

Damage to the Mangrove Forest Ecosystem in Wosi Village Manokwari Regency West Papua Indonesia.

Elia Ramandey¹, Andoyo Supriyantono^{2*}, Rully N Wurarah³, Aser Rouw⁴

¹Doctoral Program in Graduate School University of Papua;

²Faculty of Animal Husbandry University of Papua Manokwari West Papua Indonesia;

³Fakulty of Economics and Business University of Papua Manokwari West Papua Indonesia;

⁴Agricultural Instrument Standardization Agency (BSIP) Manokwari West Papua Indonesia

*Corresponding author

Received: 26 February 2023; Revised: 15 March 2023; Accepted: 21 March 2023;

Published: 14 April 2023

ABSTRACT

Mangrove ecosystems are ecosystems consisting of coastal plants dominated by several types of mangroves that are able to grow and develop in coastal intertidal areas and river banks. This study aims to study the effect of the economic activities of the population on damage to the mangrove forest ecosystem in Kali Dinginin Wosi Village, West Manokwari District. The research method was descriptive research by collecting data through interviews and observations of 78 people. The results showed that the economic activities of the population can cause damage to the mangrove forest ecosystem in Wosi Manokwari village. Some areas of the mangrove forest ecosystem have transferred the function into residential land (making kiosks, stalls, and market stalls) and land for development such as markets, settlements, and transportation facilities. The utilization of mangrove forest resources such as utilizing parts of the mangrove trees and marine biota to be used directly for their own needs caused the area and density of mangrove vegetation on the beach and along the banks of the Wosi River to have decreased. Meanwhile, the consequences of human activities were no habitat for spawning and breeding grounds for biota, no additional supply of nutrients to coral reef ecosystems and seagrass ecosystems, and loss of physical defense of the coast from tidal waves and currents. The dense settlements around the coastal area have an impact on the area of mangroves along the coast of the Doreri Bay of Manokwari. The percentage of community contact with the forest areas of utilization of forest areas and forest products reaches 88%, with environmental services at 65%, agricultural and animal husbandry activities at 13%, and other activities at 10%.

Keywords: Mangrove, Population, Economic Activity, Wosi.

INTRODUCTION

Mangrove ecosystems face high rates of deforestation, contamination, and loss of important habitats for various organisms (Spalding, 2010). Global degradation of mangrove ecosystems has occurred in the last few decades as a result of various development activities, land conversion for development, and fisheries purposes (Thomas et al., 2017; Hamilton and Friess, 2018; FAO and UNEP, 2020). The degradation has occurred in Indonesia also, currently, there are 3.2 million hectares remaining in Indonesia. West Papua Province is one of the largest areas of mangrove forests in Indonesia, it is about 482,029 hectares out of a total area of 3.49 million hectares. Average annual mangrove deforestation rate of 0.13% between 2000 and 2016 (Goldberg et al., 2020). The development of cities, the increase in population, and the result of the expansion of new autonomous regions in the land of Papua were some reasons decreasing in the mangrove forest. At the same time, there is an expansion of urban areas and economic and business activities around the Wosi market which can threaten the management of mangrove forests on the Dingin riverside. These activities result in a decrease in the area of mangrove forests, the area of agricultural land, and plantations from time to time.

They are often forced to carry out resource utilization activities by ignoring the rules of sustainability in order to meet their daily needs. Regional ecosystem problems that occur in Wosi village West Manokwari (figure 1) are the same as in other areas. The purpose of this study was to study and analyze (the economic activity, type of work, attitudes, actions, and educational) economic activity in the mangrove forest area in Wosi village.

MATERIAL AND METHODS

The research was located in the Wosi sub-district, Manokwari Regency (figure 2) and it was carried out in October – December 2021.

The population of the research is focused on coastal communities, riverbank areas, and Dingin rivers in the Wosi sub-district that utilize the mangrove forest ecosystem, both the flora and fauna. The population is 29,910 people who lived around mangroves. To sample the population, we used Slovin formulae with an estimation error of 15%. Based on Slovin’s formulae:

Noted:

$$n = \frac{N}{N(d^2) + 1}$$

n = sample size

N = population siza

d = estimation error (15%)



Figure 2. Map of Research Site (source: private documents)

Based on the formulae, we got 45 respondents as a sample population. Data was collected using an observation technic guided by a questionnaire. Data (variables) collected include the type of work, number of family dependents, level of education, and economic activity. Observations were done for data collection as an overview of activities carried out by people which resulted in damage to the mangrove ecosystem in Bugis villages, Wosi markets, Madu Raja, Transito bridges, and Trikora Wosi roads. Questionnaires are used to capture data for an overview of how people’s activities can affect damage to mangrove forests at the study site. Data gathered were analyzed using Minitab version 17 to get the mean and frequencies (percentages) of each variable measured.

RESULT AND DISCUSSION

In general, the ecological conditions of a region influence human life patterns including the use of natural resources, thus forming specific social and economic systems (Simmie and Marthin, 2010; Mozumder, 2018). Human interaction with nature creates social, economic, and cultural conditions that vary in each type of ecosystem, including the mangrove ecosystem which is constantly changing. Several studies have revealed that many development activities have changed the state of ecosystems, including those in Papua (Cámara-Leret et al. 2019; Gaveau et al. 2021).

In recent years, the conversion of land and mangrove forest functions in the Wosi sub-district to become residential areas and traditional markets for the needs of the community's economic activities has caused damage to mangrove forests. Damage to mangrove forests is also caused by illegal logging of mangrove vegetation, the existence of tofu manufacturing factories, the food and beverage industry, the pace of settlement development for local communities and migrants, expansion of land with piled up land along the banks of the Wosi river to become selling stalls, expansion meat markets, building shops, basic food stalls, workshops, food stalls, and other businesses. The local government of Manokwari district did not take any action on these community activities. The damage to the mangrove forests on the banks of the Kalidingin river is due to economic activity which is reflected in the type of work of the people who live around the area. Economic activity in the field of entrepreneurship is an activity that is the main cause of damage to mangrove forests, especially by people who live in Bugis villages (59%), people around the Trikora Wosi road (16%), and people in Maduraja (13%).

Table 1 shows the types of jobs of the people who live around the Mangrove forest. As many as 60% of the community has a job as an entrepreneur which causes damage to the mangrove forest along the banks of the Wosi Kali Berlian sub-district. This type of work shows direct interaction with the utilization of mangrove forest natural resources such as utilizing mangrove wood products for house poles, charcoal, firewood, boat construction, and house fences. Different results were found in other areas, namely the village of Jaring Halus, Secanggang District, Langkat Regency, where most of the livelihoods were fishermen (Asbi and Rouf, 2019). Anthropogenic activities in Central Java that have reduced the ecological, economic, and socio-cultural roles of mangrove forest ecosystems are fisheries/ponds, agriculture, development areas and buildings, logging, food ingredients, animal feed, medicinal ingredients, industrial raw materials, and tourism (Setyawan and Winarno, 2006). Meanwhile, the types of disturbances that cause decreased function and degradation of mangrove forests in Wakatobi National Park include landfills, conversion of mangrove land, and harvesting of mangrove wood (Jamili et al., 2009). Direct use of mangrove forests in the form of wood, fruit, and mangrove leaves also occurs on the coast of East Sinjai, where around 67% of people use wood (Saprudin and Halidah, 2012).

The increase in the number of residents in the Wosi sub-district due to immigration from other areas due to the expansion of the New Autonomous Region (DOB) in the Province, Regency/City of West Papua means that the land needed is also increasing. Settlement development by community entrepreneurs and the social behavior of residents who do not maintain the sustainability and continuity of forest functions results in neglect of mangrove forest ecosystems and causes forest damage and causes environmental pollution. According to Giri et al. (2008) that the conversion of mangrove forests into aquaculture/ponds and agriculture is the main cause of the degradation of mangrove forests in Indonesia. Ilman et al. (2011) and Eong (1995) argue that anthropogenic activities in the form of fisheries, plantations, agriculture, salt ponds, settlements, industry, logging (legal logging and illegal logging), and mining are the main factors for the degradation and loss of mangrove forests in Indonesia.

Table 1. The Types of Jobs of The People Who Live Around The Mangrove Forest

Village	Types of job							
	Government employees	Private employees	Students	Fisherman	Entrepreneur	Housewife	No job	Farmer
Jembatan Transito	0	1	0	0	1	1	0	0
Jembatan Wosi	0	0	0	0	1	0	0	0
Jl. Transito	0	2	0	0	1	1	0	0
Jl. Trikora Wosi	0	1	0	1	6	0	0	0
Kampung Bugis	0	1	0	0	10	0	0	1
Maduraja	1	1	1	1	5	3	1	0
Pasar Wosi	1	0	0	0	3	0	0	0
Jumlah	2	6	1	2	27	5	1	1
Percentage	4,44	13,33	2,22	4,44	60,00	11,11	2,22	2,22

Source: Primary data

Meanwhile, Kustanti et al. (2012) argue that more than 50% of mangrove forests are degraded or lost due to several factors, such as the conversion of mangrove forests for fisheries, urbanization, pollution by oil and industrial waste, and lack of public awareness. Figure 2 shows the activity of sand mining by community entrepreneurs around the Mangrove Forest, Manokwari subdistrict, West Mananowari district, which has caused forest damage.

According to Widyawati and Arif(2013), the number of family dependents is the number of family members who are still dependents of the head of the family using one person unit. The results showed that 34% had 3-4 dependents in one household, 30% had 1-2 dependents, and 14% had 4-5 dependents. This shows that the level of daily economic needs is large so that meeting the needs of life is done by looking for other alternatives by interacting with the environment, namely by draining mangrove forest products and also disposing of household waste in the Kali Wosi area around the mangrove forest. The potential of mangrove natural resources that are utilized by the people of the Wosi sub-district is in the form of trees that are used for wood, charcoal, poles, boat axles, and firewood. In addition to the trees that grow in the mangroves, the community also makes use of the fauna in the mangrove forest in the Wosi sub-district, such as marine biota. These community activities are in accordance with the opinion of Walters et al. (2008) who stated that the mangrove forest ecosystem, directly and indirectly, plays a role in the socio-economics of the people who inhabit it.



Mangrove Forest Prior to human activity



Mangrove Forest after human activity



Mangrove Forest Prior to house construction



Mangrove Forest after house construction



Figure 2. Various economic activities in the Mangrove Forest of the Wosi Village (source: private documents)

The results of other studies show different things, namely the more family members, the more potential to preserve the environment in the Kabonga Besar area, Banawa District, Donggala Regency. According to Wiakanti et al (2016) the higher the number of family dependents, the more active the farmer groups are in preserving mangroves because if the area is sustainable, the more marine biota there will be.

The use of mangrove forests for firewood, building materials, and as a place to find food (fish, crabs, shrimp), honey bees, and for hunting wild animals and medicinal plants has been carried out from generation to generation (Walters et al, 2008). Some of the direct benefits of the mangrove ecosystem include fishing areas with a net value of 31 USD/ha/year, shrimp (4 USD/ha/year), crabs (2 USD/ha/year), firewood (2 USD/ha/year). year), charcoal (5 USD/ha/year), and handicrafts from Nypa (5 USD/ha/year) (Malik, et al, 2015).

Table 3. The number of family dependents on respondents in the Wosi Village

Village	Family dependents						
	No dependents	1-2	3-4	5-6	7-8	>8	Total
Jembatan Transito	1	1	1	1	1	0	5
Jembatan Wosi	0	0	0	5	0	0	5
Jl. Transito	2	3	2	0	0	0	7
Jl. Trikora Wosi	0	7	4	1	0	0	12
Kampung Bugis	5	4	8	2	0	0	19
Maduraja	7	4	5	4	0	0	20
Pasar Wosi	0	3	5	1	0	1	10
Jumlah	15	22	25	14	1	1	78

The education level of the community is mostly elementary to high school, 87%. This level of education causes a lack of public awareness of maintaining, managing, and preserving mangrove forest ecosystems. Wiakanti et al (2016) stated that the low education of respondents in the Kabonga Besar Area, Banawa District, Donggala Regency had a negative impact on mangrove conservation. According to Rahmawaty (2006) that a low level of education results in limited self-development abilities and causes limited employment opportunities that can be entered. A low level of education also limits a person's ability to seek and take advantage of opportunities.

CONCLUSION

Based on the results of the study, it can be concluded that due to the economic activities of the residents in the Wosi Manokwari sub-district, the impact of land conversion has resulted. In addition, other activities in the form of logging Mangrove Forests, opening new land by hoarding land at locations along the banks of the Wosi River, and opening settlements for market residents resulted in a reduction in mangrove forests. Pollution occurred along the Kalidinding riverbank due to home industry activities, meat market activities, and workshops. Furthermore, the biggest impact is the disruption of marine biota and natural resources contained around the Bay Doreri Manokwari area, West Papua.

ACKNOWLEDGEMENTS

We thanked all people informants, and staff for collecting and sharing data including information. Statisticians from the University of Papua were grateful for consulting the statistical analysis. We also thanked all blind reviewers for improving this manuscript to be readable and understandable.

REFERENCES

1. Arief, A. (2003). Hutan Mangrove (Fungsi dan Manfaatnya). Yogyakarta: Kanisius.
2. Asbi, M., dan Rouf, R.A., (2019). Pengaruh Eksistensi Hutan Mangrove terhadap Aspek Sosial, Ekonomi dan Kearifan Lokal Masyarakat Pesisir di Desa Jaring Halus, Kecamatan Secanggang, Kabupaten Langkat Adnin. *Jurnal Ilmiah Universitas Batanghari Jambi*, 19(3), pp.666-674. DOI 10.33087/jjubj.v19i3.709.
3. Bengen, D.G. (2003). Pedoman Teknis Pengenalan dan Pengelolaan Ekosistem Mangrove. Pusat Kajian Sumberdaya Pesisir dan Lautan. Institut Pertanian Bogor. Bogor
4. Cámara-Leret, R., N. Raes, P. Roehrdanz, Y. De Fretes, C. D. Heatubun, L. Roeble, A. Schuiteman, P. C. van Welzen, and L. Hannah. (2019). Climate change threatens New Guinea's biocultural heritage *R Sci. Adv.*, 5 (11), eaaz1455. DOI: 10.1126/sciadv.aaz1455
5. Eong, O.J. (1995). The ecology of mangrove conservation and management. *Hydrobiologia*, 295: 343–

351.

6. FAO and UNEP. (2020). *The State of the World's Forest 2020. Forest, Biodiversity and People*, Rome. <https://doi.org/10.4060/ca8642en>
7. Gaveau, D. L. A., Descals, A., Salim, M. A., Sheil, D., and Sloan, S.: Refined burned-area mapping protocol using Sentinel-2 data increases estimate of 2019 Indonesian burning. (2021) *Earth Syst. Sci. Data*, 13, 5353–5368, <https://doi.org/10.5194/essd-13-5353-2021>.
8. Gibs D, Harris N, Seymour F. (2018). *By the Numbers: The Value of Tropical Forests in the Climate Change Equation* [Internet]. [cited 26 February 2023]. Available: <https://www.wri.org/insights/numbers-value-tropical-forests-climate-change-equation>.
9. Giri, C., Z. Zhu, L. L. Tieszen, A. Singh, S. Gillette, and J. A. Kelmelis. (2008). Mangrove forest distributions and dynamics (1975–2005) of the tsunami-affected region of Asia. *Journal of Biogeography* 35:519–528.
10. Goldberg, L., Lagomasino, D., Thomas, N. and Fatoyinbo, T. (2020). Global Declines in Human-driven Mangrove loss. *Global Change Biology*, 26(10), pp.5844-5855.
11. Hamilton, S.E. and Friess, D.A. (2018). Creation of a High Spatio-temporal Resolution Global Database of Continuous Mangrove Forest Cover for the 21st Century (CGMFC-21). *Global Ecology and Biogeography*, 25(6), pp. 729-738.
12. Iman, M. Wibisono, I.T.C. dan Suryadiputra, I.N.M. (2011). *State of the Art Information on Mangrove Ecosystems in Indonesia*. Wetlands International-Indonesia Programme. Bogor.
13. IUCN. *Forests and Climate Change* [Internet]. (2021). [cited 26 February 2023]. Available: <https://www.iucn.org/resources/issues-briefs/forests-and-climate-change>.
14. Jamily, Setiadi, D. Qayim, I. dan Guhardja, E. (2009). Struktur dan Komposisi Mangrove di Pulau Kaledupa Taman Nasional Wakatobi, Sulawesi Tenggara. *Ilmu Kelautan* 14(4): 36-45.
15. Joint Research Centre. (2014). *The European Commission's Science and Knowledge Service* [Internet]. [cited 26 February 2023]. Available: <https://ec.europa.eu/jrc/en/science-update/reporting-greenhouse-gas-emissions-deforestation-and-forest-degradation-pan-tropical-biomass-maps>.
16. Joint Research Centre. (2020). *The European Commission's Science and Knowledge Service* [Internet]. 2020. [cited 26 February 2023]. Available: <https://ec.europa.eu/jrc/en/science-update/deforestation-and-forest-degradation-major-threat-global-biodiversity>.
17. Kustanti, A. Nugroho, B. Darusman, D. dan Kusmana, C. (2012). Integrated Management of Mangrove Ecosystem in Lampung Mangrove Center (LMC) East Lampung Regency, Indonesia. *Journal of Coastal Development* 15(2): 209-216.
18. Malik A., Fensholt R., Mertz O., (2015). Economic valuation of mangroves for comparison with commercial aquaculture in South Sulawesi, Indonesia. *Forests* 6:3028-3304.
19. Mozumder, M M H, Shamsuzzaman, M M, Rashed-Un-Nabi, M & Harun-Al-Rashid, A. (2018). Socio-Economic Characteristics and Fishing Operation Activities of the Artisanal Fishers in the Sundarbans Mangrove Forest, Bangladesh, *Turkish Journal of Fisheries and Aquatic Sciences*, vol. 18, no. 6, pp. 789-799. https://doi.org/10.4194/1303-2712-v18_6_05
20. Rahmawaty, (2006). *Upaya Pelestarian Mangrove Berdasarkan Pendekatan Masyarakat Karya Tulis*.
21. Saprudin dan Halidah. (2012). Potensi dan Nilai Manfaat Jasa Lingkungan Hutan Mangrove di Kabupaten Sinjai Sulawesi Selatan. *Jurnal Penelitian Hutan dan Konservasi Alam* 9(3): 213-219.
22. Setyawan, A.D. dan Winarno, K. (2006). Pemanfaatan Langsung Ekosistem Mangrove di Jawa Tengah dan Penggunaan Lahan di Sekitarnya; Kerusakan dan Upaya Restorasinya. *Biodiversitas* 7(3): 282-291.
23. Simmie, J. and Martin, R. (2010) *The economic resilience of regions: Towards an evolutionary approach*. *Cambridge Journal of Regions, Economy and Society*, 27-43.
24. Spalding, M. (2010). *World Atlas of Mangrove*. Routledge. London. <https://doi.org/10.4324/9781849776608>
25. Thomas, N., Lucas, R., Bunting, P., Hardy, A., Ronsenvist, A. and Simard, M. (2017). Distribution and Drivers of Global Mangrove Forest Change, 1996 – 2010. *PloS One*, 12(6), p.e0179302.

26. Walters, B.B., P. Roombaack, J. M. Kovacs, B. Crona, S. A. Hussain, R. Badola, J.H.Primavera, E.B. Barbier, and F. Dahdouh-Guebas. (2008). Ethnobiology, socio-economics and management of mangrove forests: A review. *Aquatic Botany* 89: 220–236. <https://doi.org/10.1016/j.aquabot.2008.02.009>.
27. Wiakanti, Rahman, I., Toknok, B., (2016). Peran Serta Kelompok Tani Dalam Pelestarian hutan Mangrovedi Kawasan Kabonga Besarkecamatan Banawa Kabupaten Donggala. *Warta Rimba* Volume 4, Nomor 2 Hal: 47-53
28. Widyawati. RF. and Arif.P, (2013). Pengaruh Umur, Jumlah Tanggungan Keluarga, LuasLahan, Pendidikan, Jarak Tempat Tinggal Pekerja ke Tempat Kerja, dan Keuntungan Terhadap Curahan Waktu Kerja Wanita Tani Sektor Pertanian di Desa Tajuk, kec. Getasan, Kab. Semarang. *Diponegoro Journal Economics*. 2(3)