Climate Change Mitigation through Mangrove Based-Blue Carbon Utilization in Balikpapan

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***Abstract* — Since 2010, the Indonesian government has been undertaking climate change mitigation efforts through Blue Carbon. However, few local governments have policies and development plans for their blue carbon potential in their respective regions. Furthermore, the popularity of blue carbon lags behind that of green carbon derived from terrestrial forests, including those in East Kalimantan. This article discusses the utilization of blue carbon potential based on mangroves in the efforts to mitigate climate change in Balikpapan City, East Kalimantan Province. Research findings from Balikpapan indicate that the utilization of blue carbon in climate change mitigation, specifically based on mangroves in Balikpapan City, has not been maximized. This is due to several factors: (1) The government and the public have not fully understood the benefits of mangroves as contributors to climate change mitigation; (2) The utilization of mangrove forests' potential as blue carbon still primarily focuses on livelihood needs rather than climate change mitigation; (3) Environmentally unfriendly development processes continue to occur in this province, resulting in simultaneous mangrove conservation and degradation, leading to overall environmental degradation.**

***Keywords* — blue carbon, mangrove, climate change mitigation**

I. INTRODUCTION

Blue Carbon is a type of carbon that is stored in or absorbed by or released by the ecosystem of coastal vegetation and sediments, which includes the ecosystems of mangrove, seagrass, and salt marsh [6]. The term blue carbon is used to describe that this type of carbon is formed underwater [9]. The coastal ecosystem is capable of storing over three times the amount of carbon per hectare compared to the amount stored by the terrestrial ecosystem. An ecosystem with this potential offers a great opportunity in the mitigation efforts of climate change.

International efforts to develop the potential of blue carbon in mitigation's framework were emphasized at the COP-22 in Marrakech, Morocco in 2016 which is a continuation of the Kyoto Protocol scheme. In addition, this is also in line with the Fourteenth Goal of the Sustainable Development Goals (SDGs), namely to conserve and sustainably use the oceans, seas, and marine resources for sustainable development. Across the globe, as many as 151 countries possess blue carbon, but only 50 of those have an agenda for carbon reduction following their Nationally Determined Contributions (NDC) [2]. Indonesia is one of the countries committed to being actively involved in this action.

The commitment of the Government of Indonesia to take part in the mitigation of climate change has been proven by its participation in the implementation of the Clean Development Mechanism (CDM) Reduction of Emission and Forest Degradation Plus (REDD+) program through several activities including the Berau Forest Carbon Program, the Heart of Borneo Program (HoB), and the Sumatra Tropical Forest Conservation Action. However, these activities are focused on terrestrial forest conservation. This means that the potential for blue carbon in Indonesia has not received serious attention for its utilization in the mitigation of climate change.

As the largest archipelagic country in the world, Indonesia has great potential to utilize its marine and coastal resources to play an active role in mitigation efforts through the utilization of blue carbon. Indonesia possesses a mega biodiversity of marine life and coastal ecosystems, such as the coral triangle covering 52% of the world's coral reef ecosystems, mangrove ecosystems of around 3.15 million hectares or 23% of the world's mangroves, and 3.30 million hectares of seagrass beds, the largest in the world [18].

According to Yudiarso, a CIFOR researcher, Indonesia has a total of approximately one-fifth of the world's blue carbon [13]. Specifically in the potential of mangroves, Conservation International (CI) Indonesia [6], explained that in 2015, Indonesia had 3.1 million hectares of mangrove areas. This means that Indonesia has 22% of the world's mangrove ecosystems. The Papua region makes the largest contribution to mangrove forests, amounting to 482,029.24 hectares [3]. In addition, the Ministry for Maritime Affairs and Fisheries, Research and Development Division (KKP Balitbang) (2017) stated that seagrass meadow ecosystems have the potential to absorb and store carbon of around 4.88 tons per hectare per year. The total seagrass ecosystem in

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Indonesia can store 16.11 million tons of carbon per year [17].

However, the utilization of this blue carbon faces several problems. The Ministry of Maritime Affairs and Fisheries (KKP) stated that Indonesia had lost more than a quarter of its mangrove forest area in the last three decades from 4.20 million hectares in 1982 to 3.48 million hectares in 2017 [17]. Damage to coastal ecosystems tends to be very high, up to 4 times the damage that occurs in tropical rainforests. This damage rate accounts for 42% of global blue carbon emissions, or the equivalent of emissions from 11 million vehicles per year [4].

Furthermore, the concept of REDD+ is still focused on forests in the highlands, so to offer the concept of "beyond the forest" there must be a clear strategy. The concept of REDD+ in coastal areas must be oriented towards the welfare of the community, especially local communities and fishermen, and at the same time ensure the sustainability of resources and the preservation of the coastal environment. This is a difficult challenge considering that the utilization of coastal resources is a complex matter because these resources are generally accessed openly by many actors for different purposes (multi-use and multi-stakeholders), which is why the coastal area and its resources are prone to conflicts [20].

The large potential for blue carbon coupled with the high level of damage each year requires the government to have a roadmap for the development and conservation of this blue carbon. The blue carbon program in Indonesia was launched for the first time at the World Environment Ministers Forum in Nusa Dua, Bali, on 24 February 2010. The Minister of Maritime Affairs and Fisheries of Indonesia, Doctor Fadel Muhammad, and the Executive Director of the United Nations Environment Program (UNEP) Doctor Achim Steiner discussed the Indonesia Blue Carbon Program. This opens a wide opportunity for Indonesia to start conducting scientific research on the important role of marine and coastal ecosystems in controlling global climate change. The first blue carbon study, the Blue Carbon Pilot Project, was conducted in 2009 in Banten Bay. The program has been continued with the Demonstration Site Blue Carbon Project in the Derawan Islands, East Kalimantan since 2012 [21].

Even though the pilot project was aimed only at Derawan Island, Berau, there is ample potential for a blue carbon program in the whole of East Kalimantan. Areas that have the potential for Mangrove forests in this province include Balikpapan, Berau, Bontang, Kutai Kartanegara, East Kutai, Paser, and North Penajam Paser (PPU) [10]. In these areas, the mangroves' potential is developed in the framework of conservation by turning them into tourist forests such as in Balikpapan, Berau, Bontang, East Kutai and North Penajam Paser.

The potential for seagrass beds can be found in Balikpapan, Bontang, Berau, East Kutai and North Penajam Paser. Additionally, coral reefs can be found in Balikpapan, Bontang, Berau, Kutai Kartanegara, East Kutai, Paser, and North Penajam Paser [10]. This means that the entire East Kalimantan region, except for Samarinda, has the potential to participate in climate change mitigation. Moreover, East Kalimantan is one of the provinces in Indonesia which is included in the World Coral Triangle Initiatives [8], which is the world's foundation for implementing climate change mitigation.

Among these areas, the utilization of this coastal and marine ecosystem in Balikpapan is interesting to be explored. The Balikpapan government has plans to develop mangrove forests in the 2012-2032 Regional Spatial Plan. This plan aims to develop mangrove forests as areas for mangrove conservation, tourism and mangrove fisheries.

II. RESEARCH METHOD

Balikpapan was chosen as the research location because this area has a significant blue carbon potential, but the local government does not yet have an integrated policy roadmap for the utilization of blue carbon potential, only partial policies. This research uses a descriptive method with a qualitative approach. Analysis was carried out from data obtained from previous research, official government documents, interviews with informants and direct observations.

III. RESULTS AND DISCUSSION

Blue Carbon in Climate Change Mitigation in Indonesia

Until the twentieth century, the world's concern for conserving the global environment was limited to green carbon or terrestrial forests. This caused the existence of blue carbon to grow dim and unpopular. However, entering the twenty-first century, blue carbon became a topic that attracted world attention in climate change mitigation.

Blue carbon as a potential in mitigating climate change by reducing carbon emissions was brought forth at the 22nd UNCCC COP Marrakesh, Morocco, in 2016, after being mentioned previously at the 21st COP Paris, France, 2015 and listed in point 14 of the Sustainable Development Goals (SDGs). In Indonesia, this idea emerged in several forums discussing climate change such as the World Environment Ministers Forum in Nusa Dua, Bali, 24 February 2010; Blue Carbon Expert Forum, 15 October 2014 implemented by the REDD+ Managing Agency; Workshop on Discussion of Draft Policy Directions for REDD+ Initiatives in Coastal Areas, 20 November 2014 by BP REDD+; World Blue Carbon Conference, September 2017 in Jakarta by WWF-Indonesia; The Indonesia Blue Carbon Development Framework and Strategy Meeting held by the National Development Planning Agency (Bappenas), in Jakarta on 2 November 2017; and the 2018 Blue Carbon Summit organized by the Indonesian Centre for Forestry Research (CIFOR) and the Indonesian Academy of Sciences, July 2018, in Jakarta.

Nonetheless, this idea is unfortunately unpopular when compared to the carbon sequestration potential of terrestrial forests. Expert Staff to the coordinating minister for Maritime Affairs for Socio-Anthropology, Tuku Rameyo, explained amongst the indicators of this unpopularity are the absence of a detailed government policy on the use of blue carbon and the absence of an appointed institution to lead this effort. Ideally, the Ministry of Maritime Affairs and Fisheries (KKP) would be the institution that leads efforts to develop blue carbon potential for environmental change campaigns through mitigation and adaptation because it is

directly related to the marine and fisheries sector. Other actors that must be involved are Indonesian society in general and stakeholders related to this issue [2]. The involvement of the community, especially those in direct contact with the coastal economic sector, is something that must be considered to avoid conflicts both vertically (between the community and the government, and between one agency and another) and horizontally (between communities, between communities and companies, etc.).

In 2010, the Government of Indonesia committed to reducing greenhouse gases as part of a disaster risk reduction strategy in the face of climate change. This intention is confirmed through the Nationally Determined Contribution (NDC) of 26% in 2020 and 29% in 2030. The largest emission reduction target is located in the forestry sector, including mangrove forests which are included in blue carbon. Based on the fact sheet Indonesia Blue Carbon Strategy Framework (IBCSF). Indonesia has the largest mangrove forest area and seagrass beds in the world. Mangrove forests have an area of 3.2 million hectares and have the potential to absorb 950 MgC ha-1 of carbon. Seagrass beds covering an area of 3 million hectares have the potential to store 119.5 MgC ha-1. The same data shows that Indonesia's total blue carbon storage potential is 3.4 giga tonnes or equivalent to 17% of blue carbon reservesof the global amount [16].

Based on LIPI's analysis at ten research locations coupled with secondary data, it explains that carbon uptake in Indonesia is quite high in terms of Net Primary Productivity (NPP) values. The results of the analysis show that the average mangrove forest in Indonesia can absorb 52.85 tonnes of CO2/ha/year which is twice as high as the global estimate, which is 26.42 tonnes of CO2/ha/year. Overall, Indonesia's Mangrove forests have a carbon sequestration potential of 170.18 Mt CO2/year. Kalimantan Island has the largest potential for mangrove absorption, which is 94.32 tons of CO2/ha/year, followed by Papua with 57.99 tons of CO2/ha/year, Sulawesi with 53.95 tons of CO2/ha/year, Sumatra with 37.07 tons of CO2/ha/year, and Java with 39.27 tons of CO2/ha/year [19].

On the other hand, until 2018 seagrass uptake in each province has not been recorded in detail. With seagrass meadows covering an area of 150,693.16 ha, Indonesia has considerable reserve and absorption potential. Seagrass communities in Indonesia on average store carbon stocks of 0.94-ton C/ha or a total of 141.98 kt C. The characteristics of the diverse seagrass communities have carbon stocks ranging from 0.34-ton C/ha – 1.53-ton C/ha. The seagrass community is generally dominated by E.acoroides and T.hemprochii seagrasses so these two types of seagrasses have a sizeable contribution to the value of carbon stocks. Meanwhile, seagrass ecosystems in Indonesia can store 558.35 tonnes C/ha/year in the substrate (total carbon of 84.14 Mt C). Carbon reserves in the substrate can be stored for a long time. In addition, seagrass ecosystems have a high carbon absorption value. With a carbon absorption rate of 6.59 tons C/ha/year, seagrass beds in Indonesia have a total carbon absorption of 992.67 kt C/year (equivalent to 3.64 Mt CO2/year) [19].

Utilization of the potential for blue carbon, especially Mangrove forests, has been carried out in Kaimana Regency, West Papua since 2014. The Kaimana Regency Government in collaboration with Conservation International Indonesia (CII) conducted research on the potential for blue carbon in the areas of Buruway, Etna Bay, Arguni Bay and Kaimana City. This research resulted in a local policy for the conservation of the aquatic environment which provides a solution for the government to overcome environmental damage due to land clearing activities for forest exploitation, one of which is for palm oil plantations. Kaimana is even used as a natural laboratory for the development of blue carbon in Indonesia.

The CII record explains that the utilization of blue carbon in the mangrove forest area in Kaimana stated that the area of mangrove forests in his research reached 34,439 ha which spread across Buruway, Etna, Arguni and Kaimana Kota, while the total area of mangroves in Kaimana Regency was 74,393 ha which has the potential to store emissions of up to 54,091,909 Mg C [2][6].

The problems faced by Kaimana also occur in almost all Indonesian waters. On the one hand, in the development process, all natural resources are used to meet the needs of human life, and on the other hand, the damage caused by the development process makes nature unable to provide the best for human life and tends to be a disaster for humans themselves. Mangrove forest deforestation occurs massively every year due to the conversion of land into agriculture, plantations and ponds. In addition, water pollution such as oil spills is also a threat and contributes to the destruction of this coastal ecosystem.

Based on REDD+ data, damage to mangrove ecosystems is higher when compared to damage to seagrass ecosystems which reaches 3.7% per year with the highest level of damage in Java, especially in the north coast region. In contrast, the best conditions for this ecosystem are in East Kalimantan, Papua and Maluku. In more than three decades, Indonesia has lost its mangrove forest area from 4.20 million hectares in 1982 to 3.48 million hectares in 2017. Of this damage, 40% of mangrove forests were damaged due to aquaculture [1].

There are several scenarios that can be carried out in order to save Indonesia's blue carbon potential, such as: (1) creating a Blue Carbon Road Map of Indonesia, the essence of which is what, why, how and who is responsible for implementing the road map; (2) blue carbon protection, conservation and rehabilitation; and (3) harmonization of protection, conservation and rehabilitation activities with blue carbon utilization activities as a livelihood for coastal communities so that various interests related to this potential can be achieved through a win-win solution.

In terms of Mangrove conservation, the Government of Indonesia has issued a Presidential Regulation of the Republic of Indonesia year 2012 concerning the National Strategy for Mangrove Ecosystem Management. This regulation is the basis for every regional head in Indonesia in their efforts to conserve the mangroves as an important element of blue carbon in climate change mitigation.

Blue Carbon Potential in East Kalimantan

East Kalimantan is one of the provinces in Indonesia that has blue carbon potential in the form of large mangrove forests and seagrass beds in Indonesia. The irony is that theutilization of this blue carbonpotential in mitigating

climate change has not yet been realised, but damage to coastal ecosystems, especially to mangroves, continues to reoccur.

The area of East Kalimantan's Mangrove Forest reaches 883,379 ha. Of that number, around 685,277 haor 75% of the total area was damaged. Around 329,579 ha was heavily damaged, around 328,695 ha was moderately damaged, and the rest was slightly damaged. While mangroves with good conditions are only around 225,105 ha or 25% of which are still preserved [11].

Results from interviews conducted with the Maritime Affairs and Fisheries Service on 1 November 2018, the Tourism Office on 26 October 2018 and the Bappeda (Regional Development Planning Agency) of East Kalimantan Province on 27 October 2018, the issues of climate change, climate change mitigation and blue carbon have never been discussed at all. From the Maritime Affairs and Fisheries Service website, data regarding the area of mangrove forests and seagrass beds are available, but their use in climate change mitigation is not yet available.

To date, climate change mitigation in East Kalimantan has only focused on efforts to conserve and rehabilitate tropical or terrestrial forests. On the other side, coastal ecosystems such as mangroves, brackish swamps and seagrass beds have not been much explored. Mangroves are only used for tourism activities which isrun by the local community, the private sector or a collaboration between the city government and the private sector with small and local business scale. This shows that there is no utilization of the potential of blue carbon in East Kalimantan, both at the government level and at the community level. Only a few non-governmental organizations with international networks such as CIFOR, Yayasan Kehati and the Nature Conservancy have initiated efforts to assess the potential of blue carbon in East Kalimantan.

Potential and Utilization of Mangrove Forest in Balikpapan

Balikpapan has a long coastline which allows this city to have the potential as an area for the development of mangrove forests. Mangrove forest areas in Balikpapan City are located in West Balikpapan and East Balikpapan Districts. The area of mangrove forest in Balikpapan City amounts to 1,878.19 Ha or 3.73% of the area of Balikpapan City. Utilization of protected areas in Balikpapan City is directed to the development of Mangrove protected areas, as the development of Mangrove animal habitats, as well as nature and fisheries tourism [5].

Mangrove forest areas in Balikpapan City include mangrove forests located on the Tempadung River and Berenga River, Kemantis Mangrove Forest, Wain River Mangrove Forest, Somber River Mangrove Forest, Margo Mulyo Mangrove Forest, Margasari Mangrove Forest, Baakan River Mangrove Forest, Sepinggan River Mangrove Forest, Manggar River Mangrove Forest, Lamaru Beach Mangrove Forest and Teritip Mangrove Forest. The following map and table illustrate the extensive range of the mangrove forest plan in Balikpapan City.

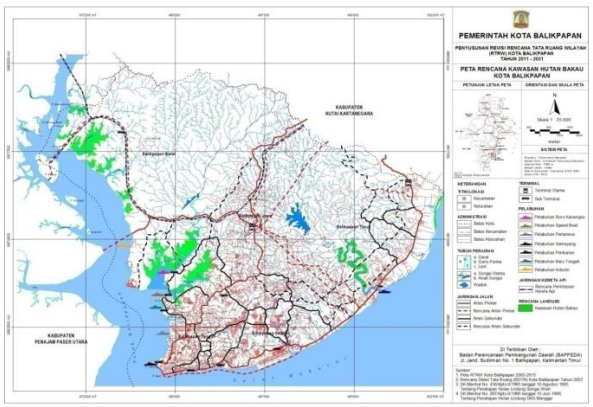

Figure 1. Proposition Map for Mangrove Plantation in Balikpapan City
(Source: Sistem Informasi Pembangunan Daerah Kota Balikpapan 2015)

Table 1: Proposition of the Expanse of Mangrove Plantation in Balikpapan City.

No	Mangrove Plantation	District Location	Size (ha)	Percentage (%)		Details
				Plantation	City	
I	**West Balikpapan District**					
1	Kemantis River	Kariangau	80,44 ha			Natural mangrove plantations developed into ecotourism
2	Tempadung River	Kariangau	351,89 ha			Natural mangrove plantation
3	BerengaRiver	Kariangau	128,03 ha			Natural mangrove plantation
4	Tengah River	Kariangau	71,62 ha			Natural mangrove plantation
5	Teluk PudakRiver	Kariangau	38,41 ha			Natural mangrove plantation
6	SanrumuktiRiver	Kariangau	42,23 ha			Natural mangrove plantation
7	WainRiver	Kariangau	519,43 ha			Natural mangrove plantation
8	Margomulyo	Margomulyo	16,645 ha			Natural mangrove plantations
		Baru Tengah	0,253 ha			developed into ecotourism
9	Margasari	Margasari	6,531 ha			Mangrove Reforestation
10	SomberRiver	Baru Ulu	12,424 ha			Natural mangrove plantation
	Total		1. 267,89 ha	67.51		
II	**Central Balikpapan District**					
	Karangjati	Karangjati	0,94 ha			Natural mangrove plantation
	Total		0,94 ha	0,5		
III	East Balikpapan District					
1	Manggar BesarRiver	Manggar	76,39 ha			Natural mangrove plantation
		Manggar Baru	81,72 ha			Natural mangrove plantation

		Lamaru	88,95 ha			Natural mangrove plantation
2	Teritip Mangrove	Teritip	45,04 ha			Natural mangrove plantation
	Total		292,09 ha	15,55		
IV	**North Balikpapan District**					
	SomberRiver	Batu Ampar	100,08 ha			Natural mangrove plantation
		Karangjoang	3,11 ha			Natural mangrove plantation
		Kariangau	184,61 ha			Natural mangrove plantation
		Muara Rapak	29,46 ha			Natural mangrove plantation
	Total		317,26 ha	16,89		
	Total Amount		878,19 ha	100.00	3,73	

Source: Rencana Tata Ruang Wilayah 2012-2032 Kota Balikpapan

From the table 1 it can be seen that the widest mangrove forest is in the Wain River area with an expanse of 519.43 ha while the smallest area of expanse is in Karangjati with 0.9 ha. In addition, West Balikpapan District has the largest mangrove area in Balikpapan, while Central Balikpapan has the smallest.

To the year 2023, of all of those Mangrove areas at least six (6) of them are Mangrove Conservation and Tourism areas in Balikpapan, each of which is managed by the government and the private sector, including Conservation of Mangrove Earth Hour Balikpapan in DAS Manggar; Mangrove Forest Hall Barnacle, Pendopo Teritip Mangrove Forest; National Mangrove Forest, Marga Sari; Margomulyo Mangrove Conservation Area; Mangrove Hill Area, Kariangau, and Mangrove Centre Graha Indah, Batu Ampar.

The existence of mangrove forests and beaches in the city of Balikpapan, both those that grow naturally and those that are deliberately developed, have become a popular tourism destination for both local, inter-local, and international tourists. This was made possible because there is a multi-level of good tourism management from both the community, the private sector and the government.

The involvement of the local community (Kelompok Sadar Wisata (pokdarwis) and Karang Taruna (local youth), private companies and the government has proven that the potential for Mangrove ecotourism could draw great attention to local communities which allowed them to succeed in driving economic growth, especially the income of people living on the coastal areas and boost the income for the city government.

With the support of the government of Balikpapan City in ecotourism development, climate change mitigation efforts through blue carbon go hand in hand with its economic utilization for the community. This is a good strategy and must be developed because the economic motive is an attraction to mobilize the participation of all parties. Here, the private sector and the community are directly and indirectly moved to deliberately cultivate mangroves and protect the beaches because they will have quite a high economic value.

The management and utilization of mangrove potential in Balikpapan is a collaboration between the government, local communities and companies operating in the Balikpapan area. An example of this collaboration can be seen in the management and utilization of mangrove potential in Teritip Village. Based on the Decree of the Head of the Balikpapan City Youth, Sports and Tourism Office Number 188.46/047/DPOP concerning the Inauguration of the Teritip Tourism Village Management, the Teritip Tourism Village was built with a Community Based Tourism system. The management of this tourist village relies on local communities with the support of the city government, other institutions such as the Natural Resources Conservation Agency, the Balikpapan City Environment and Basarnas Service, and Pertamina RU V [7][14][15].

Figure 2. Mangrive Forest Pendopo Teritip, Balikpapan

Another example is the Graha Indah Kariangau Mangrove Forest Management Center, Batu Ampar. At first, the management of mangrove forests began with mangrove restoration activities in 2001. This restoration was carried out because the damage to mangrove forests had an impact on damage to the settlements of the surrounding residents due to tornadoes and hot weather. Therefore the local community initiated mangrove restoration and developed it into ecotourism that combines elements of conservation and socio-cultural economic empowerment of local communities. In its development this management involves several companies such as PT. Pertamina, Total E&P, PT. Jasa Raharja, PT. Hexindo, and others, as well as other environmental care communities.

Figure 3. Magrove Center Graha Indah Kariangau, Batu Ampar, Balikpapan

The Mangrove ecotourism model, such as in Balikpapan City, has become an example which is followed by almost all the other regions in the East Kalimantan, such as Bontang City and Berau Regency. Thus, efforts to preserve and develop mangroves in mitigation in Balikpapan

City and East Kalimantan Province will be effective if carried out through an economic approach. Although it seems to be economically participatory, it also provides a better-focused and better-maintained development of conservation and mitigation efforts.

Although conservation and reforestation efforts are carried out in tandem with activities to build mangrove ecotourism, in reality, damage to mangroves in Balikpapan continues to occur. An example is the damage to the mangrove ecosystem in the Balikpapan Bay area.

Balikpapan Bay has a watershed area (DAS) of around 211,456 hectares and an area of waters covering 16,000 hectares. A total of 54 sub-watersheds are located in this bay area, including one of the Wain River watersheds which has become a protected forest or what is known as the Wain River Protected Forest. As many as 31 small islands adorn the face of this bay. The sustainability of Balikpapan Bay, which is rich in potential and biodiversity, is increasingly being diminished. The development of the Kariangau Industrial Area spanning an area of 5,130 hectares around the bay which is administratively located in the Kariangau Village, West Balikpapan, has threatened the ecosystem of the bay and will certainly causedisaster [12].

Based on data from the Balikpapan City Environmental Agency, approximately 40 companies carry out their activities in this area [12]. As a result, not only the mangrove ecosystem is damaged but also the piscicultureactivities of the locals are also disrupted and gradually disappear. Even though previously the piscicultureactivities were the main threat to this mangrove ecosystem. Apart from thepisciculture and industrial activities, another problem that adds to the long list of mangrove destroyers is the oil spill in Balikpapan Bay in April 2018.

IV. CONCLUSION

Efforts to utilize blue carbon in climate change mitigation in East Kalimantan are still based on mangroves, and even this is still far from what was expected. This situation is caused by several things:

Blue carbon as a contributor to climate change mitigation is not yet thoroughly familiarised and comprehended either by the government or the society at large.

The utilization of mangroves as one of the elements of blue carbon is carried out based on the understanding that any damages to mangroves disrupt the lives/livelihoods of the coastal communities, because of the natural role it plays as a breeding ground for coastal ecosystems, as a barrier to coastal abrasion, etc. This is but a small part of the whole reasoning of why mangroves must be maintained and preserved, simply because they are related to the needs of coastal communities in the short term. However, the bigger picture of how the conservation of mangroves can save the earth from global climate change has not yet emerged.

Development processes that are not environmentally friendly are persisting in this province, which results in simultaneous Mangrove conservation and Mangrove degradation which leads to environmental degradation in general.

REFERENCES

[1] Ambari, M. (2017a, September 11). Besarnya Potensi Karbon Biru dari Pesisir Indonesia. Tetapi Belum Ada Roadmap Blue Carbon. Kenapa? http://www.mongabay.co.id/2017/0911/besarnya-potensi-karbon-biru-dari-pesisir-indonesia-tetapi-belum-ada-roadmap-blue-carbon-kenapa/.

[2] Ambari, M. (2017b, Oktober 20). Karbon Biru di Mata Pemerintah Indonesia. Penting atauTidak? http://www.mongabay.co.id/2017/10/20/karbon-biru-di-mata-pemerintah-indonesia-penting-atau-tidak/.

[3] Antara News. (2017, Oktober 17). KemenkoKemaritiman: Indonesia berpotensikembangkankarbonbiru. https://www.antaranews.com/berita/659117/kemenko-kemaritiman-indonesia-berpotensi-kembangkan-karbon-biru

[4] Azhar, R. A. (2017, Oktober 3). Indonesia Berpotensi Simpan 17 Persen Karbon Biru Dunia. https://regional.kompas.com/read/2017/11/03/13002661/indonesia-berpotensi-simpan-17-persen-karbon-biru-dunia.

[5] BAPPEDA Balikpapan. (2015). Sistem Informasi Pembangunan Daerah Kota Balikpapan Tahun 2015. http://bappeda.balikpapan.go.id/sipd_2015.

[6] Barakalla, & Megawanto, R. (2017). Sains dan Kebijakan Karbon Biru. ReferensiKhususuntukKabupatenKaimana, Papua Barat. Conservation International Indonesia.

[7] Borneoflash. (2020, 8 November). DLH Kota Balikpapan, Apresiasi Pertamina RU V Menanam 1000 mangrove Dengan Model Demplot. https://borneoflash.com/2020/11/08/dlh-kota-balikpapan-apresiasi-pertamina-ru-v-menanam-1000-mangrove-dengan-model-demplot/

[8] Coral Triangle Initiative. (t.t.). About | CTI-CFF. Diambil 10 Juni 2023, dari https://www.coraltriangleinitiative.org/about

[9] Cusworth, C. C. (2018, Maret 22). What is blue carbon? A look at ongoing research into the world's water-based carbon sinks. https://forestsnews.cifor.org/55358/what-is-blue-carbon?fnl=en.

[10] Dinas Kelautan dan Perikanan. (2018). Data Sumber Daya KP3K dan Pengawasan. dkp.kaltimprov.go.id>post>data-sumber-daya-kp3k-dan-pengawasan.

[11] Ghofar, M. (2012, April 28). 16 HektareUntuk Pusat Informasi Mangrove. ANTARA News. https://kaltim.antaranews.com/berita/6647/16-hektare-untuk-pusat-informasi-mangrove

[12] Hardjanto, Y. S. (2015, April 1). Teluk Balikpapan yang Terus TergerusAkibatEkspansiIndustri. https://www.mongabay.co.id/2015/04/01/teluk-balikpapan-yang-terus-tergerus-akibat-ekspansi-industri/

[13] Media Indonesia. (2016, November 18). RI Butuh Skema Perlindungan Karbon Biru. http://mediaindonesia.com/read/detail/77980-ri-butuh-skema-perlindungan-karbon-biru.

[14] Mulyani, Yogiana, et.al. (2021). Penguatan Kelembagaan dan Tata Kelola Pengurus Desa Wisata Teritip. Jurnal Abdimas Terapan 1(1), 22 – 27, p-ISSN/e-ISSN: 2798-6624

[15] Niaga.Asia. (2022, 5 Februari). Tahun Emas Basarnas, 177 Bibit Mangrove Ditanam di Teritip Balikpapan. https://www.niaga.asia/tahun-emas-basarnas-177-bibit-mangrove-ditanam-di-teritip-balikpapan/

[16] Noor, Y. R. (2017, November 2). Pengembangan Karbon Biru di Indonesia. Wetlands International Indonesia. https://indonesia.wetlands.org/id/berita/pengembangan-karbon-biru-di-indonesia/

[17] Rmol.co. (2017, September 7). Indonesia Punya Ekosistem Karbon BiruTerbesar Dunia. http://politik.rmol.co/read/2017/09/07/306177/Indonesia-Punya-Ekosistem-Karbon-Biru-Terbesar-Dunia-.

[18] Supangat, A. (2014, Juni 26). Quo Vadis "Blue Carbon" di Indonesia? http://www.mongabay.co.id/2014/06/26/que-vadis-blue-carbon-di-indonesia.

[19] Wahyudi, Aan J., et.al. (2018). Potensi Cadangan dan Serapan Karbon Ekosistem Mangrove dan Padang Lamun Indonesia. LIPI, Kementerian Kelautan dan Perikanan, dan COREMAP-CTI. https://www.researchgate.net/publication/326649366.

[20] Wahyudi, L. S. (t.t.). BP REDD+ Persiapkan Inisiatif Karbon Biru di Kawasan Pesisir. Diambil 10 Juni 2023, dari http://badan-staging.reddplusid.id.org/berita/berita-redd/2327-bp-redd-persiapkan-inisiatif-karbon-biru-di-kawasan-pesisir.

[21] World Wild Fund. (2013). Karbon Biru. Sebuah Terobosan Baru untuk Mengurangi Dampak Perubahan Iklim melalui Konservasi dan Pelestarian Ekosistem Pesisir di Kawasan Coral Triangle.