

Utilization of Mangrove Forest for Mangrove Charcoal in the Pangkalan Siata Village Pangkalan Susu Subdistrict, Langkat Regency

Delvian^{1,*}, Agus Purwoko¹, Elisabeth Ika Herawati²

¹Faculty of Forestry, Universitas Sumatera Utara, Medan, Indonesia

²Master Program of Natural Resources and Environment Management, Postgraduate School, Universitas Sumatera Utara, Medan, Indonesia

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Abstract: The mangrove forest of Pangkalan Siata Village, Pangkalan Susu Subdistrict, Langkat Regency has the potential of utilizing wood forest products for the charcoal industry. This study aims to determine the economic value of mangrove forest utilization as a source of raw materials for mangrove charcoal industry for the community around the mangrove forest of Pangkalan Siata Village. The study was conducted from June to September 2016. The study sites were forest for other land uses and Production Forest which have been granted Social plantation forest. The results showed that labor income in the average mangrove charcoal industry was Rp 1,500,000 /ton/year. With the need for raw materials of mangrove wood as much as 204.18 m³/ cycle and production capacity of 61.5 ton/cycle, the average profit of whole industry of Pangkalan Siata is Rp 497.382.480, -/year.

1 INTRODUCTION

Pangkalan Siata Village is one of the coastal villages in Pangkalan Susu Subdistrict, with a village area of 1,712 ha, and has a mangrove forest of ± 803.94 ha. Resources for mangrove forests in Pangkalan Siata provide a variety of livelihood sources for surrounding communities, including to mangrove wood seekers, mangrove charcoal makers, fishes, crabs and shrimps collectors, and grouper cage businessmen. In the location Land A llocated for Other Purposes or *Area Penggunaan Lain* (APL), villagers in the Forest Farmers Group or *Kelompok Tani Hutan*, have planted mangroves as an effort to conserve the mangrove forests and utilize the wood as a source of raw material for mangrove charcoal industry. Whereas in the Production forest of Pangkalan Siata, there has been a Business Permit for the Utilization of Smallholder Timber Forest Products/ *Izin Usaha Pemanfaatan Hasil Hutan Kayu – Hutan Tanaman Rakyat* (IUPHHK-HTR) which is managed by two cooperatives, appointed by the Langkat Regent on behalf of the Indonesian Ministry of Forestry since 2012 covering 524 Ha. In Pangkalan Siata, there is a mangrove charcoal

industry managed by the community where the community uses timber from the APL and HTR areas.

The use of mangrove timber for the manufacture of mangrove charcoal has long been carried out by the community around the village of Pangkalan Siata. The use of mangroves as charcoal raw material in Indonesia in addition to Langkat District, can also be found in East Aceh District, Batam City, Bengkalis Regency and Kubu Raya Regency. Charcoal production in each of these places aims to meet the needs of local and export markets (Santoso, 2013; Ritabulan, 2016).The utilization of mangrove charcoal by the people of Pangkalan Siata is still conventional and traditional. Therefore, the research is aimed to find out the economic value of the use of mangrove forests as a source of raw material for mangrove charcoal industry for the community around the mangrove forest in Pangkalan Siata Village.

2 MATERIALS AND METHODS

2.1 Study Site

The study was conducted in the charcoal manufacture industry owned by the community of Pangkalan Siata Village, Pangkalan Susu Subdistrict, Langkat Regency. The duration of study was three months, starting from mid-June to mid-September 2016.

2.2 Data Collection

The sample unit for data collection is all charcoal industries that are still actively operating in Pangkalan Siata. Data collection was carried out by field surveys, interviews with owners of charcoal industry, as well as secondary data collected from related institutions, namely the Forestry and Plantation Service and the Integrated Service Office of Langkat Regency.

2.3 Data Analysis

Descriptive analysis was intended to describe the condition of the mangrove manufacture industry in Pangkalan Siata. The purpose of descriptive analysis is to systematically describe the facts and characteristics of the research object, namely the mangrove charcoal industry appropriately. Economical analysis of community income is

obtained from the cost of producing and the selling price of mangrove charcoal. The data then is used to calculate the economical benefits of mangrove charcoal craftsmen, as well as the average income of workers in the mangrove charcoal industry.

3 RESULT AND DISCUSSION

3.1 Mangrove Charcoal Industry in Pangkalan Siata Village, Pangkalan Susu Subdistrict

Based on field observations and interviews, charcoal production in Pangkalan Siata in 1 unit of mangrove charcoal kitchen stove is generally 1 ton for each combustion cycle. Whereas the need for mangrove wood as raw material for mangrove charcoal industry is 4 tons or 3.32 m³ in 1 burning cycle. The total capacity of mangrove charcoal production in 36 units of mangrove charcoal furnaces in the village is 61.5 tons for each combustion cycle. The required timber as raw material for mangrove charcoal industry for each burning cycle in the 36 units is 204.18 m³. During the year, the average combustion process in each charcoal kitchen stove is 8 times the combustion cycle. Production capacity and needs of mangrove wood in the mangrove charcoal industry are presented in Table 1.

Table 1: Industrial need of mangrove charcoal industry in Pangkalan Siata Village

Description	Volume	Total volume
Number of charcoal kitchen stove	1 unit	36 units
Production capacity	1 ton per cycle	61.5 ton per cycle
Timber requirement	3.32 m ³	204.18 m ³

Compared to other regions, on Sembilan and Kampai Island, Pangkalan Susu Subdistrict, Langkat Regency, for each production of 10 kg charcoals, approximately 5 m³ of mangrove timber are needed for the process (Silalahi *et al.*, 2016). Meanwhile, based on the results of a survey in Yeesarn, Thailand, for every 30 m³ of mangrove timber (around 26.7 tons of dry matter), 5 tons of mangrove charcoal were produced (Kridiborworn *et al.*, 2012). Thus, for each region, the need for mangrove timber for charcoal production per ton is different. This is possible because of differences in the treatment of the mangrove charcoal burning process. According to the results of interviews with charcoal craftsmen, the dryness level of mangrove timber and fire

stability during combustion process also affected the production of mangrove charcoal. Instability during combustion will cause the resulting mangrove charcoal to become more fragile and easily broken, rendering production output. The architect of a charcoal kitchen stove in Desa Pangkalan Siata can be seen in Figure 1.



Figure 1: Charcoal stove in the industrial kitchen: Pre-combustion process (Left image) and during combustion process (Right image)

3.2 Mangrove Charcoal Production Process

Based on the results of interviews with charcoal craftsmen, the process of making mangrove charcoal is generally carried out for approximately 22 (twenty-two) days. The process starts from collecting mangrove timber as raw material for charcoal and collecting firewood for 2 (two) days. The raw material for mangrove wood is obtained from harvesters both in Production Forest (HP) and Land Allocated for Other Purposes (APL), depending on the owner membership of the mangrove charcoal kitchen. The membership is available to the Bina Usaha Farmers Group (for locations on APL), as well as on the Community Plantation Forest (HTR) management cooperative in Production Forests (HP), namely the Coasta Community Cooperative or the *Wahana Hijau* Cooperative. Mangrove timber used as raw material has an average stem diameter of 7–9 cm. The trunks are cut in size around 1.5–2 m. In addition, firewood is also collected mainly from rubber wood, *api-api*, *cingam*, betel wood and other species.

The next process is to arrange mangrove wood into the stove, which is done for approximately 1 (one) day. The composition of mangrove wood in the stove corresponds to the straightness of mangrove logs. Straight wood is arranged horizontally, and the bent one is arranged vertically. The arrangement is meant to allocate space effectively in the solid furnace while heating during combustion will also spread evenly. Heating is performed through the fumigation system that comes out of the combustion process. The burning process is carried out for approximately 11 (eleven) consecutive days. During this burning activity, the

fire must be maintained so as to produce constant heat. This is done to maintain the quality of charcoal produced. If the fire is not constant, it will cause the mangrove charcoal to become brittle yet broken. After the smoke of the combustion process begins to fade and the smell of smoke has been quite stinging, the fire is extinguished for the next stage, namely cooling process. The process is performed for approximately 3 (three) days. Cooling activities are carried out by closing the entire smoke hole and turning off the fire. After the cooling process, the finished mangrove charcoal is ready to be removed from the charcoal kitchen furnace. The charcoal is then removed, collected and selected based on the types of charcoal. The next process, charcoal is cut to the size of the order, usually with a size of 20 cm. Cutting is done by using a saw.

The last process is mangrove charcoal packaging. After the cutting, charcoal is grouped according to its quality. The process of selecting and packaging mangrove charcoal is usually done by females. In the production of mangrove charcoal with a capacity of 1 ton, selection and packaging are usually carried out by 3 (three) people. Charcoal that has been grouped, is then arranged or packaged in plastic sacks. The weight of charcoal in one package is 25 kg, or according to consumer demand. After packaging, mangrove charcoal is ready to be marketed. The stages of the mangrove charcoal production process are informed in Figure 2 while the time budget for making the mangrove charcoal is listed in Table 2.

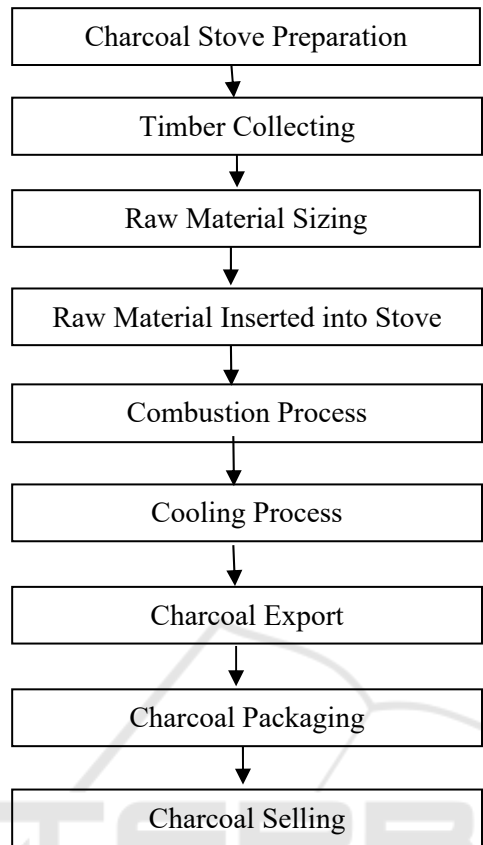


Figure 2: Schematic steps in mangrove charcoal production

Table 2: Production process of making mangrove charcoal based on time

Production steps	Time allocation (day)
Timber and firewood collecting	2
Arrangement of mangrove timber inside stove	1
Combustion	11
Cooling	3
Charcoal export	1
Selection on mangrove charcoal and packaging	4
Total	22

3.3 Economic Profit of Mangrove Charcoal Production

Based on the results of interviews with mangrove charcoal craftsmen, the cost of mangrove charcoal production in general for the production capacity of 1 (one) ton is distinguished from the source of raw material for mangrove wood from APL and HP. In the Production Forest, the utilization of mangrove timber is managed in the permit for the management of HTR which are burdened with Forest Resource Provision or *Provisi Sumber Daya Hutan* (PSDH)

payments. The production costs are presented in Table 3.

Table 3: Economic profit of mangrove charcoal industry capacity of 1 ton / year based on raw material source of mangrove charcoal

Description	Source of raw material	
	APL	HP
Cost of manufacturing (IDR/ton/year)	14,000,000	14,624,960
Sale value (IDR/ton/year)	22,400,000	22,400,000
Economic profit (IDR/ton/year)	8,400,000	7,775,040

Table 4: Economic profit of the entire mangrove charcoal industry of Pangkalan Siata Village are based on the source of raw materials of mangrove charcoal

Description	Source of raw material	
	APL	HP
Cost of manufacturing (IDR/ton/year)	861,000,000	899,435,040
Sale value (IDR/ton/year)	1,377,600,000	1,377,600,000
Economic profit (IDR/ton/year)	516,600,000	478,164,960

If the production capacity of the mangrove charcoal industry is 61.5 tons / burning cycle (or equal to 492 tons / year), then the economic profits of the mangrove charcoal industry in 1 year can be concluded as presented in Table 4.

Thus, the economic profits of the entire mangrove charcoal industry in Pangkalan Siata are on average of 497,382,480 IDR per year. The lowest income of workers in the mangrove charcoal industry is from the mangrove timber compiler and

packaging which is 100,000 IDR per person in 1 burning cycle or 800,000 IDR per year. The highest income is mangrove wood harvesters, which is 375,000 IDR per person for 1 burning cycle or 3,000,000 IDR per year. Based on the cost of making mangrove charcoal for 1 ton of mangrove charcoal production capacity, the general income for each workforce in the mangrove charcoal industry is presented in Table 5.

Table 5: Community income in mangrove charcoal industry

Labor	Income (IDR/cycle)	Income (IDR/year)
Mangrove timber harvesters	375,000	3,000,000
Firewood harvesters	150,000	1,200,000
Firewood compiler	100,000	800,000
Fire management	250,000	2,000,000
Charcoal management	150,000	1,200,000
Charcoal selectors and packaging	100,000	800,000
Average income	187,500	1,500,000

In general, the average labor income that works in the mangrove charcoal industry is 187,500 per burning cycle or 1,500,000 IDR per year. This income is an additional income because each worker does not rely his life only from the mangrove charcoal industry. The main profession of workers in the mangrove charcoal industry in general is fishermen, both traditional and modern fishermen. The average income of the fishermen from Pangkalan Siata is around 1,200,000 to 2,200,000 IDR per month or 14,400.00 up to 26,400,000 per year. The income is generally not enough to meet family needs, causing fishermen find additional income by working in the mangrove charcoal industry.

3.4 Economic Condition of Community Working at Mangrove Charcoal Industry

Fishermen in Pangkalan Siata village are divided into 2 (two) categories, namely traditional and modern fishermen. Traditional fishermen are individuals characterized by conventional fishing apparatus, small engine boats and one-time fishing for a day. Modern fishermen are equipped with motorized boats, with capacity of 4-5 people on a boat, and fish in the sea for about 6 (six) days. Traditional fishermen are only able to work as much as 22 (twenty two) days a month considering the existence of high tides for 8 (eight) days and

operating on the periphery with boats and simple fishing gear, so that the results obtained are in small amounts (Eriza, 2010). Modern fishermen can go to sea every day without any apparent obstacles, both in the middle sea and on the outskirts of the traditional fishing area. Based on field observations with fishermen in Pangkalan Siata, the average income of the fishermen are between 1,200,000 to 2,200,000 IDR per month. Fishermen's income data in Gebang District, Langkat Regency in 2012 was 1,407,637 IDR (Wirani *et al.*, 2013).

The minimum level of income per month of the fishermen population in Langkat Regency is 55,000, IDR while the highest is 7,440,000 with an average income of 1,259,207 IDR. Based on these data, the income of Pangkalan Siata is still included into the category of average income of fishermen in Langkat District. Based on the reference from the Central Statistics Agency or *Badan Pusat Statistik* (BPS), the fishermen community of Pangkalan Siata is not included in the category of poor families. Even so, with fishermen's income of 1,200,000 to 2,200,000 IDR per month, it is still considered insufficient to meet the needs of the fishing community. For this reason, Pangkalan Siata fishermen seek additional income from the mangrove charcoal industry.

Communities involved in the mangrove charcoal industry have an average income from the mangrove charcoal industry of 187,500 per burning cycle or 1,500,000 IDR per year. The income is indirectly influenced by the relatively low selling price of mangrove charcoals, which are 2,800 IDR per kg. The price of mangrove charcoal varies depending on the local market and the quality of the mangrove charcoal. The selling price of mangrove charcoal in Secanggang District, Langkat Regency varies according to the quality of the charcoal product. Starting from the best quality, the prices are 1,000, 700, 600 and 350 IDR per kg (Rumapea, 2005). The price of mangrove charcoal is based on quality, namely for quality A is 1,500 IDR per kg, quality B is 1,250 IDR per kg, charcoal *cataw* 1,000 IDR per kg and charcoal dust 300 IDR per kg (Direktorat Bina Rehabilitasi Hutan dan Lahan, 2008). In addition to the selling price of mangrove charcoal, factors considered to affect the economic benefits of the mangrove charcoal industry are the intensity of combustion and the capacity of mangrove charcoal production.

The mangrove charcoal industry in Pangkalan Siata is 36 units, with mangrove charcoal production capacity in general is 1 ton, with 8 cycles of burning resulting in an average economic profit of

497,382,480 IDR per year. According to the results of study in East Aceh Regency, with the number of mangrove charcoal kitchens as much as 475 units, production capacity of 500 kg, burning intensity 24 times / year and the price of mangrove charcoal of 1,200 IDR per kg; the economic profits from the mangrove charcoal industry is 10,680,000 IDR (Kurniawan, 2008). Judging from the data of the mangrove charcoal industry in Pangkalan Siata, production capacity is inversely proportional to the number of combustion cycles. The greater the production capacity of a charcoal kitchen, the fewer burning cycles per year, because the burning process will become longer if the mangrove charcoal produced is more and more in a charcoal kitchen unit. Economically, the profits will be even greater if the selling price of mangrove charcoal per kilogram becomes more expensive.

The economic profits of Pangkalan Siata villagers from the utilization of mangrove forests for the mangrove charcoal industry are needed to be linked to the sustainability of mangrove forests. The economy development to improve the community must be related with sustainable development. Sustainable development is a human effort to improve the quality of life by not overexploiting the natural resources beyond life-supporting carrying capacity of ecosystem. In this case the fulfillment of economic development, namely the charcoal mangrove industry must be endeavored not to exceed the capacity of mangrove forest ecosystems to remain sustainable. Thus, the community of Pangkalan Siata may continue to meet the economic needs of utilizing mangrove forests for the mangrove charcoal industry, without neglecting the sustainability aspects of the mangrove forest itself.

4 CONCLUSIONS

Based on the results of the study, the economic profits of 36 (thirty six) mangrove charcoal industrial units in Pangkalan Siata village on average are 497,382,480 IDR per year. Labors' income in the mangrove charcoal industry is on average 1,500,000 IDR/ton/year, indicating that the business of mangrove charcoal industry can only be used as additional work for the community. In realizing sustainable development to preserve mangrove forests, it is necessary to develop mangrove charcoal production technology to improve the utilization efficiency of mangrove timber. By doing so, the mangrove forests may remain sustainable along with prosperity of communities around the forest.

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