Rhizophora Apiculata was found at 10 individuals at station II from both plots.

Station III of the mangrove forest area obtained three types of Rhizophora plants with a total of 49 types of Rhizophora plants including Rhizophora Stylosa which is still the dominant plant found at each station, namely at station III 39 individuals were found while in Rhizophora Mucronata only 1 individual was found and in Rhizophora Apiculata there were 9 individuals found at station III. The mangrove forest of Hamlet V was divided into three observation stations by forming 2 square plots measuring 5x5m2 at each station, the largest number of species was obtained at station III by obtaining 49 types of Rhizophora plants from the three types, the lowest number of Rhizophora plant species was found at station II in the coastal area with a total of 28 types of Rhizophora plants.

Table 4 Measurement results of absolute frequency (FM), relative frequency (FR), relative density (KR) data of Rhizophora plants in Hamlet V, Pematang Kuala Village, Teluk Mengkudu District, Serdang Bedagai Regency**.**

No	Species Rhizophora plants	STATION I			STATION II			STATION III		
		FM	KR	FR	FM	KR	FR	FM	KR	FR
1	Rhizophora Stylosa	2	66.6	40	2	46.4	33.3	2	79.5	40
2	Rhizophora Mucronata	1	7.14	20	2	17.8	33.3	1	2.04	20
3	Rhizophora Apiculata	2	26.1	40	2	35.7	33.3	2	18.3	40

Based on the table above, the calculation results show the relative density (KR) and relative frequency (FR) values can be seen at each station. The highest relative density (KR) value is found at station III, the pond area in the mangrove forest, which is 79.5%, Rhizophora Stylosa individuals, the lowest relative density value is also found at station III, which is the mainland area with a value of 2.04%. The highest relative frequency (FR) value is found at stations I and III with the same value, which is 40%, while the lowest relative frequency (FR) value is also found at stations I and III, which is 20% found at stations I and III, the pond and mainland areas.

Table. 5 Importance Value Index (INP) and Summed Dominance Ratio (SDR) of Rhizophora Plants in Hamlet V, Pematang Kuala Village, Teluk Mengkudu District, Serdang Bedagai Regency

NO	Type Rhizophora plants	UNI STATION		STATION II		STATION III	
		INP	SDR	INP	SDR	INP	SDR
1	Rhizophora Stylosa	106.6	53.3	79.7	39.85	119.5	59.75
2	Rhizophora Mucronata	27.14	13.57	51.1	25.55	22.04	11.02
3	Rhizophora Apiculata	66.1	33.05	69	34.5	58.3	29.15

Based on the table above, the results of the calculation of the Important Value Index can be seen at each station in Hamlet V, while the highest INP value is at station III in the coastal land area of the mangrove forest, namely with a value of 119.5 for the individual INP of Rizhophora stylosa and the lowest INP value is again at station III for the INP of Rizhophora mucronata in the mainland area of the mangrove forest, namely with a value of 22.04 for the individual INP of Rizhophora mucronata.

Summed Dominance Ratio (SDR), at each station in Hamlet V with the highest SDR value was at station III in the mangrove forest area, namely 59.75 SDR for Rhizophora stylosa individuals and the lowest SDR value was again found at station III with a value of 11.02 for Rhizophora mucronata SDR individuals in the mangrove forest area.

Discussion

Market price assessment. Mangrove forest commodities in Pematang Kuala Village that have market value include:wood from the plant species Rhizophora apiculata, Mucronata, Stylosa as well as leaves, flowers, fruit from the Rhizophora plant. The table shows that wood from the Rhizophora Apiculata species is a mangrove forest commodity with the highest economic value, which is Rp. 123,250,000/year and the commodity with the lowest value, which is Rp. 32,000,000/year because it is very rarely used as a medicinal business opportunity for the community. Meanwhile, flowers from all Rhizophora plant species are the commodity with the lowest value, which is Rp. 32,000,000/year because it is very rarely used as a medicinal business opportunity for the community.

Temperature, Substrate, pH and Salinity, where the temperature in the coastal area of the mangrove forest ranges between 30.2°C - 30.5°C, the air temperature does not have a large distance because the air at each station is almost the same and the temperature is also very good for the mangrove forest vegetation environment with this air temperature is still optimal for mangrove growth, and this temperature is also very possible for the growth of Rhizophora.

Based on the results of observations at each station, it can be seen the types of Rhizophora plants found in the mangrove forest area of Hamlet V, Pematang Kuala Village. From the results of observations, three species were found: Rhizophora stylosa, Rhizophora mucronata, and Rhizophora apiculata. The most common species found at each station was Rhizophora stylosa, while the least common species found at each station was Rhizophora mucronata. These types of Rhizophora mangrove plants can be found at the research location, but not all of them are found completely in each observation plot. From the many Rhizophora plants, there are very large business opportunities in Pematang Kuala Village.

The highest relative density (KR) value is found at station III, the pond area in the mangrove forest, which is 79.5%, Rhizophora Stylosa individuals, the lowest relative density value is also found at station III, which is the mainland area with a value of 2.04%. The highest relative frequency (FR) value is found at stations I and III with the same value, which is 40%,

while the lowest relative frequency (FR) value is also found at stations I and III, which is 20% found at stations I and III, the pond and mainland areas. The highest INP value is found at station III in the coastal mainland area of the mangrove forest, namely with a value of 119.5 for the INP of the Rhizophora stylosa individual and the lowest INP value is again found at station III for the INP of the Rhizophora mucronata in the mainland area of the mangrove forest, namely with a value of 22.04 for the INP of the Rhizophora mucronata individual. Summed Dominance Ratio (SDR), at each station in Hamlet V with the highest SDR value was at station III in the mangrove forest area, namely 59.75 SDR for Rhizophora stylosa individuals and the lowest SDR value was again found at station III with a value of 11.02 for Rhizophora mucronata SDR individuals in the mangrove forest area.

From the morphology of the Rhizophora plant, only the leaves, flowers, and fruit can be used as agribusiness opportunities or have economic value because the local people believe that the leaves, flowers, and fruit can treat wounds because they have antioxidants in those parts. and not only treat wounds. Business opportunities that have economic value in the fruit can also be used as a medicine for rheumatism or pain which is often used by the local community and some of the people there make it a traditional medicine business.

CONCLUSION

The abundance of Rhizophora apiculata and mucronata plants in Pematang Kuala Village is able to produce good economic value by utilizing wood from Rhizophora Apiculata plants with the highest sales of IDR.123,250,000/yearwith the largest sales every year because the Rhizophora apiculata plant is easier to find in the Pematang Kuala Mangrove Village, Teluk Mengkudu District.Meanwhile, the flowers of all Rhizophora species are the lowest-value commodity, at Rp. 32,000,000 per year, because they are rarely used as a medicinal business opportunity by the community.

Rhizophora stylosa was found as many as 28 individuals at station I and Rhizophora mucronata was found only 3 individuals, while Rhizophora apiculata was found as many as 11 individuals at station I. Rhizophora apiculata was found at station II. At station III, Rhizophora stylosa was found as many as 39 individuals, Rhizophora mucronata was found only 1 individual, and Rhizophora apiculata was found as many as 9 individuals at station III.

Based on the physical environmental conditions which include (Temperature, pH, Substrate, Salinity) which are good for rhizophora plants to be used as an economic function in the coastal area of mangrove forests in Hamlet V, Pematang Kuala Village, Teluk Mengkudu District, Serdang Bedagai Regency, North Sumatra Province with a temperature that is suitable for mangrove life, especially for Rhizophora plants, because the salinity is good enough and the pH is also good enough for the life of Rhizophora mangrove plants at the research location.

. The highest relative density (KR) value was found at station III in the mainland area, namely KR 79.5% of Rhizophora stylosa individuals, the lowest relative density value was also found at station III with a value of 2.04%. The highest relative frequency (FR) value was found at stations I and III with the same value of 40%, while the lowest relative frequency (FR) value was also found at stations I and III, namely 20%. The highest INP value was found at station III in the mainland area, namely with an INP value of 22.04 Rhizophora stylosa individuals and the lowest INP value was again found at station III, namely with an INP value of 22.04 Rhizophora mucronata individuals. The highest SDR was found at station III in the mainland area, namely 59.75 SDR of Rhizophora stylosa individuals and the lowest SDR value was again found at station III with a value of 11.02 SDR of Rhizophora mucronata individuals in the mainland area.

ACKNOWLEGMENT

-

REFERENCES

Arief, A. 2003. Mangrove forests, their functions and benefits. Yogyakarta: Kanisius

Ilman, M., Wibisono. ITC, & Suryadi Putra, INN, 2011. Advanced Information on Mangrove Ecosystems in Indonesia. Bogor. Wetland International Indonesia Program

Irwanto, 2008. Mangrove Forests and Their Benefits, Creative Design. Ambon

https://www.google.com/?hl=id#hl=id&q=faktor (Downloaded May 15, 2015). 2:35 PM.

LF Dewi, D. Pringgenies, and A. Ridlo, "Utilization of Mangrove Rhizophora Mucronata as a Natural Dye for Cotton Fabric," Journal of Marine Research, vol. 7, pp. 79-88, May 2018.

Rahman AR, Asbi, Adnin M, 2019. The Influence of Mangrove Forests on Social, Economic, and Local Wisdom Aspects. Jenderal Soedirman University Repository.

Salim AB Masykhur, AK Riyadi S. Rina, HFM Said AH Nurhalis W. Adi N. Susanto, Fajria DS Darmiyati M. 2021. Utilization of Rhizophora mangrove fruit in efforts to improve the community's economy. Journal of Community Service for Master of Science Education

Smith, RL, Smith, TM (2001). Ecology and Field Biology

Sugiyono, (2017). Quantitative, Qualitative, and Research and Development Methods. Bandung: CV. Alfabet.

Qodrina, L., Hamidy, R., and Zulkarnaini. 2012. Economic valuation of mangrove ecosystems in Teluk Pambang Village, Bantan District, Bengkalis Regency, Riau Province. Journal of Environmental Sciences. 6 (2): 93—98 pp.

Copyright holder :
© author. (2024)
First publication right :
Internasional Journal of Economic, Agribisnis and Development Studies
This article is licensed under:
CC-BY-SA