

Research Article

Mangrove forest management model as sustainable production forest of post COVID-19 in South Sulawesi, Indonesia

Amal Arfan^{1,*}, Syafruddin Side¹, Rosmini Maru¹, Muhammad Faisal Juanda²

¹Geography Department, Makassar State University, Makassar, 90222, Indonesia

²Postgraduate Program for Geography Education Study Program, Makassar State University

(Received: April 24, 2021; Revised: July 26, 2021; Accepted: July 30, 2021)

ABSTRACT

The impact of the Covid-19 pandemic has transformed indonesia's economy, as evidenced by budget diversions in the context of its handling including budgets for coastal villages around mangrove forest areas. This research aims to create a model of mangrove forest management as a sustainable production forest paca pandemic covid. Data is collected directly from informants and respondents through live interviews and Focus Group Discussion (FGD). Sampling techniques are launched with a purposive sampling system. Informant consists of community leaders, local governments, related agencies, NGOs, fishing groups, fire groups, women's groups and youth figures. The implementation model of mangrove forest management as a production forest is carried out through four stages, namely the planning, management, supervision and conservation stages. At the planning stage consists of socialization, the formation of community groups, identification and evaluation of economic value huan mangrove. At the management stage consists of improving the quality of human resources, increasing the participation of the community, local communities in the mangrove area as partners. At the stage of supervision consists of cultivation activities, types of equipment and fishing equipment used, compliance of business licenses and activities, community activities in mangrove forest areas. At the conservation stage consists of rehabilitation, restoration and conservation of mangrove forests, spatial management for the expansion of mangrove forest areas, education of cultivation systems, utilization and use of environmentally friendly fishing equipment in mangrove forest areas

Key words: Management model, mangrove, pandemic covid-19

INTRODUCTION

The impact of the COVID - 19 pandemic has transformed indonesia's economy, as evidenced by budget diversions in order to handle it including budgets for villages. As a result, the villages are affected mainly in the field of economy and development which has been relying heavily on assistance from the center (Sarib *et al.*, 2020) Other economic impacts due to the COVID - 19 pandemic are also felt in the Micro, Small and Medium Enterprises (MSMEs) sector (Sugiri, 2020). Small businesses are among the hardest hit by the COVID-19 crisis, many of which have temporarily closed their businesses (Baker and Hakim, 2020), even though the contribution of MSMEs to the national economy is quite large. The biggest impacts are also felt in coastal and coastal areas globally. In developing countries there was a 25% drop in tourism resulting in a loss of \$7.4 billion (or a 7.3% drop in GDP) (Coke - Hamilton, 2020). For the Caribbean, the analysis forecast job losses to be 1.4 million to 2 million and losses for the tourism sector to \$27 billion to \$44 billion (WTTC, 2020). Recovery is expected to take at least 10 months to two years after the pandemic, and longer for smaller economies depending on the arrival of tourists from some developed countries (UNCTAD, 2020). Based on this, a model of coastal area management is needed after the covid pandemic. One of them is the mangrove forest management model (Figure 1).

Mangrove is one of the most productive marine ecosystems on earth because it provides a unique habitat for various species (Carugati *et al.*, 2018). Mangrove forests provide essential services around the world including essential goods and services for humans worth US\$194,000 ha year-1 (Costanza, 2014; Romanach *et al.*, 2018). Mangrove forests have many functions and benefits that play an important role in the lives of their inhabitants biologically, ecologically, physically and socioeconotically (Yanagisawa *et al.*, 2010; James *et al.*, 2013; Abino *et al.*, 2014, Sandilyan and Kathiresan, 2015; Kusmana and Sikwika, 2018). Mangrove area as a protected area that was once a source of raw materials for daily life of local people can be used as a means of tourism cultural and spiritual identity and provide ecological services to the surrounding environment (Chen *et al.*, 2009; Saprudin and Halidah, 2012; Carandang *et al.* 2013; James *et al.*, 2013; Widiastuti *et al.*, 2016; Idrus *et al.*, 2017; Small *et al.*, 2017).

Mangrove forests are utilized by humans for a variety of purposes, including fisheries, agriculture, forestry and supporting fishing, fish conservation due to the fertile environment, mammals, fish, crustaceans, shellfish and reptile spawning and bird breeding (Manson *et al.*, 2003; Able, 2005; Arfan *et al.*, 2018). Mangrove forests provide essential services around the world including goods and services that are essential to humans worth US\$194,000 ha year-1 (Costanza 2014;

*Corresponding Author's E-mail: amalarfan@unm.ac.id

Romanach *et al.*, 2018). It is estimated that mangroves have a value of about \$200,000-\$900,000 per hectare and use them as a primary livelihood (Spalding, 2010). In the Gulf of Thailand, services are available in the form of fisheries worth US\$ 33-110 ha-1 year-1 (Barbier, 2000). Furthermore in Southeast Asia the services provided are worth US\$ 239–4,185 ha-1 year-1 in the form of Fisheries, firewood, coastal protection (Brander 2012), Can Gio, Vietnam services provided are Fisheries, forest products, aesthetics as well as recreation and climate change mitigation worth US\$ 358–503 million TEV, Sundarbans Reserve Forest, Bangladesh / India Services providing Wood, firewood, wild food, cultural services worth US\$ 744,000 year-1 (Kuenzer and Tuan, 2013). Mangrove wood products are used as light construction wood, boat making charts, bridges, fishing poles, charcoal, tanners, tannins, and pulp. Non-timber forest products include sweets and dodol api-api (*Avicennia sp.*), honey bees, sharing types of fish and crustaceans. Mangrove forest area is also a nutrient contributor to the surrounding ecosystem because the falling mangrove litter will decompose into organic matter (Kusmana, 2015; Rizal *et al.* 2017; Arfan *et al.*, 2018)

The concept of sustainability of mangrove forest management requires criteria and indicators to ensure a balance between the economic, social and ecological dimensions of development. This will provide something that the community wants as a whole. The successful implementation of mangrove management policy is determined by the enforcement of law regulations in coastal areas, collaboration between scientists, politicians, governments, stakeholders (Bidayani *et al.*, 2016), Successful implementation of mangrove management policies determined by waste management and pollution control; environmental counseling and education to the community; strategic development planning that considers the carrying capacity and carrying capacity of mangroves; tourism development involving local communities and wisdom (Lugina *et al.*, 2017). An integrated approach to all management in coastal areas using traditional ecological knowledge and involving coastal communities will also determine the successful implementation of a program (Dencer-Brown, 2018). The function of mangrove forest as a sustainable production forest area has been felt by the people in Tanakeke Island, Takalar Regency, South Sulawesi. Mangrove management in Tanakeke Island is done by the community independently. There is an area of mangrove forest called Bangko Tapampang which is designated by the community as a protected area. To reduce the rate of damage caused by the felling of charcoal raw materials, the village government issued a Village Regulation governing each logger is required to leave the parent tree to ensure mangrove regeneration. Charcoal raw materials come from mangrove forests, either owned by themselves or bought from the community. The high low price of wood depends on the size of the wood, the average price reaches 10-30 million/ha. The price of mangrove charcoal at the producer level reaches Rp.75.000,-/sack, with one burn can reach 100-150 sacks. Charcoal produced by the community is directly marketed in the city of Makassar (Mestika *et al.*, 2017).

Management of mangrove forest areas can not be separated from the interests and roles of actors in the utilization of resources in mangrove forest areas. There are six types of interests, namely the existence of green lines to be maintained, types of diversity (biodiversity),

educational facilities, the need for the fulfillment of firewood, non-timber forest products and as a means of tourism. The actors' roles in this matter are the Environment Agency, the Department of Plantation and Forestry, the Mangrove Protection Area Management Agency (BPDPM) and the NGO Mitra Bentala. Scientific research can show concrete steps to increase stakeholder participation and develop strategies to help engage local communities in a more efficient way. In order to promote mangrove conservation, in addition to law enforcement and government protection, the public needs to be aware of the goods and services provided by mangroves. Population awareness usually only arises after mangrove degradation (Ferreira and Lacerda, 2016). However, science and technology often fail to translate knowledge to decision makers and the general public (Granek, 2010). Local communities often have a symbolic relationship with mangrove forests, so the socio-cultural dimension of mangrove services needs to be considered by policymakers to address challenges in coastal ecosystem conservation (Queiroz *et al.*, 2017).

Various strategies are carried out in the management of mangrove forests to be sustainable, namely the design of capacity building, community empowerment strategies, conflict resolution strategies, and improving public education and collaboration between various stakeholders (Mondal *et al.*, 2021). Furthermore, by developing the potential of mangroves that are sustainable and have economic value through environmentally friendly cultivation and fishing, increasing the role of NGOs to increase community knowledge and awareness in mangrove management, developing the potential of mangrove forests as ecotourism areas, empowering communities through fishermen/farmer groups to realize home-scale industry based on mangrove resources (Arfan *et al.* 2021).

MATERIALS AND METHOD

This research is an applied research that aims to identify, analyze, then make a solution to the problem, then the results of this research can be modeled and implemented for the widest interest. The data collected in this study are primary data and secondary data. Primary data was carried out by means of observation, in-depth interviews through PRA (Participatory Rural Appraisal) and Focus Group Discussion (FGD) approaches. The informants chosen to be interviewed are informants aged between 20-60 years who live around the coastal mangrove forest area of South Sulawesi and have lived for more than 10 years, because these informants provide valid information. about the mangrove forest in the area. The sampling technique was implemented using a purposive sampling system. Informants consisted of community leaders, local government, related agencies, NGOs, fishing groups, firefighter groups, women's groups and youth leaders. Based on the PRA phase cycle, sequentially, the stages were carried out in interviews, discussions and FGD (Focus Group Discussion). The discussions focused on mangrove forest management activities as production forests starting from the planning, management, monitoring and preservation stages.

RESULTS AND DISCUSSION

The implementation of sustainable mangrove forest management can be carried out in various ways, namely

the integration of human livelihood needs by balancing conservation goals can be a solution for the long-term sustainability of mangrove forests around the world (Romanacha *et al.* 2018), raising awareness and strengthening biodiversity programs for coastal ecosystems (Abidin *et al.* 2021). The implementation model of mangrove forest management as a production forest in this study was carried out through four stages, namely the planning, management, monitoring and conservation stages. The four stages are interrelated and complementary by involving the community around the mangrove forest. For each stage of the implementation of mangrove forest management as a production forest, it can be seen from the descriptions and pictures as follows:

A. Planning

1. Socialization: Socialization Implementers is local governments or related agencies or fisheries/agricultural extension or researchers. The target of socialization is the community around the mangrove forest area, local agencies (village level), non-governmental organizations, community groups, slave entrepreneurs and other businesses around the mangrove forest area. Socialization material about the purpose and purpose / plan / model / strategy of mangrove forest management as a production forest. Socialization methods, namely:

- (i) Visiting the relevant parties respectively to be given an explanation
- (ii) Meeting by inviting the relevant parties and providing explanations about the management of mangrove forests as production forests.

2. Formation of community groups: Groups formed are fishermen groups, firefighting groups, seaweed breeding groups, women's groups of 10 - 15 people fostered by the relevant services (fisheries and marine services, village community empowerment services, forest services). The group was formed in order to play an active role in the sustainable utilization and management of the economic function of mangrove forests as production forests

3. Identification and Evaluation of Economic Value of Mangrove Forests : Identification and evaluation of the economic value of mangrove forests can be done by cooperating with researchers, extension of agriculture / fisheries by partnering with communities in mangrove forest areas and directly utilizing mangrove forests as a source of income. Identification is done including the way done by the community, the type of fishing equipment used, and community activities in mangrove forest areas. While the economic value can be calculated by conducting interviews about the benefits obtained by the community after activities in mangrove forest areas.

B. Management

1. Improvement of The Quality of Community Resources: Improvement of the quality of human resources can be done by:

- (a) Counseling on regulations related to the utilization and management of mangrove forests in Indonesia, management of coastal areas and small islands. Regulations that are informed to the public are :
 - (i) presidential regulation of the Republic of Indonesia number 73 of 2012 concerning the national strategy of mangrove ecosystem management,
 - (ii) Regulation of the Minister of Forestry No. P.70/Menhut-II/2008 concerning Guidelines for implementation of Forest and Land Rehabilitation.

- (iii) Government Regulation No. 6/2007 concerning Forest Governance and Forest Management Plan, As well as Forest Utilization (State Gazette of the Republic of Indonesia of 2007 Number 22);

- (b) Training on intensification of aquaculture. This activity is carried out by involving the community (fishermen / farmers) in terms of maintenance techniques, cultivation models and development of silvofishery cultivation

- (c) Introduction and training on the use of fishing equipment. This activity involves relevant local government agencies, community leaders, production groups in the community, fishermen, farmers, and communities whose livelihoods are around mangrove forest areas.

2. Increased Community Participation Increased community participation in the implementation of mangrove forest management as a production forest needs to involve the community bottom up. One of the approach patterns used is the PRA (Participatory Rural Appraisal) approach and method, which is an approach and method that allows the community to jointly analyze life's problems in order to formulate real planning and policies. This pra approach pattern is aimed at increasing community participation. As part of their real involvement incentives are by providing facilities and infrastructure including:

- i) Health facilities, road access, clean water, education, lighting and home surgery programs,
- ii) Providing soft capital assistance to individuals and groups,
- iii) Making pilot projects utilization and environmentally friendly management

3. Local Communities in mangrove areas as local government partners or related agencies make local communities as partners in mangrove forest management and utilization programs and activities. The partners intended are productive community groups that have activities in mangrove forest areas. Local government / agencies provide assistance with production tools, appropriate technology, and in the form of management innovations so that the community will be motivated in the implementation of mangrove forest management as a production forest.

C. Supervision

1. Cultivation activities, types of equipment and fishing equipment used: Supervision is carried out on cultivation activities carried out by the community around mangrove forests that have the potential to damage such as the clearing of pond land without regard to environmental conservation methods, including the type of equipment and fishing equipment used. Supervision carried out in this case is preventive supervision, which is done by making or determining regulations related to the management of mangrove forests as production forests, making guidelines in accordance with established regulations, setting sanctions against activities that have the potential to damage mangrove forests and determining coordination, reporting, and inspection systems –

2. Compliance of business licenses and activities: Compliance of business licenses and or activities carried out based on SOP (Standard Operational Procedure) Supervision of Licensing And Environmental Management Legislation, Ministry of Environment and Forestry Directorate of Complaints, Supervision and

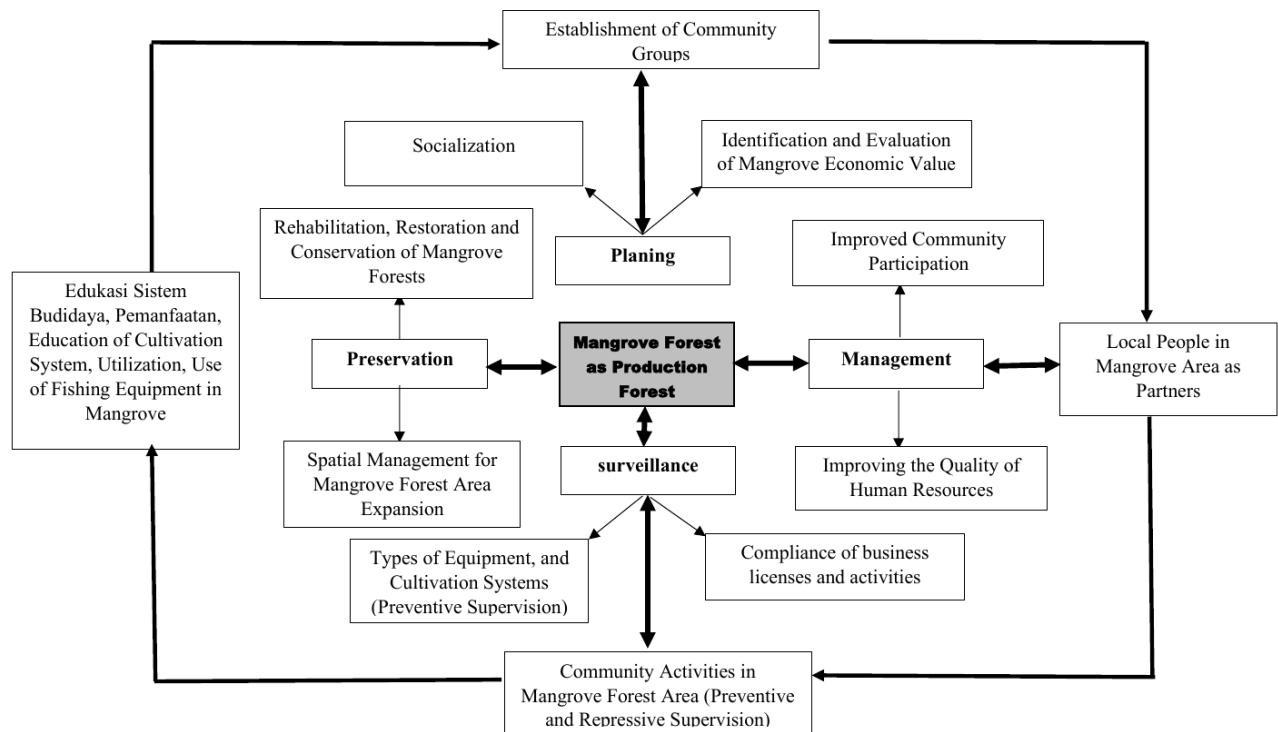


Figure 1. Mangrove forest management model

Administrative Sanctions, Year 2015.

3. *Community activities in mangrove forest areas:*

Supervision of community activities in mangrove forest areas is carried out with the aim of preventing mistakes and errors in implementation. Supervision carried out in this case is preventive supervision, namely by making or determining regulations related to the management of mangrove forests as production forests, making guidelines in accordance with established regulations, setting sanctions against activities that have the potential to damage mangrove forests and determining coordination systems, reporting, and inspection and repressive supervision, to ensure the continuity of the implementation of work / activities so that the results are in accordance with the plan that has been set and carried out after the work or activities are carried out

D. Preservation

1. Rehabilitation, Restoration and Conservation of Mangrove Forests: Mangrove forest conservation efforts can be done by rehabilitation, restoration and conservation. Rehabilitation is an activity that aims to transform damaged ecosystems into balanced ecosystems, and restore the aesthetic value and ecological function of mangrove forest areas. This activity is carried out by planting mangrove species in accordance with degraded areas by involving the community or implementing an incentive system in the hope to stimulate and spur efforts in mangrove forest management and conservation activities. Mangrove forest conservation by way of restoration is an effort to improve the mangrove ecosystem so that the condition of the ecosystem is again close to the ecosystem before being degraded by means of natural succession, supporting natural succession, crop enrichment, or planting.

2. Spatial Management for Mangrove Forest Area Expansion: Spatial management for the expansion of

mangrove forest areas with a view to provide a special space / area as a rehabilitation, decoration and restoration area. Spatial management is carried out by referring to the Regional Regulation of South Sulawesi Province No. 2 of 2019 concerning Zoning Plan of Coastal Areas and Small Islands of South Sulawesi Province in 2019-2039.

3. Education System Cultivation, Utilization, Use of Fishing Equipment in mangrove area: Education cultivation system, utilization, use of fishing equipment in mangrove areas that are environmentally friendly is an effort to maintain the sustainability of the function of mangrove forests as production forests. This education is conducted by:

- i) providing counseling, training and demonstration on the use of fishing equipment in mangrove areas
- ii) making silvofishery cultivation denplot for traditionally managed ponds,
- iii) making brochures / lifflets / books about cultivation systems, utilization, use of fishing equipment in mangrove areas and then distributed and given to community groups or stored in the village / village library.

CONCLUSION

The implementation model of mangrove forest management as a post-pandemic covid-19 production forest is carried out through four stages, namely the planning, management, supervision and conservation phase. The four stages are interconnected and complement each other by involving the community around the mangrove forest. At the planning stage, conducted by means of socialization with the target is the community around the mangrove forest area. The formation of community groups of 10 - 15 people. Identification and Evaluation of The Economic Value of Mangrove Forests by cooperating with researchers, extension of agriculture /

fisheries by partnering with communities in mangrove forest areas and directly utilizing mangrove forests as a source of income. At the stage of management by improving the quality of community resources conducted by means of counseling on regulations related to the utilization and management of mangrove forests in Indonesia, management of coastal areas and small islands. Training intensification of aquaculture. This activity is carried out by involving the community (fishermen / farmers) in terms of maintenance techniques, cultivation models and development of silvofishery cultivation. Introduction and training on the use of fishing gear. This activity involves relevant local government agencies, community leaders, production groups in the community, fishermen, farmers, as well as communities whose livelihoods are around mangrove forest areas, shortening the Participation of Communities, Local Communities in mangrove areas as partners. The supervisory stage is the monitoring of cultivation activities, types of equipment and fishing equipment used, compliance of business licenses and activities. At the conservation stage, namely by conducting rehabilitation, restoration and conservation of mangrove forests.

ACKNOWLEDGEMENTS

This article is sourced from the results of excellent applied research universities financed by the Ministry of Technology Research and Higher Education. Therefore, thanks to the Ministry of Technology Research and Higher Education, also to the rector of Makassar State University who has given permission in this research.

REFERENCES

- Abidin, A., Setiawan, B., Muhaimin A.B. and A. Shinta. 2021 . The role of coastal biodiversity conservation on sustainability and environmental awareness in mangrove ecosystem of southern Malang, Indonesia. *Biodiversitas*. 22(2) : 648 - 658. <https://doi.org/10.13057/biodiv/d220217>
- Abino, A.C., Castillo, J.A. and Y.J. Lee. 2014. Assessment of species diversity, biomass and carbon sequestration potential of a natural mangrove stand in Samar, the Philippines. *Forest science and technology* 2 10(1):2-8. <https://doi.org/10.1080/21580103.2013.814593>
- Able, K. W. 2005. A re-examination of fish estuarine dependence: evidence for connectivity between estuarine and ocean habitats. *Estuarine, coastal and shelf science* 64(1):5-17. <https://doi.org/10.1016/j.ecss.2005.02.002>
- Arfan, A., Maru, R., Side, S., Abidin, M.R. and U. Sideng. 2021. Mangrove Forest Management Strategy as A Sustainable Production Forest Area in Luwu District, South Sulawesi Province, Indonesia. *Journal of Physics: Conference Series* 1752. 012089 IOP Publishing doi:10.1088/1742-6596/1752/1/012089
- Arfan, A., Abidin, M.R., Leo, N.Z., Sideng, U., Nympa, S., Maru R., Syarif, E. and Y. Lao 2018. Production and Decomposition Rate of Litterfall *Rhizophora mucronata*. *Environment Asia* 11(1):112-24. <https://doi.org/10.26858/ugj.v1i2.5312>
- Baker, T. and K. Judge. 2020. How to Help Small Businesses Survive COVID-19. *Columbia Law and Economics Working Paper(620)* Retrieved from <https://doi.org/10.2139/ssrn.3571460>
- Barbier, E.B. 2000. Valuing the environment as input: review of applications to mangrove-fishery linkages. *Ecological economics*. Oct 1;35(1):47-61. [https://doi.org/10.1016/S0921-8009\(00\)00167-1](https://doi.org/10.1016/S0921-8009(00)00167-1)
- Bidayani, E., Soemarno., Nuddin., H and Rudianto. 2016. Blue Economy Approach-Based Mangrove Resources Conservation for Coastal Community's Prosperity in Sidoarjo Regency, East Java, Indonesia. *International Journal of Ecosystem* 6 (1):1-9. <https://doi.org/10.21776/ub.ecsofim.2016.004.01.01>
- Brander, L.M., Wagtendonk, A.J., Hussain, S.S., McVittie, A., Verburg, P.H., de Groot RS, and S.van der Ploeg. 2012. Ecosystem service values for mangroves in Southeast Asia: A meta-analysis and value transfer application. *Ecosystem services* 1(1):62-9. <https://doi.org/10.1016/j.ecoser.2012.06.003>
- Carandang, A.P., Camacho, L.D., Gevaña, D.T., Dizon, J.T., Camacho, S.C., de Luna, C.C., Pulhin, F.B., Combalicer, E.A., Paras, F.D., Peras, R.J. and L.L Rebugio. 2013. Economic valuation for sustainable mangrove ecosystems management in Bohol and Palawan, Philippines. *Forest science and technology* 9(3):118-25. <https://doi.org/10.1080/21580103.2013.801149>
- Carugati, L., Gatto, B., Rastelli, E., Martire, M.L., Corral, C., Greco, S. and R. Danovaro. 2018. Impact of mangrove forests degradation on biodiversity and ecosystem functioning. *Scientific reports* 8 (1):1-1 <https://doi.org/10.1038/s41598-018-31683-0>
- Chen, L., Wang, W., Zhang, Y. and G. Lin. 2009. Recent progresses in mangrove conservation, restoration and research in China. *Journal of Plant Ecology* 2(2):45-54. <https://doi.org/10.1093/jpe/rtp009>
- Coke-Hamilton, P. 2020. Unity for the benefit of all. In *International Trade*. International Trade Centre Forum 4:3-3. <https://doi.org/10.18356/15645304-2020-4-1>
- Costanza, R., De Groot, R., Sutton, P., Van der Ploeg, S., Anderson, S.J., Kubiszewski, I., Farber, S. and R.K. Turner. 2014. Changes in the global value of ecosystem services. *Global environmental change* 1(26):152-8 <https://doi.org/10.1016/j.gloenvcha.2014.04.002>
- Dencer-Brown, A.M., Andrea, C. A., Simon, M and P. John. 2018. A Review on Biodiversity, Ecosystem Services, and Perceptions of New Zealand's Mangroves: Can We Make Informed Decisions about Their Removal?. *Resources* 7 (23). <https://doi.org/10.3390/resources7010023>
- Ferreira, A. C., Lacerda, L. D. 2016. Degradation and conservation of Brazilian mangroves, status and perspectives. *Ocean Coastal Manage* 2016;125 : 38-46. doi: 10.1016/j.ocecoaman. 03. 011
- Granek, E. F., Polasky, S., Kappel, C. V., Reed, D. J., Stoms, D. M. and W.W. Koch. 2010. Ecosystem services as a common language for coastal ecosystem-based management. *Conserv. Biol.* 24: 207-216. doi: 10.1111/j.1523-1739.2009.01355.x

- Idrus, S., Ismail, A. and M. Ekayani. 2017. Potential payments for environmental services of mangrove forests in West Halmahera Regency. *Jur. Ilmu. Pert. Indo.* 21:195-202. <https://doi.org/10.18343/jipi.21.3.195>
- Mestika, I.Y., Kustanti, A and H. Rudi .2017. Kepentingan Dan Peran Aktor Dalam Pengelolaan Hutan Mangrove Di Desa Pulau Pahawang Kecamatan Marga Punduh Kabupaten Pesawaran. *Jurnal Sylva Lestari* 5(2) : s113-127. <https://doi.org/10.23960/jisl25113-127>
- James, G.K., Adegoke, J.O., Osagie, S., Ekechukwu, S., Nwilo, P. and J. Akinyede. 2013. Social valuation of mangroves in the Niger Delta region of Nigeria. *International Journal of Biodiversity Science, Ecosystem Services & Management* 9 (4):311-23. <https://doi.org/10.1080/21513732.2013.842611>
- Kuenzer C., Tuan, V.Q. 2013. Assessing the ecosystem services value of Can Gio Mangrove Biosphere Reserve: Combining earth- observation- and household-survey-based analyses. *Applied Geography* 45:167-84. <https://doi.org/10.1016/j.apgeog.2013.08.012>
- Kusmana, C. 2015. Integrated Sustainable Mangrove Forest Management Pengelolaan Hutan Mangrove Yang Berkelanjutan Dan Terintegrasi. *Jurnal Pengelolaan Sumberdaya Alam Dan Lingkungan* 5: 1-6. <https://doi.org/10.19081/jpsl.2015.5.1.1>
- Manson, F.J., Loneragan, N.R. and S.R. Phinn. 2003. Spatial and temporal variation in distribution of mangroves in Moreton Bay, subtropical Australia: a comparison of pattern metrics and change detection analyses based on aerial photographs. *Estuarine, Coastal and Shelf Science* 57(4):653-66. [https://doi.org/10.1016/S0272-7714\(02\)00405-5](https://doi.org/10.1016/S0272-7714(02)00405-5)
- Lugina, M., Alviya, I., Indartik and M. Pribadi. 2017. Strategi Keberlanjutan Pengelolaan Hutan Mangrove Di Tahura Ngurah Rai Bali. *Jurnal Analisis Kebijakan Kehutanan* 14 (1): 61-77 <https://doi.org/10.20886/jakk.2017.14.1.61-77>
- Mondal, T., Wade, W., Bowers and M.D.H. Ali. 2021. Sustainable Management of Sundarbans: Stakeholder Attitudes Towards Participatory Management and Conservation of Mangrove Forests. *Journal of Sustainable Development* 14(3) <https://doi.org/10.5539/jsd.v14n3p23>
- Queiroz, L. S., Rossi, S., Calvet-Mir, L., Ruiz-Mallén, I., García-Betorz, S. and A.J.D.A. Meireles. 2017. Neglected ecosystem services: highlighting the socio-cultural perception of mangroves in decision-making processes. *Ecosyst. Serv.* 2017; 26: 137-145. doi:10.1016/j.ecoser.2017.06.013 <https://doi.org/10.1016/j.ecoser.2017.06.013>
- Romañach, S.S., DeAngelis, D.L., Kohc, H.L., Ldi, Y., Tehe, S.Y., Barizanf, R.S. and L. Zhai. 2018. Conservation and restoration of mangroves: Global status, perspectives, and prognosis. *Ocean & Coastal Management* 15(154):72-82. <https://doi.org/10.1016/j.ocecoaman.2018.01.009>
- Sandilyan S., Kathiresan K. 2015. Mangroves as bioshield: an undisputable fact. *Ocean & Coastal Management* 1;103:94-6. <https://doi.org/10.1016/j.ocecoaman.2014.11.011>
- Saprudin, S., Halidah H. 2012. The potential and value of environmental services of mangrove forests in Sinjai Regency South Sulawesi. *Jurnal Penelitian Hutan dan Konservasi Alam* 9:213-219. <https://doi.org/10.20886/jphka.2012.9.3.213-219>
- Sarip, S., Syarifuddin, A and A. Muaz. 2020. Dampak covid-19 terhadap perekonomian masyarakat dan pembangunan desa. *Al-Mustashfa: Jurnal Penelitian Hukum Ekonomi Syariah* 5(1): 10-20. <https://doi.org/10.24235/jm.v5i1.6732>
- Sugiri, D. 2020. Menyelamatkan Usaha Mikro, Kecil dan Menengah dari Dampak Pandemi Covid-19. *Fokus Bisnis: Media Pengkajian Manajemen dan Akuntansi* 19(1): 76-86. <https://doi.org/10.32639/fokusbisnis.v19i1.575>
- Yanagisawa, H., Koshimura, S., Miyagi, T. and F. Imamura. 2010. Tsunami damage reduction performance of a mangrove forest in Banda Aceh, Indonesia inferred from field data and a numerical model. *Journal of Geophysical Research: Oceans* 115(C6). <https://doi.org/10.1029/2009JC005587>

