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Mangrove State Forest and Communities' Welfare: A Case Study In Sagulung and Sei Beduk Sub-District, Batam,Indonesia

Hutan Mangrove dan Kesejahteraan Komunitas: Kasus Studi di Kecamatan Sagulung dan Sei Beduk, Batam, Indonesia)

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Abstract: *A conflict between coastal communities in the Sagulung and Bagan sub-district, Batam City, an environmental non-governmental organization (NGO), and the Ministry of Environment and Forestry (MoEF) representative regarding illegal logging of the state mangrove forests has occurred for years. On the contrary, the local authorities develop urban planning that allocates some state forest areas for several developments. A semi-structured interview was employed to collect information from the community head, mangrove charcoal industry owners and workers, the NGO and the MoEF representative about mangroves' illegal logging. The local communities are willing to stop illegal logging and find other jobs. However, the communities expect the local authorities to legalize the mangrove charcoal industry. Meanwhile, the NGO cannot tolerate the unlawful logging of the state mangrove forest area and commits to suing the illegal loggers. According to illegal logging, the MoEF accommodates complaints about forest destruction from the public and manages state forest conservation. Matang Mangrove Forest Reserve in Malaysia and mangrove forests concession in Bintuni Bay and Kubu Raya, Indonesia, have established sustainable mangrove forests by applying silvicultural systems and precise regulation from the authorities. On the other side, seagrass cultivation is prospective in Batam city. However, current seagrass collecting is detrimental to the fish population in the future. In conclusion, forest management is essential in developing sustainable mangrove forests as a livelihood for coastal communities.*

Keywords: *mangrove, illegal logging, local communities, forest management*

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Jurnal Archipelago,
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Abstrak: Konflik antara masyarakat pesisir di Kecamatan Sagulung dan Bagan, Kota Batam, Lembaga Swadaya Masyarakat (LSM) lingkungan hidup, dan perwakilan Kementerian Lingkungan Hidup dan Kehutanan (KLHK) terkait pembalakan liar di hutan bakau negara sudah terjadi bertahun-tahun. Sebaliknya, pemerintah daerah mengembangkan perencanaan kota yang mengalokasikan sebagian kawasan hutan negara untuk beberapa pembangunan. Wawancara semi terstruktur digunakan untuk mengumpulkan informasi dari tokoh masyarakat, pemilik dan pekerja industri arang bakau, LSM dan perwakilan KLHK mengenai pembalakan liar bakau. Masyarakat lokal bersedia menghentikan pembalakan liar dan mencari pekerjaan lain. Namun, masyarakat mengharapkan pemerintah daerah untuk melegalkan industri arang bakau. Sementara itu, LSM tersebut tidak dapat mentolerir penebangan liar di kawasan hutan bakau negara dan berkomitmen untuk menuntut para pembalak liar. Terkait illegal logging, KLHK menampung pengaduan masyarakat mengenai kerusakan hutan dan mengelola konservasi hutan negara. Hutan Lindung Mangrove Matang di Malaysia dan konsesi hutan bakau di Teluk Bintuni dan Kubu Raya, Indonesia, telah mewujudkan hutan bakau lestari dengan menerapkan sistem silvikultur dan peraturan yang tepat dari pihak berwenang. Di sisi lain, budidaya lamun cukup prospektif di Kota Batam. Namun pengumpulan lamun saat ini akan merugikan populasi ikan di masa depan. Kesimpulannya, pengelolaan hutan sangat penting dalam mengembangkan hutan bakau berkelanjutan sebagai penghidupan Masyarakat pesisir.

Kata kunci: mangrove, illegal logging, masyarakat pesisir, manajemen hutan

Jurnal Archipelago,
Vol. 02 (2), p.123-131 Desember 2023

I. INTRODUCTION

Batam (0° 25' 29" - 1° 15' 00" N; 103° 34' 35"-104° 26'04" E) is the biggest city in Riau Islands Province, Indonesia covering areas of 3,868,97 km² (Harianja et al., 2022). Batam lies adjacent to Singapore and Malaysia, making the central government develop Batam as a Free Zone of Trade. Batam City rules under two bodies: the Batam Indonesia Free Zone (BIFZ) authority and the municipality government. The rapid growth of industries and population resulted in forest mangroves declining. According to Larno (2015), in the 1970s, mangrove forests cover 24% of the areas of Batam City. Then, in 2016, the remnant mangrove forest in Batam City was 4.3% or equal to 18,805,713.92 m² (1,880 ha) (Irawan & Malau, 2016). In 2022, many local media mentioned that mangrove forests in Batam have been declining because of settlement development (Kurniawan, 2022) or illegal logging (Sahputra, 2021). Another pressure on mangroves in Batam City is land use change for industrial areas, ports, ponds, contaminants intrusion from the shipbuilding industry and crude oil spills (Efendi, 2013).

One of the largest mangrove forest areas in Batam is Sagulung sub-district. The Sagulung sub-district occupied the largest mangrove forest in Batam at about 718.97 ha (Irawan et al., 2016). Many cases of mangrove forest devastation in Batam City occurred in the Sagulung sub-district (Simajuntak, 2021; Sitanggang, 2022). Rhizophoraceae family consists of *Rhizophora apiculata, Bruguiera gymnorrhiza, Bruguiera cylindrical dan Ceriops tagal* dominates mangroves in the Sagulung sub-district (Dora et al., 2021). So far, mangrove forests in the Sagulung sub-district benefit the local people with their wood and fish abundance (Batam Pos, 2019). Mangrove destruction also occurred in Sei Beduk, Batam (Sahputra (2022). Mangrove areas in the Sei Beduk sub-district cover 484.07 ha and are dominated by *Avicena lanata* and *Lumnitzera littorea*. (Irawan et al., 2016). The damage was mainly from forest landfilling for settlements occurred in Tanjung Piayu village, forest occupation and illegal reclamation. The Tanjung Piayu is a village where mangrove silvo ecotourism is located and managed by the MoEF (Lestari et al., 2023).

Mangroves provide many benefits for small islands, i.e., protection from erosion, wildlife habitat, wood provision, education and tourism (Kusmana, 2015a). Mangroves can reduce and prevent sea abrasion and reduce the magnitude of the tsunami wave disaster. The effect is on the level of disaster damage, the amount of losses and the number of victims that can be minimized. In addition, mangroves have a necessary role in controlling climate change through their ability to store and absorb carbon 4-5 times greater than mainland tropical forests. Laut tribe in Dapur Arang, Sagulung Sub-district, was an exporter of mangrove charcoal from the Dutch colonial era until the 2006-2007 period when the local government banned the charcoal-making activity due to mangroves decreasing (Prihatna, 2019). According to (Brown, 2007), mangroves were threatened by the charcoal industries because the government did not determine harvest limitations or post-harvest rehabilitation and the concession holders ignored sustainable mangrove harvesting.

In 2021, Indonesian authorities established one map mangrove as a guideline to rehabilitate mangroves governed by the MoEF, Ministry of Marine Affairs and Fisheries, Peat Restoration Body, Ministry of Finance, Ministry of National Development Planning, Ministry of Tourism and Creative Economy and Ministry of Village, Disadvantaged Regions and Transmigration (Laksono, 2021). Mangrove forest restoration in Batam City is challenging because of the overlapping land ownership land status and policies of the central and local governments (Sahputra, 2021). Suryahusada & Wijaya (2019) mentioned land use overlapping occurred between the BIFZ and the MoEF on the coastline in Batam

Jurnal Archipelago,
Vol. 02 (2), p.123-131 Desember 2023

City regarding the shipyard industry. Meanwhile, a conflict between the local people and the local authorities is commonly related to illegal logging for wood or charcoal. Protected forest management and conservation in Batam are under the Protected Forest Management Unit (PFMU). The PFMU is technically supervised by the MoEF and administratively under the Ministry of Home Affairs. As mandated in Law 32 of 2014, Regional Government Forest Management in all districts/cities will be transferred to the hands of the province. The study aims to review the possibility for the local people to utilize mangrove wood and maintain mangrove sustainability.

II. METHOD

The study is qualitative research and occurred at Dapur XII in the Sagulung subdistrict and Bagan in the Sei Beduk subdistrict in 2021. Both studied sites are located in Batam City, Indonesia, and was chosen because the two villages depend on mangrove for their livelihood. A semi-structured interview was employed to gather information from stakeholders of mangrove forest, (i) the villagers of Dapur XII and Bagan on illegal logging, (ii) a local non-governmental organization (NGO) to know the expectations on mangroves and (iii) the local authority on how to establish sustainable mangroves. The interviewees were the head of the villagers' association, the chief of the community empowerment institution of Dapur XII, charcoal home industries owners and workers of the village of Bagan, a local NGO focused on mangroves decreasing areas and an officer of the PFMU. The head of the villagers' association, the head of the community empowerment institution of Dapur XII, and a local NGO represent civil society. Charcoal home industry owners and workers of the village of Bagan represent mangrove charcoal manufacturers. The PFMU officer acts for the authority. The interview investigates the factors of the villagers engaging in illegal logging, measures the villagers' willingness to stop the illegal logging, the view of the NGO on the state of mangroves in Batam City and the proactive actions of the authority regarding developing mangroves sustainability. Narrative analysis was then held to interpret the data. The price calculation on the current USD exchange rate is based on 1 USD equal to Rp 15,459 (Bank of Indonesia, 2023).

III. RESULT AND DISCUSSION

Coastal communities in Batam City are categorised as low economic income, and the majority work as fishermen and charcoal making (Qodriyatun, 2013). Hamta (2016) mentioned small-scale fishermen in Batam City experience a lack of infrastructure, a daily income ranging from 4.87-7 USD, fish catches are commonly sold to a traditional market or for self-consumption, some fishermen run aquaculture as their livelihood, and some the family members work in informal sectors to support family finance. However, rapid development in Batam City generated waste that polluted seawater and decreased the fish population (Inge, 2021). While mangrove hoarding for settlements held by property companies reduced the fishermen's catches (Indah Suara News, 2021). Therefore, many fishermen in Batam City turn to cultivate sea grasses, *Sargassum* sp., is sold for 0.9 (₵/kg dry) (Gunawan, 2021) and can generate a daily income of about 14 to 24.38 USD (Bie, 2013). As the number of seagrasses collected increases, the local authority restricts some areas from seagrasses scavenging to protect the fish population (Naim, 2021).

Popular charcoal industries along the Batam coast were in Seijodoh, Duriangkang, Dapur XII and Sungai Buluh. However, mass charcoal industries in Batam depleted mangrove wood for charcoal raw material. As a result, in 1980-ies, some charcoal industries were bankrupted. Nowadays, a threat to the mangrove forest in Dapur XII and Bagan Village is residential area expansion

Jurnal Archipelago,
Vol. 02 (2), p.123-131 Desember 2023

(Romus, 2020; Sahputra, 2022). On the other side, the local regulation regarding urban planning of Batam City mentioned some areas of conservation forest and production forest allocated for industries, settlements, trade areas, public facilities, tourism and transportation sites (Perda Kota Batam No 3 Tahun 2021, 2021). However, Hardin et al. (2019) found forest communities rarely knew state forest boundaries. In 2021, the government of the Republic of Indonesia enacted social forestry that allows smallholder farmers or communities to cultivate land in the state forest areas. Social forestry is managed through village forests, community forests, community plantation forests, customary forests and forestry partnerships. However, social forestry management in protected forests excludes forestry partnerships.

Dapur XII is an old village in Sagulung sub-district, Batam City, occupied by 400 householders. Most of those householders work as fishermen and collect mangrove wood. Mangrove is mainly for construction since the BIFZ banned mangrove for charcoal-making. In contrast to Dapur XII, villagers of Bagan are fishermen and mangroves charcoal-making. However, charcoal production is decreasing because mangrove wood is rare in the market and charcoal price is low. A charcoal-making owner in Bagan village stated that collecting three tons of mangroves takes three months. The charcoal-making owner requires USD 140.18 to operate the mangrove furnace. However, the industry owner commonly borrowed the money from a charcoal collector and the charcoal produced is sold to the charcoal collector at 2.77 (₵/kg). Other charcoal industry owners rent out their charcoal furnaces for a price of USD 35 for one-time charcoal production. On the other side, a remaining charcoal-making owner in Dapur XII village uses a mix of mangrove and non-mangrove woods that requires ten days to collect a ton of wood materials that cost USD 70. The head of the community empowerment institution of Dapur XII mentioned it is difficult to switch the villagers' livelihood from mangrove wood collectors to other jobs. He also claims illegal logging occurs in almost all small islands. Selling mangrove wood provides cash to the villagers, a factor in why they engage in illegal logging. Also, small island communities inherit mangrove-logged habits from their ancestors.

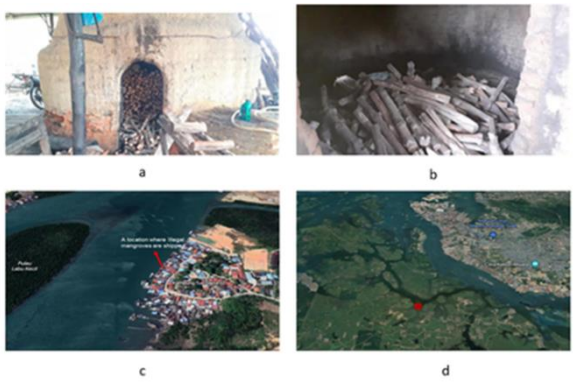

Figure 1.
(a) a furnace full of mangrove wood, (b) mangrove wood for charcoal making, (c) a red line showed a location where the illegal mangrove is piled in Dapur XII village, (d) a red square showed a location where the MoEF officers found Illegal mangrove transported through the South China Sea.

According to the PFMU and the NGO interviewed, mangrove logging in protected forests and by the villagers of Dapur XII and Bagan is illegal. The villagers have been warned several times by the PFMU officers of their illegal logging activities. The PFMU admitted the lack of mangrove supervision due to personnel shortages. Therefore, the PFMU and the NGO rely on the local authorities to take decisive action against the illegal loggers. The NGO and the Watershed Management Center, a unit of the MoEF in Batam, are actively rehabilitating degraded mangroves along the coastline. The villagers' ignorance of the protected forest makes them easily provoked by capitalized individuals or big capital companies to do illegal logging. In addition, the local authorities located some of their development planning in the protected forest zones. However, the head of community

Jurnal Archipelago,
Vol. 02 (2), p.123-131 Desember 2023

empowerment of Dapur XII said the villagers are willing to shift illegal loggers to another job if the job generates money that meets their needs. On the other side, the community head of Dapur XII mentioned that forcing the villagers from mangrove loggers to factory workers is challenging because the villagers used to earn income quickly. Instead, the villagers hope the authorities legalize charcoal-making activity for their livelihood. Rachmawati (2021) mentioned the history of the charcoal industry in Dapur XII began in the 1930-ies. The village had 12 charcoal furnaces with each volume ±125 m^3. Charcoal mangrove combustion occurred for about one to 1.5 months. Each furnace could generate 30 tons of charcoal. The charcoal produced was exported to Singapore.

Syahputra et al. (2020) mentioned the non-accessible mangrove forest to local people is vulnerable to social conflict in the future. Hence, mangrove is a renewable resource that should be managed by considering ecology, economy and society to gain sustainability (Kusmana, 2015). The mangrove charcoal-making industry in the Batu Ampar village in West Kalimantan province is proven to prevent the misuse of mangroves by implementing a local system, namely "Retas", or mangrove clear-felling occurs at 50-200 m from the forest edge (Prasetiamartati et al., 2008). The Retas system prevents mangrove habitat loss of shrimp and fish. Sustainable mangrove management for charcoal and pole production practises by Matang Mangrove Forest Reserve, Malaysia, for years (Satyanarayana et al., 2021). The reserve conducts a 30-year rotation cycle for charcoal industries and permits a charcoal contractor to log mangroves at an area of 2.2-6.6 (ha/year). On the contrary, the logging activities of the villagers in Batu Ampar for charcoal making have been illegal since the application for community plantation forests in 2013 (Ritabulan et al., 2019).

A large mangrove concession area in Indonesia is located in Bintuni Bay, West Papua, designated for a chip mill (PT BUMWI, 2021). The concession clears fallen mangroves for 1,658 ha/year with a rotation cycle for 30 years. The clear-felling area is determined at 50 m and 100 m inside the seashore and the riverside, respectively. Another mangrove forest concession for charcoal and wood chip production in Indonesia lies in Kubu Raya, West Kalimantan (Evans, 2013). According to PT Kandelia Alam (2018), the concession applied forest management as the harvesting area covers 615 ha/year and determined 50 m from the beach and 10 m from riparian, a cutting cycle is 20 and 30 years, harvesting occurred to trees with a diameter more than 10 cm, each harvesting area should leave 40 trees/ha mother trees to promote natural regeneration. However, the first forest management system for mangroves was applied in the Cilacap forest, Indonesia, in 1938 by implementing clear-cutting of *Rhizophora*-dominated mangroves and leaving 60-100 mother trees with a minimum diameter of 20 cm, protecting forest areas along the coast and river where *Avicenna* and other mangroves vegetation dominate, and the last, mangrove is not for production material (Burbridge & Koesoebiono, 1982). Meanwhile, according to Soediono (1976) in (Burbridge & Koesoebiono, 1982), a small-scale charcoal industry in Sumatra at that time with a cutting cycle of 35 years generated sustainable mangrove production for about 50-100 m^3/ha/year.

A forestry partnership in North Sumatra, Indonesia, was established to utilize mangrove forest ecotourism (Tampubolon, 2020). However, after ecotourism ran for five years, the members of the forestry partnership were less interested because ecotourism generated low income to meet their daily needs. On the other hand, communities in six mangrove villages in Tanekeke Island, Sulawesi, are willing to change their livelihood from shrimp and fishponds to seaweed

mariculture (Brown et al., 2014). On the other hand, (Genta, Tang, Anwar, & Wahyuni, 2018) found communities in Bengkalis Regency, Indonesia, support mangrove charcoal production to make a livelihood. The study also mentioned strengths and threats to developing sustainable mangrove charcoal in the Bengkalis Regency. The driving factors to initiating sustainable mangroves were the fertile mangrove lands, clean river water, the established cooperative groups for charcoal and mangrove forest management, a high requirement of charcoal in local and international markets, an abundance of food sources for fish, and the availability of coastal management regulation from the authorities. Meanwhile, the threats were a waste of charcoal production potent to damage mangrove forests, flora and fauna in the mangrove forests depleted, vulnerable to illegal trade, aquaculture reduces mangrove area, forests and river misuse, and over-exploitation of mangroves materials.

IV. CONCLUSION

The communities of Sagulung and Bagan sub-district inherit mangrove logging activities from their ancestor. As a result, the illegal logging activities of coastal communities in the Sagulung and Bagan sub-districts contradict the PFMU and the environmentalist NGO. A conflict between the coastal communities in Sagulung and Bagan sub-district to the PFMU and the NGO has occurred for years. Meanwhile, coastal communities' welfare is a determinant factor in developing a sustainable forest. The mangrove management system applied in the Cilacap forest in 1938 seems suitable to regulate mangrove forest in the Sagulung and Sei Beduk sub-districts since the mangrove dominance is the same, *Rhizophora* and *Avicenna*. Mangrove logging based on a forest management system can maintain wood availability and conserve forest biodiversity. On the other side, social forestry program enables coastal communities to utilize the forest through a scheme of village forests, community forests, or community plantation forests. Seagrass cultivation is also potent to enhance the coastal communities' income in the future.

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