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Conservation Efforts of Pertamina Gas Operation Kalimantan Area Company in Protecting Flora and Fauna Diversity Ecosystems in Mangrove Forests Kutai Saleba Bontang National Park, East Kalimantan

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ABSTRACT: *The purpose of this study is to describe the current diversity of flora and fauna, analyze and describe the efforts made by Pertamina Gas OKA to maintain biodiversity and the challenges faced in increasing biodiversity benefits. The research was conducted by direct tracing method to the field. Data were collected from competent institutions and analyzed descriptively. Of the 10 types of flora that have been found in the Kutai National Park Conservation Mangrove Forest, East Kalimantan. For fauna, 4 types of biodiversity data were obtained based on the results of intensive exploration to increase the effectiveness of conservation efforts.*
KEYWORDS: *Diversity of Flora and Fauna, Pertamina Gas OKA, Biodiversity, Mangrove Forest Conservation, Conservation Efforts.*

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I. INTRODUCTION

Kutai National Park is the only national park in East Kalimantan Province established based on the Decree of the Minister of Forestry of the Republic of Indonesia Number SK.4194 / Menhut-VII / KUH / 2014 dated June 10, 2014 with an area of 192,709.55 ha. The main task of the Kutai National Park Office based on the Regulation of the Minister of Environment and Forestry number 7/Menlhk/Setjen/OTL.0/1/2016 concerning the Organization and Management of the Technical Implementation Unit of the National Park is to carry out the conservation of biological natural resources of Kutai National Park and its ecosystem based on the provisions of laws and regulations. In carrying out its main duties, the Kutai National Park Office carries out several functions, including the preservation of plant and wildlife species along with their habitats and genetic resources. Kutai National Park area consists of several types of ecosystems, one of which is the mangrove ecosystem that stretches along the Makassar Strait which is the eastern boundary of the area. According to Government Regulation Number 121 of 2012, mangrove ecosystems are forest areas with coastal vegetation arrangements that have a distinctive morphology with root systems that are able to adapt to tidal areas with mud or sandy mud substrates. This ecosystem has ecological and economic benefits as a provider of a large number of timber and non-timber forest products, nutrients, protecting coastlines from erosion, wind effects, waves, water currents, biodiversity conservation, coral reef protection, shipping lane protection, fighting siltation, ecotourism, habitat provision, and nutrition for aquatic biota including many commercial species (FAO, 2007; Giri et al, 2010; Syamsuddin et al, 2011).

PT Pertamina Gas Operation Kalimantan Area is one of the companies in the gas transportation sector located in Bontang City, East Kalimantan. In carrying out its business, Pertagas has a commitment to maintain environmental sustainability through environmental management, monitoring, and conservation. This activity is a form of the company's responsibility and compliance with laws and regulations in environmental management. One of these environmental commitments is realized through biodiversity and ecosystem conservation programs. The existence of biodiversity is important to be preserved because it ensures the balance of nature and the implementation of the ecological function of an ecosystem. One of the areas of implementation of the biodiversity conservation program carried out by Pertamina Gas Operation Kalimantan Area is in the mangrove area of Kutai National Park. The management of the mangrove area provides benefits for the survival of aquatic biota and habitat for wildlife, as well as providing value and benefits to the community around the mangrove area. Mangrove forests are restored natural resources and have an important socio-economic role in life. Mangroves are capital resources that can provide economic roles such as; provide employment opportunities, business opportunities and sources of income and services in the protection of other resources (preventing damage to beaches, corals and destruction of flora and fauna). Entering the era of globalization, accelerated economic growth increases needs both in agriculture, infrastructure, land needs, and other sectors. The increase in demand has led to higher pressure

on forests. Mangrove forests as one of the most productive forest ecosystems in the world are also experiencing the same pressure.

Efforts to promote mangrove forests as one of the green economy assets in Indonesia are an important agenda in the current development process. A Green Economy is an economy that results in improved human well-being and social justice while reducing environmental risks and ecological scarcity. The concept of Green Economy emerged after the symptoms of climate change that caused environmental damage around the world due to economic activity. One of the main supports to meet the economic needs of the Indonesian people is the forestry sector, one of which is mangrove forests. Kutai Saleba National Park has great land potential to be used as a mangrove forest which is very important for the community and fauna sustainability. To support these conditions, it is necessary to continuously brief the community about the function and potential of mangrove forests, one of the efforts made is to calculate the total economic valuation as one of the concepts of the green economy. The valuation calculation is intended to provide an overview of the total economic value that is a reference in the sustainable use of mangrove forests as an effort to conserve mangrove forests. However, Indonesia is also known as a country with a high decline in biodiversity (flora and fauna). According to Sutarno and Setyawan (2015) of the 20 countries whose natural species are threatened, Indonesia occupies the 5th position and according to the Indonesian National Geography (2019), Indonesia ranks sixth as the country with the most biodiversity extinction. To prevent or reduce the rate of biodiversity decline, it is necessary to carry out and develop conservation efforts, both insitu and exitu. Based on the background that has been described, the purpose of this study is to describe the diversity of flora and fauna currently analyze and describe the factors that cause the decline in Indonesia's biodiversity, analyze and describe the efforts that have been made to provide protection of the diversity of flora and fauna in the location.

II. METHOD

The research was conducted using literature search methods and direct research. The main data, namely on biodiversity were collected from reliable sources, namely the Indonesian Institute of Sciences (LIPI), the Ministry of Environment and Forestry of the Republic of Indonesia (Kemen LHK RI), and the latest International Union for Conservation of Nature (IUCN). Data and supporting information are obtained from various literature in the form of books, reports, journals, magazines, and relevant internet sites. The data is presented in the form of monitoring and evaluation compared to previous baseline data.

III. CONSERVATION MONITORING

Time and Location

Biodiversity monitoring and evaluation activities in Bontang Mangrove Park, Kutai National Park were carried out from July 12, 2022 to July 19, 2022. The stages carried out are from preparation, field monitoring, laboratory analysis, to report preparation. Field data collection for monitoring and evaluation of biodiversity in the mangrove area of Kutai National Park was carried out on an area of 1.26 Ha. The area is divided into three locations, namely location one with an area of 0.16 Ha, location two which is land around the water flow covering an area of 0.4 Ha, and location three 0.7 Ha. These areas are adjacent and have the same ecosystem characteristics. Map of data collection locations in the mangrove area of Kutai National Park can be seen in figure 1.

Figure 1. Map of biodiversity monitoring locations in Bontang Mangrove Park

Data Retrieval Methods

This data collection was carried out to analyze biodiversity in flora and fauna, estimate stand biomass in mangrove areas, and analyze the status of fauna found. Data collection is carried out directly which is divided into three observation times, namely morning, evening and night. Morning and evening observations were made on the taxonomy of birds, mammals, and insects, while night time on the taxonomy of herpetofauna, nocturnal mammals, and nocturnal insects. Data collection methods are carried out to analyze biodiversity in flora and estimate stand biomass in mangrove areas, as well as to analyze the biodiversity of mammals, birds, herpetofauna, and insects.

Vegetation Observation

Data collection of flora in mangrove forests was carried out using the quadratic plot method. Plots (Nurrahman et al., 2012) were placed in the planting area of PT Pertamina Gas Operation Kalimantan Area as many as 3 plots. The plots used can be rectangular or pathal, and in each plot a plot of 10 x 10 m is made. The size and arrangement of plots can be seen in table 1.

Table 1. Size and Arrangement of Data Retrieval Plots

Life Stages	Plot Size	Description
Trees and poles	10 x 10 m2	Young and adult trees with a diameter of > 10 cm
Stake	5 x 5 m2	Young / saplings with a height of > 1.5 m with a diameter of < 10 cm
Seedling	2 x 2 m2	Youth/saplings ranging from sprouts to a height of < 1.5 m and undergrowth.

The creation of plot boundaries is measured using a roll meter tool. Observations of flora at the seedling and bottom plant level are carried out by calculating the type and number of each type contained in a 2x2 m plot, while observations on stakes, poles, and trees are carried out by measuring the circumference using a measuring tape. Data from vegetation analysis in addition to determining flora biodiversity are also used for miniating biomass and carbon storage. Estimation of biomass and carbon is done using allometric (non-destructive) equations that can be done quickly over large areas. To calculate biomass, what is needed is tree diameter data, which is circumference data converted into DBH data with a circular circumference formula. If the tree has supporting roots, the diameter is measured 1.3 meters from the upper limit of the supporting roots (National Standardization Agency, 2011).

Mammal &; Bird Observer

The methods used for observation and data collection of mammals and birds are the transect method and the point abundance method (Index Point Abundance). Data were collected using the point transect method, which observes mammal and bird species along transect lines and stops at designated points (Mackinnon, 1993). The length of the observation transect adjusts to the location of the observation. Point transects are located every 100 meters, with a radius of 50 meters. Figure 3 is an illustration of a bird and mammal observation plot using the point transect method.

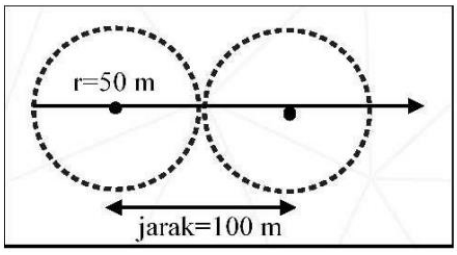


Figure 2. Point Transect Method

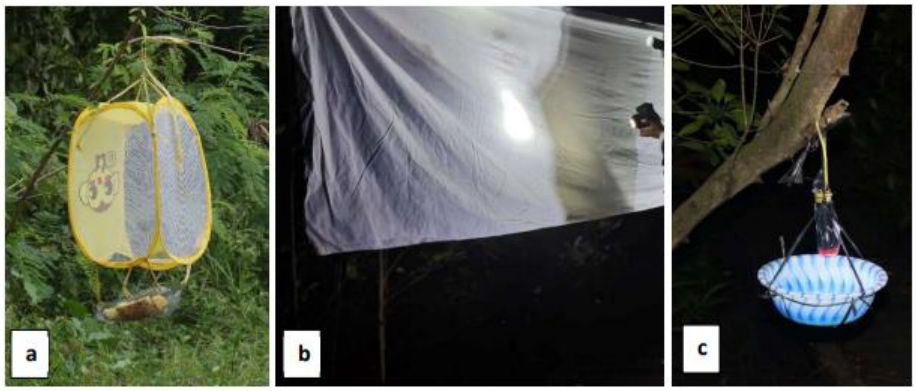
The Index Point Abundances method is a recording of all species found to be counted in a certain time and location. The data collected are the types of birds and mammals that are physically visible to observers, with the help of binoculars. Especially for birds, sounds that are heard or birds that fly past are also recorded. The time used to observe and record all birds seen and heard at that point is 10-20 minutes. Data collection starts at 06.00 WITA in the morning and 15.00 WITA in the afternoon. As well as a special time of 20.00-21.00 for nocturnal mammals. Data collection was carried out 3 times. The data taken are the type of species and the number of individuals of each type. In bird watching, species identification is done using the MacKinnon field guide. The mammals and birds found were then documented using remote cameras. For mammal data collection also uses traps and camera traps.

Herpetofauna Observation

The method used in taking data on herpetofauna (such as amphibians and reptiles) is the Visual Encounter Survey (VES) method. The Visual Encounter Survey method is a collection of species based on direct encounters on paths that are habitats for Biodiversity Monitoring and Evaluation of Kutai National Park 2022 9 animals both terrestrial and aquatic (Heyer et al., 1994). Active search with Visual Encounter Survey method is carried out with transects for 1.5 hours. Observations were made at night at 19.00-20.30 WITA, because amphibians and reptiles are nocturnal animals. So for lighting at night observation assisted by using a headlamp or flashlight. Observation of herpetofauna was carried out 3 repetitions. If herpetofauna is found at the time of bird and mammal observation, the fauna is still recorded along with the time and location of the encounter.

Insect Observation

Soil arthropods have a very vital role in the food chain especially as decomposers, because without these organisms nature would not be able to recycle organic matter. In addition, arthropods also act as prey for other small predators, so that it will maintain the continuity of other arthropods. As a consequence of microcommunity structure, arthropods will reflect environmental factors that affect the soil, including human activities (Fikri et al., 2016). Insect observations were carried out in all sessions, namely morning (05.30 – 08.00) and afternoon (15.00 – 18.30) with the same method of exploring the area as mammal and bird observations with the baited trap method (Figure 4a). In addition, insect data collection was also carried out at night (18.30 – 23.30) using a screen light trap (figure 4b) and at 18.30 – 05.30 using a light trap killing agent (figure 4c). At each observation station, a screen light trap unit is installed with a white screen and highlighted lights which is carried out in the afternoon until near midnight. Insects are usually attracted to the light of lights, so they can be caught when they perch or hit a screen. At each station, a light trap is also installed that will illuminate to attract the attention of nocturnal insects. In the trap trap installed, a killing agent is added in the form of a detergent solution that serves to reduce the surface tension of water, so that arthropods are difficult to fly. The duration of storage of the trap is for 12 hours. Data collection of tree insects using baited traps. Baited traps are placed near trees.



Gambar 3. Baited trap (a). Light trap layer (b) dan light trap killing agent (c)

IV. CONSERVATION EVALUATION EFFORTS

Vegetation Analysis

Flora data obtained in the field in the form of the number of species, number of individuals, and tree diameter. Furthermore, data processing is carried out to calculate the Important Value Index (INP), Type Dominance Index (D), Species Diversity Index (H'), Type Equity Index (E), and Type Wealth Index (R). The calculation of vegetation analysis is as follows:

Important Value Index

Important Value Index (INP) data is used to analyze the dominance (mastery) of a type in a particular community by summing the values of relative density (KR), relative frequency (FR), and relative dominance (DR). Important value is also the basis for determining the type of plant community (Soerianegara and Indrawan, 1978). Some important parameters measured in vegetation analysis (Misra, 1980) are:

Density is the number of individuals in a given unit of area (usually in hectares)

$$\text{Density (K)} = \frac{\text{Number of individuals of a type (N)}}{\text{Area of plot conto}}$$

$$\text{Relative density (KR)} = \frac{\text{Density of a type}}{\text{Total frequency of types}} \times 100\%$$

The frequency is determined based on the encounter of a plant species during observation

$$\text{Frequency (K)} = \frac{\text{Number found of a breed in the plot}}{\text{Number of plot slurs}}$$

$$\text{Relative frequency (KR)} = \frac{\text{Frequency of a type}}{\text{Total frequency of types}} \times 100\%$$

Dominance/closure is the part of the soil controlled by plants. For trees, lush lushness is expressed by the basal cover of the area, that is, the surface area of the land covered by the tree trunk. The area was determined from the measurement of the diameter of the tree at chest height (DBH), which is 1.3 meters from ground level.

$$\text{Dominance (D)} = \frac{\text{Area of a type}}{\text{Area of plot conto}}$$

$$\text{Relative dominance (KR)} = \frac{\text{Dominance of a type}}{\text{Total breed dominance}} \times 100\%$$

The important value is as a basis for determining the type of plant community which is the sum of the relative values of the three parameters. INP (Tree and pole level) = KR+ FR+ DR INP (Piling and seedling level) = KR+ FR. The higher the importance of a type, the higher the level of mastery in the community

Shannon-Wiener Species Diversity Index (H')

The type evenness index (E) indicates the degree of evenness of individuals per type. If the value of E is closer to 1, then the value of evenness is higher. The value of E (Pielou, 1975 in Magurran, 1988) is calculated using the following mathematical formula:

$$E = \frac{H'}{\text{Ln } S}$$

Information:
E = Type evenness index
H' = Species diversity index
S = Number of all types

According to Magurran (1988), the degree of evenness of individuals per type is determined by magnitude as follows:
$0 < D \leq 0.5$: indicates low type evenness
$0.5 < D < 1$: shows a high level of evenness of types

Margalef Type Wealth Index (R)

The type wealth index is calculated using Margalef's formula (Clifford and Stephenson, 1975 in Magurran, 1988) with the following calculation:

$$R = \frac{S - 1}{\text{Ln } N}$$

Information:
R = Type Wealth index
S = number of types found
N = total number of individuals

Type richness is determined by the following criteria:
$R < 2.5$: indicates a low level of type richness
$2.5 > R > 4$: indicates a moderate level of type wealth
$R > 4$: indicates a high level of type richness

Dominance Index (D)

The dominance index indicates the dominance of species in the community, the dominance index is calculated using the dominance index formula from Simpson (Odum, 1993).

$$D = 1 - \sum\left(\frac{ni}{N}\right)^2$$

Ni represents the number of individuals in a species, and N represents the total number of individuals. The value of the dominance index ranges from 0 to 1.
$0 < D \leq 0.5$: indicates that no species dominates
$0.5 < D < 1$: indicates the dominance of a particular species

Analysis of Flora and Fauna Conservation Status

Data analysis includes quantitative analysis and qualitative descriptive analysis. Descriptive analysis is used to determine the protection status of flora and fauna. This analysis refers to the conservation status of flora and fauna contained in the Regulation of the Minister of Environment and Forestry of the Republic of Indonesia Number P.106/MENLHK/SETJEN/KUM.1/ 12/2018 concerning the Second Amendment to the Regulation of the Minister of Environment and Forestry Number P.20/MENLHK/SETJEN/KUM.1/6/2018 concerning Protected Plant and Animal Species, IUCN (International Union for Conservation of Nature and Natural Resources) Red List, and the status of foreign trade Appendix CITES (Convention on International Trade in Endangered Species of Wild Flora and Faun

V. RESULTS &; DISCUSSION

Location and Area

The determination of the area of this National Park is based on the Decree of the Minister of Forestry No. 4194 / Menhut-VI / KUH / 2014 concerning the Determination of Kutai National Park Forest Area which was determined on June 10, 2014. The area of Kutai National Park is 192,709.55 Ha. One of the main reasons this area is designated as a national park is because of the very high biodiversity, both genetic, species, and ecosystem level biodiversity (Kutai National Park Office, 2019). There are several zonings in Kutai National Park, namely the core zone, jungle zone, utilization zone, rehabilitation zone, and special zone determined by the Director General of Natural Resources and Ecosystem Conservation Number SK.67 / KSDAE / Set-3 / KSA. O/4/2021 dated April 13, 2021. The Bontang Mangrove Park area is part of a nature conservation area with a type of mangrove ecosystem located in the Kutai National Park area under the management of the Kutai National Park Office. The Bontang Mangrove Park (BMP) area is part of a utilization zone with a mangrove ecosystem that has an area of 294.78 Ha in 2018 (Harjanto et al., 2019). Bontang Mangrove Park is an area of Kutai National Park located on the east coast of Bontang City.

Land and Topography

The Bontang Mangrove Park area which is the eastern part of Kutai National Park which has a flat topography and is included in the altitude class between 0 – 100 m above sea level. In general, mangrove areas have muddy soil types with three main characteristics, namely high salinity, low maturity, and contain acidic klei soil (Hardjowigeno, 1986).

Climate

Based on Schmidt and Ferguson's classification, the Bontang Mangrove Park area which is part of Kutai National Park has a type B climate with a Q value ranging from 14.3% -33.3%. The average annual rainfall reaches 2,000 mm with an average of 66.4 rainy days a year or a monthly average of 5.5 days. The average temperature is 26oC (ranging from 21-34oC) with a relative humidity of 67-90% and an average normal wind speed of 2-4 knots / hour (Kutai National Park Office, 2019).

Hydrology

The Bontang Mangrove Park area is located in a lowland in the eastern area of Bontang City facing the Makassar Strait. The water level of this area is influenced by tides (Kutai National Park Office, 2019).

Flora monitoring results

Table 2. Flora type data based on 2020-2022 monitoring

No.	Family	Scientific Name	Local Name	2020	2021	2022
1	Acanthaceae	Avicennio lonoto	Api-api	√	–	√
2	Acanthaceae	Avicennio olbo	Api-api	–	√	–
3	Acanthaceae	Avicennio marina	Api-api	√	√	√
4	Combretaceae	Lumnitzero littorea	Red streak	–	√	√
5	Combretaceae	Lumnitzero racemosa	Teruntum putlh	√	√	√
6	Lythraceae	Sonnerotla albums	Perepat	√	–	√
7	Lythraceae	Sonnerotia ovoto	Guedabu	√	√	√
8	Malvaceae	Heritiero littorolis	Oungunlaut	√	–	–
9	Rhizophoraceae	Ceriops toggle	Tengar wood	√	√	√
10	Rhizophoraceae	Bruguiero gymnorrhizo	Tancang	√	√	√
11	Rhizophoraceae	Rhizophoro apiculota	Bakau putih	√	√	√
12	Rh zophoraceae	Rhlzophoro mucronoto	Bakau hitam	√	√	√

Table 3. Important Value Index Data at the Vegetation Level of Trees and Poles at Biodiversity Monitoring Sites for 2020-2022

No	Tree Name	Is	Towards	KR (%)	F	FR (%)	D	DR (%)	PNI (%)
1	Avicenia lanata	1	11.11	8.33	0.11	16.67	0.16	6.73	31.73
2	Avicenia marina	2	22.22	16.67	0.11	16.67	0.36	14.94	48.27
3	Cerlops togal	1	11.11	8.33	0.11	16.67	0.13	5.25	30.25
4	Rhizaphora apiculato	7	77.78	58.33	0.22	33.33	1.69	69.35	161.02
5	Rhizapharo mucronata	1	11.11	8.33	0.11	16.67	0.09	3.73	28.73
Sum			133.33	100.00	0.67	100.00	2.43	100.00	300.00

Table 4. Important Value Index Data on Seedling Vegetation Level at Biodiversity Monitoring Sites in 2022

No	Tree Name	Is	Towards	KR (%)	F	FR (%)	PNI (%)
1.	Brugulero gymnorlzo	31	8,611.11	46.97	0.11	13	59.47
2.	Ceriops toggle	17	4,722.22	25.76	0.22	25	50.76
3.	Lumnitzero littorea	2	555.56	30.30	0.11	13	15.53
4.	Rhizophoro apiculata	3	833.33	4.55	0.11	13	17.05
5.	Rhizophora mucronata	4	1,111.11	6.06	0.11	13	18.56
6.	Sonneratia alba	9	2,500.00	13.64	0.22	25	38.64
Sum			18,333.33	100.00	0.89	100	200.00

Table 5. Status of Flora Conservation at Biodiversity Monitoring Sites in 2021

No	Kind	Local Name	Protection Status		
			IUCN	CITES	P.106 / 2018
1	Avicennio lonota	Api-api	VU	TT	E.G.
2	Avicennio marina	Api-api	LC	TT	E.G.
3	Bruguiero gymnorrhizo	Tancang	LC	TT	E.G.
4	Ceriops toggle	Tengar wood	LC	TT	E.G.
5	Lumnitzero littorea	Red streak	LC	TT	E.G.
6	Lumnitzero racemoso	White tummy	LC	TT	E.G.
7	Rhizophoro opicufoto	Bakau putih	LC	TT	E.G.
8	Rhlzophoro mucronoto	Black mangrove	LC	TT	E.G.
9	Sonneratio alba	Perepat	LC	TT	E.G.
10	Sonneratio ovato	Guedabu	NT	TT	E.G.

Hasil Monitoring Fauna

Mangrove communities form a mixture between two groups, namely the terrestrial (arboreal) terrestrial fauna group which generally occupies the top of mangrove trees and the aquatic / aquatic fauna group. Some animals live on trees, others among the roots and surrounding mud. Although many animals live all year round, mangrove habitat is also important for visitors who are only temporary, such as birds that use mangrove branches to perch or Kutai National Park Biodiversity Monitoring and Evaluation 2022 31 make their nests, but forage on land far from mangrove habitats (Nybakken, 1992 in Fitriah et al., 2013).

Fauna Species Diversity Index (H')

Table 6. Fauna Species Diversity Index (H') in Biodiversity Monitoring Sites in 2022

No	Taksa	Diversity Index (H')	Information
1	Bird	2.98	Keep
2	Mamalia	1.82	Keep
3	Herpetofauna	1.61	Keep
4	Insect	2.96	Keep

Fauna Type Evenness Index (E)

Table 7. Fauna Type Evenness Index (E) in Biological Equity Distribution Locations in 2022

No	Taksa	Evenness Index (E)	Information
1	Bird	0.62	Tall
2	Mamalia	0.57	Tall
3	Herpetofauna	0.50	Low
4	Insect	0.77	Tall

Fauna Type Richness Index (R)

Table 8. Fauna Type Wealth Index (R) in 2022 Biodiversity monitoring locations

No	Taksa	Wealth Index (R)	Information
1	Bird	7.08	Tall
2	Mamalia	1.57	Low
3	Herpetofauna	2.17	Low
4	Insect	7.41	Tall

Dominance Fauna Index (D)

Table 9. Fauna Type Dominance Index (D) in Biodiversity Monitoring Sites in 2022

No	Taksa	Dominance Index (D)	Information
1	Bird	0.92	There is a dominant breed
2	Mamalia	0.82	There is a dominant breed
3	Herpetofauna	0.77	There is a dominant breed
4	Insect	0.89	There is a dominant breed

Status Konservasi Fauna

Table 8. Fauna conservation status at Biodiversity Monitoring Sites in 2022

No.	Family	Scientific Name	Local Name	Protection Status		
				IUCN	CITES	P.106 / 2018
Bird						
1	Aeanthzidae	Gtrygone sulphurto	Remetuklaut	LC	TT	E.G.
2	Acciptridae	Holioeetus leucogoster	White-bellied albatross	LC	TT	D
3	Aegithinidae	Aegithino tiphia	Cipoh kacat	LC	TT	E.G.
4	Alcedine	Todlramphus chlorls	Cekakak sungai	LC	TT	E.G.
5	Apodldae	Apodldae	Jack sp.	–	–	E.G.
6	Ardedae	Lxabrychus sinensis	Bambangan kuning	LC	TT	E.G.
7	campephagidae	Lologe nigro	Kapasan kemiri	LC	TT	E.G.
8	Cisticolidae	Orthatomus ruficeps	Cinenen gray	LC	TT	E.G.
9	Cisticolidae	Prinia familiaris	Perenjak Jawa	NT	TT	E.G.
10	Columbldae	Cholcophops indico	Emerald crush	LC	TT	E.G.
11	Columbidae	Duculum oeneus	Green gam	LC	TT	E.G.
12	Columbidae	Geopelio strioto	Petkutut Jawa	LC	TT	E.G.
13	Columbidae	Treron vernans	Punaigading	LC	TT	E.G.
14	Cucuidae	Cocomontis merolinus	Wiwik gray	LC	TT	E.G.
15	Dicaedae	Dicoeum cruentotum	Red chili pepper	LC	TT	E.G.
16	Dicaedae	Dicoeum trigonostigmo	Spark chili	LC	TT	E.G.
17	Estrildidae	Wool atricapilla	Bondol rawa	LC	TT	E.G.
18	Estrildidae	Lanchura fuscons	Bondol Kalimantan	LC	TT	E.G.
19	Hemiprocnidae	Hemiprocne comoto	Tepekong rangkang	LC	TT	E.G.
20	Muscicapidae	Copsychus souloris	Kucica Village	LC	TT	E.G.
21	Nectarinidae	Anthreptes moloccensis	Head sunbird	LC	TT	E.G.
22	Nectarinidae	Leptocomo colcostetho	Mangrove sunbird	LC	TT	E.G.
23	Passeridae	Passer montanus	Erasia sparrow	LC	TT	E.G.
24	Piddae	Dlnopiumjovonense	Besl woodpecker	LC	TT	E.G.
25	Picidae	Picoides moluccensis	Caladi tilik	LC	TT	E.G.
26	Pycnonotidae	Pycnonotus ourigoster	Cucak kutilang	LC	TT	E.G.
27	Pycnonotidae	Pycnonocus gofovier	Merbah cerukcuk	LC	TT	E.G.
28	Rallidae	Amourornis phoenicurus	Kareo is good.	LC	TT	E.G.
29	Rhipiduridae	Rhipidurojovonico	Striped fan	LC	TT	D

No.	Family	Scientific Name	Local Name	Protection Status		
				IUCN	CITES	P.106 / 2018
30	Sturnidae	Acridotheres jovonicus	Kerak kerbau	VU	TT	E.G.
31	Stumidae	Aplonis ponoyensis	Beetle perling	LC	TT	E.G.
32	Timaliidae	Mixornis bornensis	Ciung air coreng	LC	TT	E.G.
Mamalia						
1	Cercopithecidae	Nasalis lorvotus	Bekantan	IN	App 1	D
2	Cercopithecidae	Macoca fascicularis	Long-tailed monkey·	IN	TT	E.G.
3	Muridae	Exulent Rottus	Field mouse	LC	TT	E.G.
4	Muridae	Rottus norvegicus	Rlul rat	LC	TT	E.G.
5	Muridae	Rorcus tonezumi	House mouse	LC	TT	E.G.
6	Muridae	Rottus tiomonicus	The bush rat	LC	TT	E.G.
7	Pteropodidae	Mocroglossus minimus	Codot chocolate plsang	LC	TT	E.G.
Herpetofauna						
1	Gekkonidae	Hemidoclyfus plotyurus	Cecak rumah	LC	TT	E.G.
2	Scincidae	Emoio otrocostato	Kadal mangrove	LC	TT	E.G.
3	Sc ncldae	Aurropis multlfoscloto	Kadal kebun	LC	TT	E.G.
4	Varanidae	Voranussolvotor	Biawak air Asia	LC	App	E.G.
5	Columbridae	Dendrelophls pictus	Mine snake	LC	TT	E.G.
6	Bufonidae	Duttoprhynus melanosricus	Kodok buduk	LC	TT	E.G.
Insect						
1	Acrididae	Acrididae 1	Belalang coklat	–	–	E.G.
2	Apldae	Dorsorous Apis	Honeybees	–	–	E.G.
3	Apidae	Apis indico	Honeybees	–	–	E.G.
4	Apidae	Amegillo sp	blue bee	LC	–	E.G.
5	Apidae	Xylocopo violacea	Wood beetle	–	–	E.G.
6	Apidae	Trigona sp.	Teweul	–	–	E.G.
7	Blatidae	Biottello asahinal	Leaf cockroach	–	–	E.G.
8	Braconidae	Braconidae 1		–	–	E.G.
9	Caliphoridae	Chrysomya bezziana	Fly	–	–	E.G.
10	Caliphoridae	Lucilia sericata	Green fly	–	–	E.G.
11	Cerembycidae	Ceresium sp.	Stem borer	–	–	E.G.
12	Cicadellidae	Cicadelidae 1		–	–	E.G.
13	Cicadellidae	Cicadelidae 2	Wereng hijau	–	–	E.G.
14	Cicadellidae	Homalodisca Vitripennis		–	–	E.G.
15	Cleridae	Cieridae 1		–	–	E.G.
16	Crambidae	Crambidae 1		–	–	E.G.
17	Crambidae	Crambidae 2		–	–	E.G.
18	Cullecidae	Culex quwnquefasciatus	Garden mosquitoes	–	–	E.G.
19	Curculionidae	Hypera postica	Alpha beetle alpha	–	–	E.G.
20	Dolichodoridae	Dolichoderus Thoracicus	ant	–	–	E.G.
21	Droshoplidae	Drosophila melanogaster	Rambeutuk	–	–	E.G.
22	Formicidae	Oecophylla sp.	Semut rarang	–	–	E.G.
23	Formicidae	Odontomachus sp	Slim black ants	–	–	E.G.
24	Formicidae	Formicidae 1	Semut fase ant from	–	–	E.G.
25	Geometridae	Lepidoptera sp. nov.	Ngengat kuning	–	–	E.G.
26	Hesperiidae	Hesperildae 1	Moth	–	–	E.G.
27	Libellulidae	Sympetrum fonscolombli	Capung	–	–	E.G.
28	Libellulidae	Neurothemis fluctuans	Red dragonfly	–	–	E.G.
29	Melolonthidae	Melolonthidae 1	Beetle	–	–	E.G.
30	Miridae	Stenodema sp.	Kepik	–	–	E.G.
31	Muscidae	Fannia spp.		–	–	E.G.
32	Muscidae	Home musca	House flies	NOT	TT	E.G.
33	Muscidae	Musca nigra	Black garbage flies	–	–	E.G.
34	Noctuidae	Plagiomimicus spumosum		–	–	E.G.
35	Notodontidae	Furcula furcula		–	–	E.G.
36	Nymphalidae	Euploea mulciber	Striped blue crow	–	–	E.G.
37	Pentatomidae	Pentatomidae 1		–	–	E.G.
38	Pentatomidae	Nezara viridula	Green chips	NOT	TT	E.G.
39	Psycodidae	Psycodidae 1		–	–	E.G.
40	Rhinophoridae	Paykullia sp. z o.o.		–	–	E.G.
41	Sciaridae	Sciara sp. z o.o.	Agas	–	–	E.G.
42	Staphylinidae	Paederus sp.		–	–	E.G.
43	Termitidae	Gilvus macroterms	Laron	–	–	E.G.
44	Tettigonidae	Debrona sp.	Belalang daun	–	–	E.G.
45	Trichoceridae	Trichocera annulata	Heron fly	–	–	E.G.
46	Vespidae	Eumenes sp.	Mud dauber	–	–	E.G.

No.	Family	Scientific Name	Local Name	Protection Status		
				IUCN	CITES	P.106 / 2018
47	Vespidae	Vespa affines	Tawon ndas	–	–	E.G.

Information:

IN	:	Endangered	App I	:	Apendiks I	D	: Protected
VU	:	Vulnerable	App II	:	Apendiks II	E.G.	: Unprotected
NT	:	Near Threatened	TT	:	Not Listed		
LC	:	Least Concern					
NOT	:	Not Evaluated					

VI. SUSTAINABLE BIODIVERSITY CONSERVATION EFFORTS

Lhoktunggul Mangrove Area Rehabilitation Program

This Mangrove Area Rehabilitation Program is carried out not in the context of fulfilling obligations stipulated in the Regulation of Law No. 5 of 1990 concerning the Conservation of Biological Natural Resources and their Ecosystems, because there are no regulations related to methods in the conservation of biological natural resources and ecosystems. 125 Value Creation: Efforts to Maintain Environmental Harmony Harmattan Investment Implementation of this Mangrove Planting Program, namely this activity has no economic value in the business aspect. PT. Pertamina Gas OKA is the only company that manages in the Lhoktunggul rehabilitation area that has a commitment to mangrove forest conservation around Salantuko Island. PT. Pertamina Gas Operation Kalimantan Area involves mangrove seed farmer groups from local communities and the Malahing Community Teaching and Learning Activity Center (PKBM) and the BIKAL Foundation. The community also planted and maintained mangrove seedlings that had been planted so that there was sustainability of the program.

Proboscis Proboscis Ecosystem Rehabilitation Program

This ecosystem rehabilitation program aims to improve the habitat conditions of proboscis monkeys, especially in the proboscis monkey feed section, namely the Sonneratia ovata mangrove fruit, which in this case the number is decreasing, due to a decrease in the amount of green land due to land use change and illegal logging in the East Kalimantan Region. This program is not carried out in the context of fulfilling obligations stipulated in the Law Regulation No. 5 of 1990 concerning the Conservation of Biological Natural Resources and their Ecosystems, because there are no regulations related to methods in the conservation of biological natural resources and ecosystems. Biodiversity Protection 126 Barriers to Investment Implementation. In carrying out the program, the investment provided by external parties of the company (community and government) is greater at 73% while the company is 27%. The amount of investment from the Company compared to external parties of the company is verified by PT Lafirza Global Indonesia. In addition, the Investment Assessment of the implementation of the program economically for the company is not profitable, but as a form of the company's commitment to the positive impact of the program on the environment, the company continues to run the program. PT. Pertamina Gas OKA collaborates with the Lestari Indah Farmer Group in planting 10,000 Rhizopora mucronata mangrove seedlings on an area of 1 Ha and Sonneratia ovata as many as 100 seedlings.

CO2 Absorbing Plant Planting Program

PT Pertamina Gas Kalimantan Area cultivates Sengon Trees on land used by forest fires. Community-based sengon tree cultivation began in 2017. 2 hectares of fire-scarred land/unproductive land planted with sengon tree seedlings. This Mangrove Area Rehabilitation Program is carried out not in the context of fulfilling obligations stipulated in Law Regulation No. 127 Value Creation: Efforts to Maintain Environmental Harmony 5 of 1990 concerning the Conservation of Biological Natural Resources and their Ecosystems, because there are no regulations related to methods in the conservation of biological natural resources and ecosystems. Investment Appraisal. The implementation of the program economically for the company is not profitable, but as a form of the company's commitment to the positive impact of the program on the environment, namely reducing emissions of 261.35 tons of CO2 / year, the characteristics of sengon tree roots contain root nodules that can help the soil porosity process and the provision of nitrogen elements in the soil so as to help increase soil fertility, the company continues to run the program. The added value of changing the value chain of this program is that fire-scarred land can be reused, minimizing the potential for forest fires, and can reduce emissions.

Planting Site Utilization Program as Edutourism and Sonneratia Ovata Mangrove Utilization Center

PT Pertamina Gas is committed to making efforts to improve the environment, especially related to efforts to protect biodiversity from several programs run in Kutai National Park conservation areas such as Mangrove Area Rehabilitation, Proboscis Proboscis Ecosystem Rehabilitation, to its use for the community. In

2022, PT Pertamina Gas Operation Kalimantan Area will implement flagship programs in the field of biodiversity protection, namely the Utilization of Planting Sites as Eduwisata program and the Sonneratia Ovata Mangrove Utilization Center. Initial Problems PT Pertamina Gas Operation Kalimantan Area has carried out its commitment to protect the flora and fauna in the Kutai National Park conservation area by focusing on several types of mangroves such as Rhizophora Mucronata and protected fauna such as Nasalis Larvatus (Proboscis monkey) since several years ago. This results in a positive impact on the ecosystem which can be seen in the results of biodiversity monitoring and evaluation carried out every year. However, this success is only known by a few parties and does not provide information or benefits directly to the community around the conservation site. On the other hand, from the planting carried out by Pertamina Gas Operation Kalimantan Area, there are several species of flora that have the potential to be utilized by the community directly, one of which is the Sonneratia ovata Mangrove. Sonneratia ovata mangrove has fruits and leaves that can be utilized by the community into several processed products. The Origin of the Idea of Change or Innovation The innovation program for the Utilization of Planting Sites as Eduwista and Sonneratia ovata Mangrove Utilization Center came from the company itself where the idea of this program emerged from discussions and feedback from several parties who helped run the biodiversity protection program of PT Pertamina Gas Operation Kalimantan Area previously including the surrounding community. This Change Idea is also supported because of the problems and potential of the planting site that is currently owned so that it can be carried out to solve existing problems and provide benefits at the same time. The company can modify the planting site which is currently only used as ecosystem rehabilitation and Proboscis monkey feed land into an Eduwisata location and Sonneratia ovata Mangrove fruit utilization center. This location has a myriad of useful knowledge to learn, interesting to be used as a tourist site, and the fruit in it can be used as processed products by the surrounding community. This aims to extend the benefits of planting sites to the surrounding community.

Changes made from the Old System of PT Pertamina Gas Operation Kalimantan Area innovated the Utilization of Planting Sites as Eduwista and Sonneratia ovata Mangrove Utilization Center which is a program that expands the benefits of planting sites that were previously only used as Proboscis monkey feed land areas and rehabilitation of conservation areas into Eduwisata locations and Sonneratia Ovata Mangrove Utilization Center. Its shady location makes this location suitable as an Eduwisata location and is equipped with a visitor road area into the mangrove forest and some information related to the flora in it. Besides being able to learn about the mangroves in it, the surrounding community can also take advantage of Sonneratia ovata mangrove fruit which can and has been used as ovata fruit syrup. This syrup has been produced by local MSMEs and traded as a typical souvenir of Bontang City. System Changes from the Innovation Program of the Planting Site Utilization Program as Eduwista and Sonneratia ovata Mangrove Utilization Center have an impact on changing sub-systems where there are Methods of Utilization of planting sites as Eduwisata and Sonneratia ovata Mangrove Utilization Centers and improving land functions by building Eduwisata facilities and additional planting of Sonneratia ovata mangroves for sustainable use with the following explanation: i. Conditions before the program: The planting location of PT Pertamina Gas conservation area in Kutai National Park is an area planted with several types of mangroves such as Rhizophora mucronate, Sonneratia alba, Sonneratia ovata, and so on with the aim of rehabilitation and repair of proboscis monkey exostems. The location is a mangrove forest that is only used by animals in that location. ii. Conditions after the program: Planting Location after the Utilization of Planting Site as Eduwista and Sonneratia ovata Mangrove Utilization Center became a location that has a dominant mangrove, namely Sonneratia ovata after additional planting of 200 seedlings. The location can also be visited by tourists who visit the bontang Mangrove Park location and can learn the condition of mangrove forests in the PT Pertamina Gas planting area. This location is also made as a center for the use of Sonneratia ovata fruit and used as syrup by the Fragrant Leaf Group and a typical souvenir of the city of Bontang. The following is a picture of the planting location which is used as an Eduwisata location and Sonneratia ovata fruit utilization center. The innovation program for the Utilization of Planting Sites as Eduwista and the Sonneratia ovata Mangrove Utilization Center are also used as educational centers, where this location is used as an Eduwisata location that can provide information and education to the community regarding the benefits of Sonneratia ovata Mangroves and the surrounding ecosystem. In addition, this program can increase public awareness of the importance of biodiversity protection so that in the future the community can contribute to becoming environmental cadres for biodiversity conservation in their environment. Environmental Impact of the Innovation Program The resulting environmental impact is an increase in the biodiversity index in 2022 to 2.06 H' from the previous 2021 of 1.8 H'.

VII. CONCLUSION

Monitoring of flora biodiversity obtained 10 types of flora from 4 families. Based on the IUCN protection status, there are Avicennia lanata species that are vulnerable (VU) or vulnerable to extinction and Sonneratia ovata species that are near threatened (NT) or endangered. Biomass storage of 23.73 tons/ha with an estimated amount of carbon stored of 10.91 tons C/ha, decreased by 10.32% from 2021 data. This decrease in the value of carbon stocks is possible due to a decrease in tree stands that experience death. The type of Sonneratia ovata as a plant

planted by PT Pertamina Gas in 2019, in 2022 monitoring has grown well which is shown by the number of plants at the level Compared to data in 2020 and 2021, in 2022 monitoring there are additional types of fauna, namely 4 species of birds, 3 species of mammals, 2 types of herpetofauna, and 36 species of insects. Faunal species diversity is included in the medium category in all taxa, high species evenness in insect, bird, and mammal taxa, high species richness in bird and insect taxa, and uneven species distribution (there are dominant types). stakes that have borne fruit. Monitoring of faunal biodiversity resulted in 32 species of birds from 22 families, 7 species of mammals from 4 families, 6 species of herpetofauna from 5 families, and 47 species of insects from 32 families. According to the IUCN, there are several species of fauna with protection status that are at risk of extinction, namely Nasalis larvatus (EN) and Macaca fascisularis (EN) from mammalian taxa, and Acridotheres javanicus (VU) and Prinia familiaris (NT) from bird taxa. According to CITES, Nasalis larvatus (proboscis monkey) is included in Appendix I which means it is banned in all forms of international trade and Varanus salvator (Asian water-monitor lizard) which is included in Appendix II category which means it is not endangered, but may be endangered if trade continues unregulated. Based on the Regulation of the Minister of Environment and Forestry of the Republic of Indonesia Number P.106 of 2018, there are protected fauna, namely Haliaeetus leucogaster (white-bellied sea eagle) and Rhipidura javanica (striped fan), as well as one protected mammal, namely Nasalis larvatus (proboscis monkey). Compared to data from 2020 and 2021, in 2022 monitoring, there are additional types of fauna, namely 4 species of birds, 3 species of mammals, 2 types of herpetofauna, and 36 species of insects. Faunal species diversity is included in the medium category in all taxa, high species evenness in insect, bird, and mammal taxa, high species richness in bird and insect taxa, and uneven species distribution (there are dominant types).

Planting activities by PT. Pertagas has been carried out and monitored for 3 consecutive years. This activity contributes positively to the management of mangrove ecosystems in Bontang Mangrove Park. To support the management of Kutai National Park, the following are recommended: 1) Recommendations: replicating activities to support the management of TNK priority species, Justification for enrichment of feed tree species and orangutan nest trees, Target achievement: increasing the population of feed trees and orangutan nest trees, Location: Orangutan habitat. 2) Recommendation: support the Ministry of Environment and Forestry program in bioprospecting development, Justification: Arboretum / Demplot Development, Target achievement: Arboretum / Demplot, Application: Kutai National Park.

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