

Intense work for mangrove planting, forest, and land rehabilitation efforts, and generating the coastal community economy in the pandemic era



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ABSTRACT

Mangrove forest is a unique, transitional ecosystem between seawater and freshwater ecosystems. Indonesia has an existing mangrove area of 3,364,081 Ha, of which the area of potential mangrove habitat is 756,183 Ha. The high value of this mangrove ecosystem places mangroves as one of the targets for rehabilitation in Indonesia. South Sumatra Province is one of Indonesia's provinces with high mangrove potential. During the Covid-19 pandemic, the activities of the business world experienced significant disruption in production, distribution, and other operational activities, ultimately disrupting the performance of the national economy. Along with the decline in the Indonesian economy as a result of the Covid 19 Pandemic, it automatically has an impact on the economic conditions of the people who live in coastal areas, where most of their lives depend on the pond business they manage or even from fishing with an unstable income level. This review highlights the progress aimed at mangrove planting and forest rehabilitation during the pandemic era by generating the coastal community in South Sumatra.



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Introduction

Mangrove ecosystems are a source of coastal wetlands and life support systems and natural wealth of very high value; therefore, it is necessary to protect, preserve and sustainably use them for the welfare of society. Mangrove forest is a unique, transitional ecosystem between seawater and freshwater ecosystems. Combining these two ecosystems causes forests to have a fairly high diversity. The uniqueness of this mangrove ecosystem provides significant benefits to life, both in terms of physical, biological, ecological, and economic¹. Physically, mangrove forests can protect beaches and riverbanks from abrasion, keep coastlines stable, prevent seawater intrusion, reduce strong winds and sea waves or tsunamis, and reduce pollutants²⁻⁴. Biologically, mangrove forests function to produce weathering material^{5,6}, which is an important food source for plankton and small invertebrates that eat weathering material, which is then also important as a food source for larger biota, spawning, and breeding grounds for various types of fish, shrimp, and crabs, shelter. and nesting of various bird species as well as

a source of germplasm. Mangrove forests are ecological sinks and reservoirs of the world's carbon stocks⁷. Meanwhile, from an economic point of view, mangrove forests are a good producer of wood for firewood, charcoal, and building materials, it is also good for industrial raw materials, as a producer of fish seeds, shrimp, crabs, eggs, and honey as well as tourism sites, research, and education sites^{8,9}.

As mentioned above, the various functions of mangroves make the mangrove ecosystem a major supporter of people's lives in coastal areas. However, the current condition of mangrove forests is experiencing pressures due to their utilization and management, which pays little attention to sustainability aspects.

Mangrove Forest Area

Indonesia has an existing mangrove area of 3,364,081 Ha, of which the area of potential mangrove habitat is 756,183 Ha (National Mangrove Map, 2021)¹⁰. The high value of this mangrove ecosystem places mangroves as one of the targets for rehabilitation in Indonesia. In the next 4 (four) years, namely from 2021-2023, the Indonesian government has targeted to rehabilitate 600,000 hectares of mangroves. South Sumatra Province is one of Indonesia's provinces with high mangrove potential.

Based on the National Mangrove Map (2021), mangroves in South Sumatra cover an area of 168,831 Ha, namely 157,760 Ha are inside the area and 11,071 Ha are outside the area¹⁰. The high level of dependence of coastal communities on the existence of mangrove ecosystems has gradually led to mangroves on the coast of South Sumatra being in quite apprehensive conditions. Added to this is weak enforcement of regulations, long spans of management, and fairly difficult accessibility making mangroves very "vulnerable" to damage. It is estimated that almost 30% of the mangrove area in South Sumatra is outside the scope of local government management (loss of government control).

South Sumatra Province is one of the target locations for National Economic Recovery activities through Mangrove Planting Intensive Work. The activity area in South Sumatra province is a beach and coastal area of approximately 438 kilometers which is the mouth of two large rivers such as the Musi and Banyuasin Rivers, as well as several small rivers such as the Sembilang, Soleh, Sugihan, and Silumput rivers.

Based on the facts on the ground, the conversion of mangrove forests into ponds provides the largest portion of damage to mangrove forests. In coastal locations, brackish water aquaculture operations are carried out in ponds, one form of habitat¹¹. Ponds are often traditional, semi-intensive, or intense in the hamlet, where fish and shrimp are grown¹². Mangrove plants surround the pond and provide a number of advantages for it, including abrasion protection, fertilization, and natural food for the pond's agricultural biota¹³. Rapid population growth causes demands to utilize mangrove resources to continue to increase. Population pressure, management that does not pay attention to sustainability aspects, and industrial and urban developments provide a significant proportion of the degradation of the mangrove forest. Thus, the decline in the number of mangrove forests and the biophysical quality of the surrounding environment is inevitable, such as coastal abrasion, loss of bird habitat, flooding, and decreased water productivity.

Factors that encourage human activity to utilize mangrove forests to meet their needs resulting in forest destruction: (1) The desire to make aquaculture with open land in the hope of being economical and profitable, because it is easy and cheap; (2) The need for firewood is very urgent for households because there are no other trees in the vicinity that can be cut down; (3) Low public knowledge of the various functions of mangrove forests; (4) There is a social gap between traditional pond farmers and modern pond entrepreneurs, resulting in an irrational process of buying and selling land^{14,15}.

National Economic Recovery Program

The Corona Virus Infectious Disease 2019 (Covid-19) pandemic has significantly disrupted economic activities in countries around the world, including Indonesia. During the Covid-19 pandemic, the activities of the business world experienced significant disruption in the processes of production, distribution, and other operational activities which ultimately disrupted the performance of the national economy.

The government in this regard has taken extraordinary policies and steps in the field of state finances in the context of saving health and the national economy, with a focus on spending on health, social safety net, and economic recovery including for the business world. and affected communities, as well as maintaining the stability of the financial sector. These extraordinary policies and steps are through the National Economic Recovery Program (PEN).

The National Economic Recovery Program (PEN) is a policy response pursued by the Government to maintain and prevent business activities from deteriorating, accelerate national economic recovery, and support state financial policies as a result of the downturn in the national economy due to this pandemic. One of the PEN programs implemented at the Ministry of Environment and Forestry (KLHK) is through Mangrove Planting Labor Intensive activities. The Indonesian government will encourage the restoration of mangroves covering an area of 600 thousand hectares for the next 4 (four) years. Mangrove Planting Labor Intensive Activities are expected to overcome the mangrove degradation that occurs.

Indonesia with mangrove ecosystems covering an area of 3.3 million hectares besides functioning to maintain the balance of the coastal environment, mangrove areas have also become a source of livelihood for coastal communities. So that the Mangrove Planting Labor-Intensive PEN program will revive people's purchasing power to recover the national economy.

Efforts to Rehabilitate Mangrove Ecosystem

According to Law of the Republic of Indonesia, Number 26 of 2007 concerning Spatial Planning mangrove ecosystems are included in Other Protected Areas, namely mangrove forested coastal areas in the form of marine coastal areas which are natural habitats of mangrove forests (mangrove) which function to protect coastal and marine life. The area referred to has a width of 130 x the average value of the annual difference between the highest and lowest tides measured from the line of the lowest tide towards the land. Meanwhile, coastal boundaries are classified as Local Protected Areas which include coastal borders, river boundaries, areas around lakes/reservoirs, areas around springs, and green open spaces. Referring to Presidential Decree 32 of 1990, the basis for setting mangrove and coastal border RHL targets is as follows: (1) Criteria for a beach border island along the shore whose width is proportional to the shape and physical condition of the beach at least 100 meters from the highest tide point towards the land (Article 14); (2) Protection of mangrove forested coastal areas is carried out to preserve mangrove forests by forming mangrove forest ecosystems and breeding grounds for various marine biota, as well as protecting the coast from erosion by sea water and protecting the cultivation businesses behind it (Article 26); (3) The criteria for a mangrove forested coastal area is a minimum of 130 times the average value of the annual difference between the highest and lowest tides measured from the line of the lowest tide towards the land (Article 27).

If seen from the facts on the ground, most of the damage to mangroves is caused by the conversion of mangroves into ponds. Economic pressure is one of the alibis of the community for encroaching on mangroves to become a source of income for their lives, in a way that pays little attention to the environmental sustainability of the mangrove ecosystem¹⁶. During the last 2 (two) years (2020-2021) Indonesia has experienced the threat of Covid-19 which has had a very significant impact on the economy of the Indonesian people. Many people are down because they have lost the financial ability to meet their daily needs. It is hoped that Mangrove Planting Labor Intensive activities in South Sumatra Province can help revive the community's

economy, especially coastal communities through the rehabilitation of mangrove forests. In 2020-2021 PEN activities will be carried out in an area of 560 hectares spread over two regencies, namely Banyuasin and Ogan Komering Ilir (OKI), namely: (1) in the Banyuasin Regency area, the location covers an area of 80 hectares in the Sembilang National Park Area (2020); (2) in OKI Regency, the location covers 230 hectares of land spread across Simpang Tiga Abadi Village, Tulung Selapan District, Simpang Tiga Jaya Village, Tulung Selapan District, and Sungai Lumpur Village, Cengal District (2020) and in Simpang Tiga Jaya Village with an area of 250 Ha (2021).

In general, the condition of the mangrove ecosystem in the target areas of the Cash for Work activities for planting mangroves has mostly turned into ponds managed by residents. In this case, the target of mangrove rehabilitation can be focused on areas that have already been converted into ponds. The implementation of efforts to preserve mangrove ecosystems and their rehabilitation needs to be carried out by taking into account the needs of pond farmers as owners of the land that is the target of mangrove rehabilitation efforts. One of the conservation efforts is through the application of the sylvofishery model. The common people are more familiar with Sylvofishery as trench ponds, trench ponds, wana mina, or forest mina. The application of the mina forest system (sylvofishery) in the mangrove forest ecosystem is one of the right approaches for the sustainable use of mangrove forest ecosystems^{17,18}.

By definition, trench ponds (Sylvofishery) are an integrated activity between aquaculture (fish, shrimp, and crab) with maintenance activities and efforts to preserve mangrove forests. The purpose of making trench ponds is to prevent further damage to mangrove forests and to restore and preserve brackish water ecosystems and coastal green belts, through land use so that they can provide maximum benefits for the mangrove ecosystem environment¹³. Mina Hutan is a fairly good technical approach pattern, which consists of a series of integrated activities between fish farming activities with planting, maintenance, management, and efforts to preserve mangrove forests. This system has simple technology, can be carried out without destroying existing mangroves, and can be carried out as an interim activity while trying to reforest green belt areas in critical coastal areas¹⁹. With this pattern, it is hoped that there will be mutually beneficial cooperation between sharecroppers and the forestry sector. The application of forest mina activities in the mangrove forest ecosystem area is generally expected to prevent the destruction of the area by the community (Fig 1) because it will provide an alternative source of income for the people in the area.



Fig 1. Planting of mangroves in ponds by the community

In essence, the application of the sylvofishery model is to gradually change the traditional pond or conventional pond model where the stretch of land in the pond is very open or has

almost no mangrove trees into a pond that is laid out with mangrove tree planting so that there is a mix of mangrove plants (wana) and cultivation of fish resources (mina).

In general, the application of the sylvofishery pattern provides several benefits, including (1) The construction of pond bunds becomes stronger because it will be held on by mangrove roots; (2) The pond bunds are comfortable for pedestrians because they will be covered by the main canopy; (3) Leaves of mangrove plants as animal feed; (4) Increase in biodiversity; (5) Prevent coastal erosion and intrusion of seawater into the land so that settlements and freshwater sources can be maintained; (6) Mangrove roots can filter solid waste and microbes so that the water quality is better; (7) Creating a green belt on the coast (coastal green belt); (8) Mangroves reduce the impact of natural disasters such as storms and tidal waves; (9) Provides long-term benefits, short-term results in the form of natural shrimp, fish, or crabs, medium-term results in the form of pond products (fish, shrimp, crabs), and long-term results in the form of wood and environmental services.

Coastal Community Economic Generator

Along with the decline in the Indonesian economy as a result of the Covid-19 Pandemic, it automatically has an impact on the economic conditions of the people who live in coastal areas, where most of their lives depend on the pond business they manage or even from fishing with an unstable income level. If people's purchasing power decreases, it will automatically affect the welfare of these farmers, because pond production will fall at very low prices, adjusting to people's purchasing power.

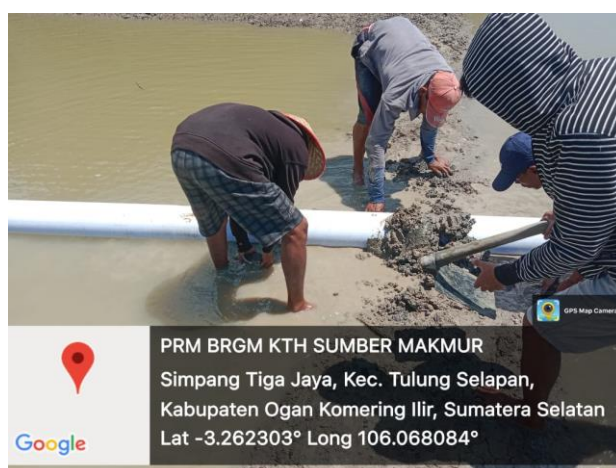


Fig 2. The process of installing tidal channels in the pond area

Based on the results of interviews with residents in Simpang Tiga Abadi Village, before the pandemic, the price of fish/shrimp from their ponds was valued at a relatively high value, starting at Rp. 15,000 per kilogram up to tens of thousands of rupiah, depending on the size and size of the fish/shrimp produced. However, during the Covid-19 outbreak, the price immediately dropped drastically to around Rp. 7000.00/kg or even lower than that price. The results from the sale of pond products certainly will not be able to cover operational costs for several months before harvest. And in the end, the farmers suffered a lot of losses and were unable to continue their business because they did not have any more capital.

The National Economic Recovery Program implemented by the Ministry of Environment and Forestry through Mangrove Planting Labor Intensive activities is expected to be able to boost and revive the economy of coastal communities. The implementation of PEN PKM in South Sumatra Province itself is carried out in 2 (two) regencies, namely Banyuasin Regency and Ogan Komering Ilir (OKI) Regency, which involve 8 (eight) farmer groups in 2020 and 5 (five) farmer groups in 2021. Most of the members of this farmer group are the community

cultivating ponds in the four villages that are targeted for the 2020-2021 PEN PKM locations (Table 1).

Table 1. Locations of Mangrove Work-Intensive activities in the Musi BPDAS Work Area

Year	Farmer Group Name	Number of Members	Planting Location	Village	Sub-district	Regency	Province	Planting Area (Ha)
2020	Pantai Hijau Lestari	60	Barong Besar 1	Sungsang IV	Banyuasin II	Banyuasin	South Sumatera	30
	Sungsang Sejahtera 1	50	Barong Besar 2	Sungsang IV	Banyuasin II	Banyuasin	South Sumatera	25
	Sungsang Sejahtera 2	50	Barong Besar 3	Sungsang IV	Banyuasin II	Banyuasin	South Sumatera	25
	Peduli Mangrove	100	Simpang Tiga Abadi	Simpang Tiga Abadi	Tulung Selapan	OKI	South Sumatera	50
	Bakau Abadi	100	Simpang Tiga Abadi	Simpang Tiga Abadi	Tulung Selapan	OKI	South Sumatera	50
	Bakau Jaya Abadi	100	Simpang Tiga Jaya	Simpang Tiga Jaya	Tulung Selapan	OKI	South Sumatera	50
	Hutan Mangrove	96	Simpang Tiga Jaya	Simpang Tiga Jaya	Tulung Selapan	OKI	South Sumatera	50
	Pecinta Mangrove	60	Sungai Lumpur	Sungai Lumpur	Cengal	OKI	South Sumatera	50
	Total	616						330
2021	Sumber Jaya	52	Block C	Simpang Tiga Jaya	Tulung Selapan	OKI	South Sumatera	50
	Sumber Rejeki	52	Block D	Simpang Tiga Jaya	Tulung Selapan	OKI	South Sumatera	50
	Lestari Mangrove Hijau	52	Block B	Simpang Tiga Jaya	Tulung Selapan	OKI	South Sumatera	50
	Mekar Hijau	52	Block A	Simpang Tiga Jaya	Tulung Selapan	OKI	South Sumatera	50
	Sumber Makmur	52	Block E	Simpang Tiga Jaya	Tulung Selapan	OKI	South Sumatera	50
	Total	260						250
Total (2020 & 2021)		876						580

To ensure that the PKM PEN funds reach the implementing community. The Minister of Environment and Forestry applies a direct payment pattern to individuals or account to account.



Fig 3. Community mangrove nurseries

In general, the implementation of this activity has absorbed around 34,076 HOK (2020) and 12,320 HOK (2021), including the work of erecting stakes, making nameplates and work huts, making seeds, collecting uprooted seeds, caring for seedlings, transporting seedlings, planting, repair of tidal channels and supervision (Fig 2).

This activity brings "fresh air" to coastal communities who take part in this program (Fig 3). From the beginning, many refused because they feared being evicted from the pond area. Finally, after going through a persuasive approach and intense outreach to the community, the community accepted and supported the PEN PKM program. The community also gets many benefits and advantages from this PKM PEN program, including (1) The implementing community obtains jobs from this activity program; (2) The implementing community gains increased knowledge capacity related to sylvo-fishery and technical skills related to mangrove nurseries and nurseries; (3) Communities implementing activities earn income from each stage of the work carried out; (4) The involvement of gender in the implementation of this activity becomes a gender issue that can be used as an interesting topic of the issue to raise.

Conclusion

This review focused on the progress aimed at mangrove planting and forest rehabilitation during the pandemic era by generating the coastal community in South Sumatra. PEN activities were held during the pandemic (2020-2021) to generate the coastal community. PEN activities were carried out in an area of 560 hectares spread over two regencies, namely Banyuasin and Ogan Komering Ilir (OKI). From the beginning, many refused because they feared being evicted from the pond area. Finally, after going through a persuasive approach and intense outreach to the community, the community accepted and supported the PEN PKM program. The community also gets many benefits and advantages from this PKM PEN program. Sylvo-fishery was used to rehabilitate the forest, and the application of the mina forest system (sylvo-fishery) in the mangrove forest ecosystem is one of the right approaches for the sustainable use of mangrove forest ecosystems and provides benefits to the mangrove ecosystem in South Sumatra during the pandemic era.

References

- 1 Kuenzer, C., Bluemel, A., Gebhardt, S., Quoc, T. V. & Dech, S. Remote sensing of Mangrove ecosystems: A Review. *Remote Sensing* **3**, 878-928 (2011). <https://doi.org/10.3390/rs3050878>
- 2 Utami, W., Wibowo, Y. A., Hadi, A. H. & Permadi, F. B. The impact of mangrove damage on tidal flooding in the subdistrict of Tugu, Semarang, Central Java. *Journal of Degraded and Mining Lands Management* **9**, 3093-3105 (2021). <https://doi.org/10.15243/jdmlm.2021.091.3093>
- 3 Ahmad, T., Tjaronge, M. & Cholikh, F. The use of Mangrove stands for shrimp Ppond waste-water treatment. *Indonesian Fisheries Research Journal* **7** (2017). <https://doi.org/10.15578/ifrj.7.1.2001.7-15>
- 4 Alongi, D. M. Mangrove forests: Resilience, protection from tsunamis, and responses to global climate change. *Estuarine, Coastal and Shelf Science* **76**, 1-13 (2008). <https://doi.org/10.1016/j.ecss.2007.08.024>
- 5 Ray, R. *et al.* Dissolved and particulate carbon export from a tropical mangrove-dominated riverine system. *Limnology and Oceanography* **66**, 3944-3962 (2021). <https://doi.org/10.1002/lno.11934>
- 6 Mandal, S. K. *et al.* State of rare earth elements in the sediment and their bioaccumulation by mangroves: a case study in pristine islands of Indian Sundarban. *Environ Sci Pollut Res Int* **26**, 9146-9160 (2019). <https://doi.org/10.1007/s11356-019-04222-1>
- 7 Meng, Y. *et al.* Relationships between above- and below-ground carbon stocks in mangrove forests facilitate better estimation of total mangrove blue carbon. *Carbon Balance Manag* **16**, 8 (2021). <https://doi.org/10.1186/s13021-021-00172-9>

- 8 Eddy, S., Mulyana, A., Iskandar, I. & Ridho, M. R. Community-based Mangrove forest conservation for sustainable fisheries`. *Jurnal Silvikultur Tropika* **7** (2016). <https://doi.org/10.31219/osf.io/x659w>
- 9 Asari, N., Suratman, M. N., Mohd Ayob, N. A. & Abdul Hamid, N. H. in *Mangroves: Ecology, Biodiversity and Management* Ch. Chapter 13, 305-322 (2021).
- 10 Anugrah, N. (Kementerian Lingkungan Hidup dan Kehutanan, 2021).
- 11 Suparjo, M. N. Daya dukung lingkungan perairan tambak desa Mororejo Kabupaten Kendal. *Saintek Perikanan: Indonesian Journal of Fisheries Science and Technology* **4**, 50-55 (2008).
- 12 Kridalaksana, A., Subiyanto & Suryanto, A. Pengelolaan tambak dan mangrove di area pertambakan di desa Mororejo, Kecamatan Kaliwungu, Kabupaten Kendal. *Management of Aquatic Resources Journal (MAQUARES)* **3**, 148-156 (2014).
- 13 Warsito, B. *et al.* Silvofishery as an alternative system of sustainable aquaculture in mororejo village, kendal regency. *E3S Web of Conferences* **202** (2020). <https://doi.org/10.1051/e3sconf/202020206043>
- 14 Alimuna, W., Sunarto & Murti, S. H. Pengaruh aktivitas masyarakat terhadap kerusakan Hutan Mangrove di Desa Gamlamo, Kecamatan Jailolo, Kabupaten Halmahera Barat. *Majalah Geografi Indonesia* **23** (2009).
- 15 Branoff, B. L. Quantifying the influence of urban land use on mangrove biology and ecology: A meta-analysis. *Global Ecology and Biogeography* **26**, 1339-1356 (2017). <https://doi.org/10.1111/geb.12638>
- 16 Elwin, A., Bukoski, J. J., Jintana, V., Robinson, E. J. Z. & Clark, J. M. Preservation and recovery of mangrove ecosystem carbon stocks in abandoned shrimp ponds. *Sci Rep* **9**, 18275 (2019). <https://doi.org/10.1038/s41598-019-54893-6>
- 17 Wijaya, N. I. & Yulianda, F. Model pengelolaan Kepiting Bakau untuk kelestarian habitat Mangrove di Taman Nasional Kutai Provinsi Kalimantan Timur (The model of mud Crab (*Scylla serrata*) management for habitat preservations of Mangrove in Kutai National Park, East Kalimantan Province). *Jurnal Manusia dan Lingkungan* **24** (2018). <https://doi.org/10.22146/jml.23079>
- 18 Harefa, M. S., Nasution, Z., Mulya, M. B. & Maksum, A. Mangrove species diversity and carbon stock in silvofishery ponds in Deli Serdang District, North Sumatra, Indonesia. *Biodiversitas Journal of Biological Diversity* **23** (2022). <https://doi.org/10.13057/biodiv/d230206>
- 19 Nuryanto, A. *Sylvofishery (Mina Hutan): Pendekatan pemanfaatan hutan mangrove secara lestari* (Institut Pertanian Bogor, 2003).

Author contributions

All authors contributed to the study's conception and design. Material preparation, data collection, and analysis were performed by [Yunita Dwi Hastuti]. The first draft of the manuscript was written by [Yunita Dwi Hastuti] and [Nisrina Salsabila]. All authors commented on previous versions of the manuscript. All authors read and approved the final manuscript