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BIODIVERSITY MONITORING AS A BASELINE FOR IN-SITU AND EX-SITU CONSERVATION AREAS OF PT PERTAMINA PATRA NIAGA INTEGRATED TERMINAL BALONGAN, INDONESIA

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ABSTRACT

PT Pertamina Patra Niaga Integrated Terminal Balongan actively engages in various Corporate Social Responsibility (CSR) activities and implements PROPER (Program for Rating the Performance of Environmental Management). This research assessed the diversity of flora and fauna and the condition of the habitat surrounding the company's operational area. The research methodology involved direct and indirect observations. The data was analyzed to determine the values of ecological index and conservation status of flora and fauna based on the standards set by the International Union for Conservation of Nature (IUCN), the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES), and the Minister of Environment and Forestry Regulation (PerMen LHK) No. 16 of 2018. The research revealed that the ecological index of flora and fauna, both within the study area (in-situ) and outside of it (ex-situ), falls into low, moderate, and high categories. Some flora and fauna found in the area are classified as near threatened species, vurnurable species, and protected.

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INTRODUCTION

Biodiversity is the variability among living organisms from all sources, including diversity within species, between species, and ecosystems (SCBD, 2006). Several human activities significantly alter ecosystems, including monoculture agriculture and plantations (Seymour & Harris, 2019; Iezzi et al., 2021), urbanization (Knop, 2016), road construction (Haider et al., 2018), mining (Sonter et al., 2017), and industrial activities (Simons et al., 2022). These changes can have an impact on biodiversity and the environment.

Indonesia has a Corporate Performance Rating Assessment for Environmental Program (PROPER) for the industrial sector, which was conceptualized and implemented by the Ministry of Environment and Forestry of the Republic of Indonesia. PROPER overarching aim is to reduce, monitor, evaluate, and take action on any company activities related to environmental impacts (Suedy et al., 2020). Important biodiversity protection programs include in-situ and ex-situ conservation and rehabilitation (Hadisusanto et al., 2022). Ministerial Regulation No. 1 of 2021 requires every company to develop an information system to collect, analyze, and assess the state and trends of biodiversity within the company (Reliantoro, 2012).

PROPER can encourage the business world to comply with environmental regulations, implement resource efficiency, and innovate in environmental management (Ardiputra, 2015). The PROPER evaluation in 2021 was conducted on 2,593 companies, and it achieved a 75% compliance rate, with 117 out of 697 innovations related to biodiversity inclusivity. These innovations include establishing community-based conservation areas, water catchment area conservation, conservation education camping, high conservation value, native tree nurseries, re-vegetation of degraded lands, conservation of rare species, and honeybee breeding (Anugrah, 2021).

PT Pertamina (Persero), one of the oldest state-owned enterprises in Indonesia, is actively engaged in various Corporate Social Responsibility (CSR) activities and participates in implementing PROPER. Specifically, PT Pertamina Patra Niaga carries out efforts for biodiversity conservation both in the vicinity of PT Pertamina Patra Niaga Integrated Terminal Balongan (ITB) and in the surrounding areas. Some of the programs already implemented include cultivating mango varieties in collaboration with the local communities and planting sea pine trees (*Casuarina equisetifolia L.*) in the coastal area of Tirta Ayu from 2020. Planting sea pine trees aims to rehabilitate the land and conserve sandy coastal areas (Sukma, 2021). Conservation efforts are necessary to preserve the diverse value of biological resources to support the sustainable utilization of biodiversity and its ecosystems (Sidjabat et al., 2017).

Biodiversity is synonymous with the stability of an ecosystem. If the biodiversity of an ecosystem is high, then the ecosystem tends to be more stable (Fachrul, 2012). The analysis of biodiversity is conducted to make decisions in creating an ideal and stable ecosystem. An ecosystem's stability is characterized by species richness, diversity, and evenness. The stability of an ecosystem provides valuable environmental services for humans (Indriyanto, 2012).

This research aims to assess the diversity of flora and fauna and the condition of the habitat surrounding the company's operational area. The presence of this baseline assessment is expected to be a company's effort to maintain biodiversity and a sustainable environment through conservation programs.

METHODE

The Assessment baseline study was conducted in both in-situ and ex-situ areas. The in-situ area covers a total area of 62 hectares (Ha) within PT Pertamina Patra Niaga ITB's territory. In contrast, the ex-situ area is located in the coastal region of Tirta Ayu, Balongan, Indramayu, covering an area of 6,090 m^2. The research was carried out in June 2023. The research areas can be seen in Figure 1 and Figure 2.

Figure 1. In-situ area

Figure 2. Ex-situ area

The monitoring of flora at the research site was conducted using various tools, including a tape tool with tagging tape, measuring tape (roll meter), camera, counter, Global Positioning System (GPS), rope, bamboo stakes, plant identification books, as well as logbooks and writing tools. Meanwhile, the diversity of fauna was observed using tools such as tape tools with tagging tape, sweep nets, cameras, logbooks, writing tools, and animal identification books.

The data were sorted based on growth form: Trees, Shrubs-Herbs-Woody, and Ground-level plant. Floristic data were collected using purposive random sampling around the well pad by the transect method. Five transects measuring 20 m x 100 m (1 Ha) were established at locations with varying environmental changes, such as habitat conditions, ecosystems, or physiognomies. Each transect was divided into five sub-transects/plots, each measuring 20 m x 20 m, for recording data on trees with a diameter above 10 cm. Then, 10 m x 10 m plots were set up for recording data on saplings with a diameter of 5 cm - 9.9 cm, 5 m x 5 m plots for recording data on seedlings with a diameter of 1 cm - 4.9 cm, and 2 m x 2 m plots for recording data on seedlings with a diameter less than 1 cm. The data collection on trees included measuring the stem diameter at breast height, total height, and height free of branches (Saribanon et al., 2022). The map of the flora observation plots can be seen in Figure 3 for a clearer view.

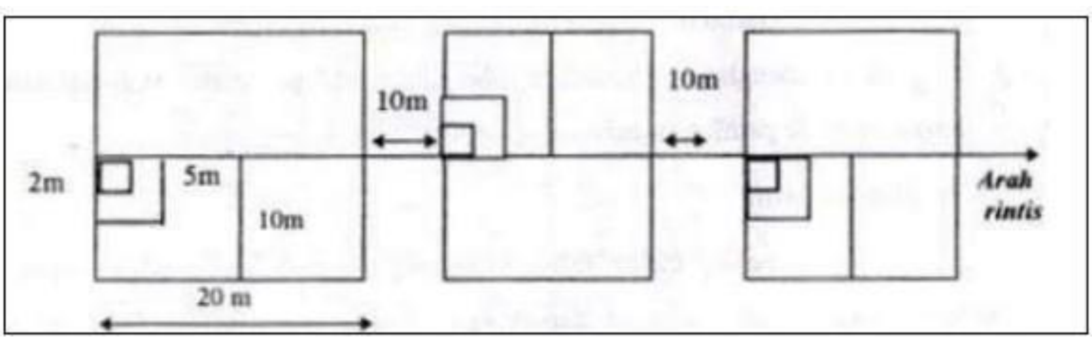

Figure 3. Map of Flora Observation Plot

Data collection for fauna was conducted using two methods: direct and indirect. Direct observation involved following trails and observing biodiversity. Their species, direct distance (DD), perpendicular distance (PPD), and activities were recorded when encountering fauna. The research locations and the presence of wildlife were marked using GPS (Saribanon et al., 2022). On the other hand, indirect observation involves examining the traces left by animals, including footprints, droppings, burrows, remnants of fur, sounds heard during observation, claw marks, odor, and food remaining. The techniques for fauna observation can be seen in Figure 4.

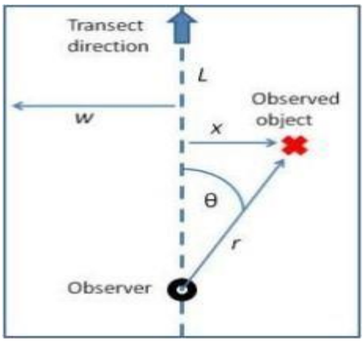

Figure 4. Techniques for Fauna Observation

The data analysis in this research is conducted to examine the ecological index. The ecological index is a measurement degree used to determine several characteristics of ecosystem components, such as dominance, diversity, evenness, and richness (Rusmendro, 2004).

The dominance index is a parameter that measures the level of centralization of species dominance within a community (Indriyanto, 2018). The dominance index represents the population of individuals compared to the total number of individuals (Smeins & Slack, 1982), as described by formula (1).

$$C = \sum(pi)^2 \qquad (1)$$

The species dominance index is classified into three groups, namely low dominance (0 < C ≤ 0.5), moderate dominance (0.5 < C ≤ 0.75), and high dominance (0.75 < C ≤ 1) (Jorgensen, 1974).

The diversity index describes the level of species diversity within a community (Indriyanto, 2018). The value of the diversity index is determined using the Shannon-Wiener formula (H') (Odum, 2019).

$$H' = \sum_{i=1}^{s} \left(\frac{ni}{N}\right) ln(\frac{ni}{N}) \qquad (2)$$

Explanation: H'= Value of diversity index
Ni = Number of individuals of species I
N = the Total number of individuals in each location.

Based on the Shannon-Wiener diversity index scale (1988, in Odum, 2019): 1.5 < H' < 3.5 = low, 3.6 < H' < 4.5 = moderate, 4.6 < H' < 5.0 = high/abundant.

The species evenness index determines the distribution balance among individuals across all species in a community (Ludwig & Reynold, 1988). Meanwhile, species richness measures the abundance or scarcity of plant species in a community (Suprapto, 2015). Species evenness is calculated using formula (3), and species richness using formula (4) (Krebs, 1989).

$$E = \frac{H'}{\ln S} \qquad (3)$$

Explanation: E = Evenness index
S = Total number of species in the sample

The values of the evennes index are classified into three categories: $0 < E \leq 0.4$, low population evennes; $0,4 < E < 0.6$, moderate population evennes; $E \geq 0.6$, high population evennes

$$R = \frac{S-1}{\ln N} \qquad (4)$$

Explanation: R = Species richness index
S = Total number of species
N = Total number of individuals

The value of the species richness index is classified into three categories: $R < 3.5$, low; $3.5 < R < 5$, moderate: $R > 5$ high.

Data analysis was also conducted to determine the presence of various wild flora and fauna species, whether they are of economic value, endemic, rare, or protected based on Indonesian regulations and laws, as well as international regulations/conventions such as the Convention on International Trade in Endangered Species of Wild Flora and Fauna (CITES, 2010), and based on the IUCN Red List (International Union for Conservation of Nature) (Hilton-Taylor & Brackett, 2000), and the Regulation of the Ministry of Environment and Forestry of the Republic of Indonesia Number P.106/Menlhk/Setjen/Kum.1/12/2018 on Protected Plant and Animal Species.

RESULT AND DISCUSSION

The baseline study in both in-situ and ex-situ areas includes flora and fauna, which are then used to calculate their ecological index and assess their conservation status.

1. Ecology Index
   a. Flora Communities

The ecological index of flora communities is measured at various vegetation levels, including ground-level plants, shrubs-herbs-woody, and Tree plants. The ecological index of flora for both in-situ and ex-situ areas can be seen in Table 1 and Table 2.

Table 1. Flora Ecology Index In-situ

Level of Vegetation	Number of Species	H’	E	C	R
Ground-level plants	3668	2,919	0,781	0,076	5,428
Shurbs-Herbs-Woody	3652	3,516	0,86	0,09	11,947
Tree plants	873	2,891	0,773	0,099	7,252
Total	**8193**				

Table 2. Flora Ecology Index Ex-situ

Level of Vegetation	Number of Species	H'	E	C	R
Ground-level plants	3308	1,897	0,508	0,2003	2,097
Shrubs-Herbs-Woody	228	0,441	0,385	1,778	3,499
Tree plants	757	1,411	0,378	0,338	2,919
Total	**4293**				

Based on Table 1, the flora's highest diversity index value is found at the tree vegetation level with a moderate category. This value indicates that the diversity at the tree level is stable. Moderate diversity represents a relatively stable ecosystem that maintains stable conditions against disturbances (Indriyanto, 2018). On the other hand, the diversity index values in Table 2 are in the low category for all vegetation levels. This indicates low diversity with low individual distribution, resulting in low community stability (Mason, 1981). A low diversity index suggests the dominance of one species with uneven distribution found only in one observation station. The in-situ area has a higher diversity index of flora compared to the ex-situ area, indicating a higher number of species diversity in the in-situ area. A plant community's high or low diversity index depends on the number of species and species richness (Indriyanto, 2012).

Table 1 also indicates a high evenness index at each level of flora vegetation. This value means that evenness at the tree, shrub-herbs-woody, and ground-level plant levels is stable (Ismaini et al., 2015), with an even distribution and abundant species in each region. The evenness index value is high when an area has abundant species (Hanafi et al., 2021). However, Table 2 shows a low evenness index value for all levels of plant vegetation. This means that evenness at the tree, shrub-herbs-woody, and ground-level plant levels is unstable (Ismaini et al., 2015).

Species dominance can be concentrated on one species, several species, or many species, depending on the level of dominance index (Indriyanto, 2018). Table 1 shows low dominance index values at each vegetation level, indicating the absence of species dominance concentration, whether at the area's tree, shrub-herbs-woody, or ground-level plant level. The smaller the value of the dominance index, the more scattered the dominance pattern of species (Indriyanto, 2012). On the other hand, in Table 2, the highest dominance index value is in the moderate category for the shrub-herbs-woody plant vegetation levels. This is because there is the growth of several flora species that are not widely spread.

The highest species richness index in Table 1 is found at the shrub-herbs-woody plant vegetation levels. The high value indicates that each vegetation level in the in-situ area has high diversity. The more species found, the larger the species richness index (Suprapto, 2015). The quantity of species in the field determines the magnitude of the species richness index (Baderan et al., 2021). Table 2 shows low species richness index values at each vegetation level. This means that the species diversity in the ex-situ area is low. The value of the species richness index is influenced by the total number of individuals found in a specific area, even if the number of species found is the same (Santosa et al., 2008).

The diversity and richness of flora in the in-situ area are higher than in the ex-situ area. The high values are due to the suitability of the growing conditions for each species and efforts to enrich the existing species, especially fruit-bearing trees, and other beneficial types. On the other hand, the low diversity index in the ex-situ area indicates that the ecosystem condition is less preserved due to ecological pressure factors. Ecological pressure can affect the stability of an ecosystem (Mokodompit et al., 2022). The ecological pressure in the Tirta Ayu Beach area is caused by being a popular tourist destination, which undoubtedly has a significant impact on the environment and poses a threat to the future state of the ecosystem.

b. Fauna Communities

The ecological index of fauna communities is measured in five classes: Malacostraca, Pisces, Aves, Herpetofauna, Mammalia, and Insect. The ecological index of fauna for both in-situ and ex-situ areas for each class can be seen in Table 3 and Table 4.

Table 3. Fauna Ecology Index In-situ

Class	Number of Species	H’	E	C	R
Malacostraca	28	1,174	0,399	0,283	1,501
Pisces	489	1,725	0,586	0,199	0,969
Aves	462	1,921	0,653	0,212	1,956
Herpetofauna	44	1,398	0,475	0,316	1,585
Mamalia	32	0,746	0,253	0,599	0,865
Insecta	768	3,601	1,223	0,032	6,472
Total	**1823**				

Table 4. Fauna Ecology Index Ex-situ

Class	Number of Species	H’	E	C	R
Malacostraca	50	0,729	0,248	0,618	0,798
Pisces	30	1,243	0,422	0,404	1,47
Aves	257	0,618	0,209	0,562	0,557
Herpetofauna	25	0,855	0,29	0,298	1,243
Mamalia	5	0,673	0,229	0,520	0,621
Insecta	1149	1,127	0,383	0,401	1,437
Total	**1516**				

Based on Tables 3 and 4, the diversity index values in the in-situ area are higher compared to the ex-situ area. However, most animal classes in the in-situ area are in the low category, except for the Insecta class, which is in the moderate category. The diversity index value is influenced by several factors, such as food availability, shelter conditions, breeding grounds, and threats to animal survival (Tharo et al., 2021). Diversity is also affected by the vegetation type that can provide food sources and protection (Azhari et al., 2018). The low diversity of fauna species is due to the area's densely populated habitat with human activities, so only certain species tolerant to human presence can thrive (I. A. Putri & Allo, 2009).

The evenness index's value can depict a community's stability (Srigandono & Tjahyono, 1993). The smaller the value, the more uneven the distribution of organisms in a community dominated by certain species (Daget, 1978). Table 3 shows higher evenness index values compared to Table 4. This is evidenced by the high evenness index values in the aves and insect classes and the moderate category in the Pisces and herpetofauna classes in the in-situ area. This means that the area has a good distribution of animals in the Aves, Insects, Pisces, and Herpetofauna groups.

Table 3 also shows low dominance index values for each class, except for mammals. A low dominance index indicates no species dominating the community (Srigandono & Tjahyono, 1993). On the other hand, Table 4 shows moderate dominance index values for the Malacostraca, aves, and mammalia classes. This value indicates the dominance of certain malacostraca, aves, and mammalia species over others (Ludwig & Reynold, 1988) in the ex-situ area.

Based on Table 3, the insect richness index value falls into the high category. This value indicates that the in-situ area has a high diversity of insect species. The more species found in a community, the higher the species richness index (Magurran, 1988). A community has high species diversity when composed of numerous species with similar or nearly equal abundance of each species (Pratiwi, 2010). Although the insect species richness index is high, it is not the case for other animal groups categorized as low. Land use change is suspected to be one of the reasons for the low diversity and abundance of animal species.

The Tirta Ayu Beach area, which has been turned into a recreational and educational site, is the only issue. The change in beach function can alter the habitat for some herpetofauna. Leaf litter, typically used as a habitat, protects from predators, nesting sites, and shelter (J. Vitt & Caldwell, 1994). Decreased or lost populations of herpetofauna indicate changes in environmental quality. Disturbances to animal shelter areas are also a critical factor in the survival of mammals since mammals are known for their sensitivity to disturbances (Mustari et al., 2011). Mammals tend to avoid areas with external disturbances, such as human activities.

Tables 3 and 4 show that the species evenness index value in the in-situ area is higher than the ex-situ area for each class. This indicates a more even distribution of animals in the in-situ area. Species evenness is influenced by competition for available resources, such as food availability (Wiens, 1989). Evenness can be used as an indicator of dominance among each species present in the community (Santosa et al., 2008). The value of the species dominance index in the ex-situ area is higher than in the in-situ area for each class. Widyastuti (2017), revealed that dominance value is inversely related to evenness value. When dominance value increases, evenness value decreases, and vice versa. The highest dominance index value in the ex-situ area is obtained for the malacostracan class, indicating that this class dominates over other species.

2. Dominant of Species and Conservation status

a. Flora

The dominant species of flora and their conservation status found in the in-situ and ex-situ areas can be seen in Table 5 and Table 6, respectively.

Table 5. The Dominant Species of Flora in the In-Situ and Ex-Situ Area

Location	Level of Vegetation	Name of Species	Local Name	Number of Species
In-situ	Ground-level plants	*Cyperus rotundus*	Rumput Teki	500
	Shurbs-Herbs-Woody	*Ixora javanica*	Soka Jawa	145
	Tree plants	*Samanea saman*	Trembesi	82
Ex-situ	Ground-level plnats	*Cyperus rotundus*	Rumput Teki	2630
	Shurbs-Herbs-Woody	*Wedelia biflora*	Seruni Laut	290
	Tree plants	*Casuarina equisetifolia*	Cemara Laut	538

Based on Table 5, the most found species are the *Samanea saman* or Saman tree (Trembesi) (Figure.5a). The Saman tree is well-suited to growing in the area because its canopy provides shade, absorbs carbon dioxide (CO_2) at a rate of 28,488.39 kg CO_2/tree/year (Sofyan & Riniarti, 2014), and absorbs water quickly (Prasetio et al., 2021). On the other hand, the *Casuarina equisetifolia* (Figure.5b), also known as the Casuarina or Sea pine tree (Cemara laut), is the dominant species in the coastal area. The Casuarina tree has a root system that can withstand wind and tidal impact (Alisani et al., 2022). Coastal areas with poor water and nutrient availability remain suitable habitats for Casuarina trees. The mutualistic symbiosis between Casuarina roots and Frankia bacteria enables the roots to fix nitrogen directly, thus enhancing soil nutrient availability (Tuheteru & Mahfudz, 2012).

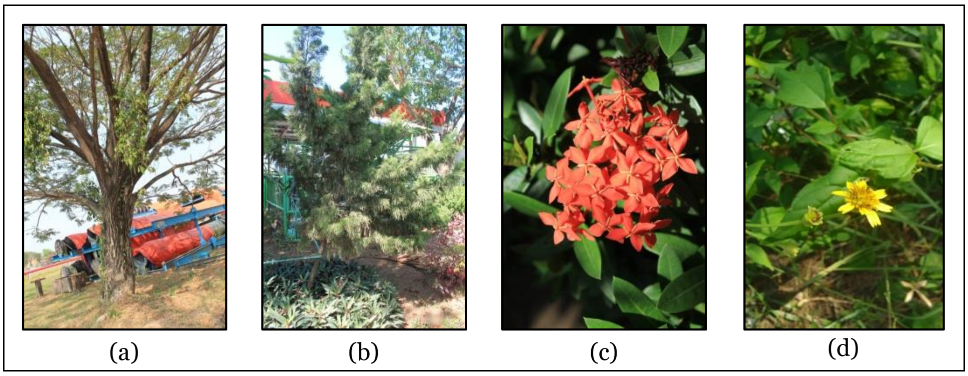

Figure 5. (a) *Samanea saman*, (b) *Casuarina equisetifolia*, (c) *Ixora javanica*, (d) *Wedelia biflora*
Source: privat doc.

Table 5 also shows the presence of shrub vegetation in the in-situ area dominated by Ixora javanica, commonly known as Soka Jawa (Figure.5c). The abundance of Soka plants aligns with the ecosystem in the in-situ area. The thick, rigid leaves and high leaf density can effectively reduce noise levels (Putri & Natalina, 2022). Additionally, the presence of Soka plants contributes to the abundance of butterfly species since it serves as both a host plant and a food plant (Mas' ud et al., 2019). A host plant is a host for caterpillars (larvae), while a food plant is a food source for adult butterflies. If either or both of these components are absent, the butterflies cannot survive in the wild

(Dendang, 2009). Meanwhile, the most abundant shrub in the ex-situ area is *Wedelia biflora* (Figure.5d), also known as seaside daisy, with a quantity of 290. Seaside daisy (Seruni laut) has a wide distribution range and can adapt to high-salinity areas. It can also prevent coastal erosion due to its deep root system.

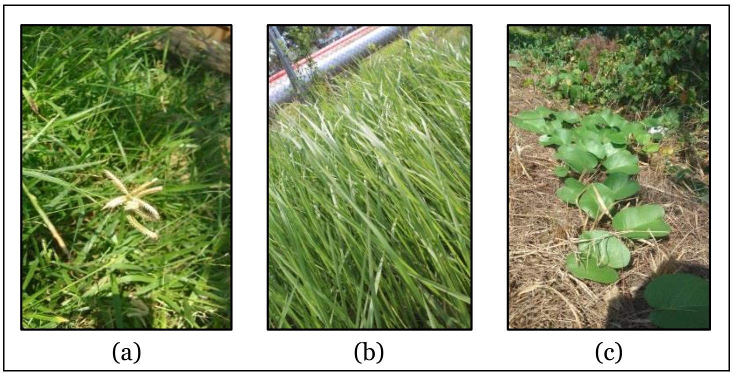

Figure 6. (a) cyperus rotundus, (b) *Imperata cylindrical*, (c) *Ipomoea pes-caprae*
Source: privat doc.

Based on Table 5, the most abundant ground-level plants are beach *Cyperus rotundus* (Figure 6.a) and *Imperata cylindrical* or cogon grass (Figure 6.b). Meanwhile, Table 5 shows two species with the highest quantity: *Ipomoea pes-caprae* or beach morning glory (Figure 6.c) and nut grass (*Cyperus rotundus*). Beach morning glory and cogon grass are classified as weed plants with a wide distribution because they can adapt to various soil types (Pranasari et al., 2012). Their ability to release allelochemicals allows them to survive in any condition (Parida & Das, 2005). On the other hand, nut grass is shoreline vegetation that can adapt to extreme conditions such as high salinity soil, high soil temperature, low nutrient content, and storm disturbances (Devall & Thien, 1992).

Table 6. The Conservation Status of Several Flora

Name of Species	Local Name	Location	Conservation Status		
			IUCN	CITES	P106/2018
Pinus merkusii	Pinus	In-Situ	VU	NA	Unprotected
Swietenia mahagoni	Mahoni	In-Situ	NT	NA	Unprotected
Saraca asoca	Asoka Kuning	In-Situ	VU	NA	Unprotected
Beaucarnea recurvata	Nolina	In-Situ	CR	App II	Unprotected
Nerium oleander	Oleanders	In-Situ	LC	NA	Unprotected
Bougainvillea glabra	Bugenvil	Ek-Situ	LC	App II	Unprotected
Rhizophora apiculata	Mangrove	Ek-Situ	LC	NA	Unprotected
Mangifera indica	Mangga	Ek-Situ	DD	NA	Unprotected
Carica papaya	Pepaya	Ek-Situ	DD	NA	Unprotected
Syzygium myrtifolium	Pucuk Merah	Ek-Situ	-	NA	Unprotected

This baseline assessment also examined the conservation status of flora and fauna. Based on Table 6, several plants were found to be in the near-threatened status (NT), including mahogany (*Swietenia mahagoni*). The data also showed species classified as vulnerable (VU) and critically endangered (CR). Species classified as vulnerable include yellow ashoka (*Saraca asoca*) and pine

(*Pinus merkusii*). Meanwhile, the species classified as critically endangered are Nolina (*Beaucarnea recurvate*).

Conservation efforts must be undertaken, considering the presence of several plant species classified as critically endangered, vulnerable, and near-threatened. One of the efforts that can be made is the inventory of green open spaces in the PT Pertamina Patra Niaga ITB area, specifically focusing on adding the inventory of plants that fall into the endangered or rare status. The inventory of green open spaces aims not only to preserve and enhance the diversity of plant species but also to serve as a carbon emission sink in the area. Similar efforts should also be carried out in the Pantai Tirta Ayu area. Although all plant species found there are classified as low risk (LC), conservation efforts should still be implemented to preserve and stabilize biodiversity.

b. Fauna

The dominant species of fauna found in the in-situ and ex-situ areas can be seen in Table 7 and Table 8, respectively.

Table 7. The Dominant Species of Fauna in the In-Situ and Ex-Situ Area

Location	Class	Name of Species	Local Name	Number of Species
In-Situ	Malacostraca	*Gecarcinucoidea*	Yuyu	11
	Pisces	*Barbodes binotatus*	Ikan Wader	142
	Aves	*Passer montanus*	Burung Gereja	181
	Herpetofauna	*Hemidactylus mabouia*	Cicak Rumah	21
	Mamalia	*Hipposideros*	Kelelawar	24
	Insecta	*Rhopalocera*	Kupu-kupu	300
Ex-Situ	Malacostraca	*Sesarma spp*	Wideng	33
	Pisces	*Oxudercinae*	Ikan tembakul	18
	Aves	*Passer montanus*	Burung Gereja	150
	Herpetofauna	*Calotes versicolor*	Bunglon Taman	11
	Mamalia	-	-	-
	Insecta	*Dolichoderus thoracicus*	Semut Hitam	480

Based on Table 7, three groups of animals are most commonly found: insects, birds (Aves), and fishes (Pisces). Many butterflies (Figure 7.a) are the most abundant species, indicating that the in-situ environment is still natural. Butterflies can be used as indicators of environmental quality (Mas' ud et al., 2019). The presence of butterflies depends heavily on the carrying capacity of their habitat, which includes host plants and food plants (Shalihah et al., 2012).

The bird group (Aves) is the second most commonly found animal in the in-situ area. The abundance of birds can be used as an indicator of environmental changes. Birds can decide about strategic plans in broader environmental conservation (Bibby et al., 1998). The ability of sparrows (Figure 7.b) to associate closely with humans live in groups, and forage on the ground is believed to be one of the reasons why sparrows can survive in significant numbers (Mackinnon & Rahardjaningtrah, 2010). In addition to the insect and bird groups, Table 7 shows many fish species

(Pisces) that were found. The wader fish (Figure 7.c) is the most abundant species, and its presence can suppress mosquito growth (Firmansyah et al., 2015) and adapt to various water conditions (Lesmana & Dermawan, 2001).

Table 7 shows the three most commonly found animal groups: insects, aves, and malacostraca. The black ant (Figure 7.d) is the most abundant species. The presence of abundant black ants can maintain and improve soil fertility because they can break down leaf litter by consuming it (Hanafiah, 2007), decompose organic matter in the soil to provide nutrients (Adianto, 1980), and serve as a food source for lizards, small predator mammals, insect-eating birds, and arthropods (Borror et al., 1997).

Figure 7. (a) *Rhopalocera*, (b) *Passer montanus*, (c) *Barbodes binotatus*, (d) *Dolichoderus thoracicus*, *(e) Sesarma spp (source: privat doc.)*

The second most commonly found animal group is aves, especially the house sparrow (*Passer montanus*). The ability of the house sparrow to associate closely with humans is suspected to be one of the reasons why it can thrive in large numbers in the area of Pantai Tirta Ayu as a tourist destination (Mackinnon & Rahardjaningtrah, 2010). Malacostraca is another animal group found in considerable numbers, particularly the *Sesarma spp* or fiddler crabs (Wideng) (Figure 7.e). The burrowing activities of fiddler crabs are necessary to supply water and oxygen to the sand and mud (Cannicci et al., 2008) and are also crucial for bioturbation (Retraubun et al., 1998).

Table 8. The Conservation Status of Several Fauna

Name of Species	Local Name	Location	Conservation Status		
			IUCN	CITES	P106/2018
Oreochromis mossambicus	Ikan mujair	In-Situ	VU	NA	Unprotected
Agapornis lilianae	Love Bird	In-Situ	NT	App II	Unprotected
Gekko gecko	Tokek	In-Situ	LC	App II	Unprotected
Varanus salvator	Biawak Air Tawar	In-Situ	LC	App II	Unprotected
Asio otus	Burung Hantu Telinga Panjang	In-Situ	LC	App II	Unprotected
Garrulax leucolophus	Burung Poksay	In-Situ	LC	App III	Protected
Herpestes javanicus	Garangan	In-Situ	LC	App III	Unprotected
Nisaetus cirrhatus	Burung Elang Brontok	Ex-Situ	LC	App II	Protected
Dendrelaphis caudolineatus	Ular Colubrid	Ex-Situ	LC	NA	Unprotected
Evania appendigaster	Tawon Bendera	Ex-Situ	DD	NA	Unprotected

Tables 8 list several animals under the conservation status is protected. The Lilian's lovebird (*Agapornis Liliana*) is categorized as near threatened (NT), and the Mozambique tilapia (*Oreochromis mossambicus*) is categorized as vulnerable (VU). The Brontok Eagle (*Nisaetus cirrhatus*), water monitor lizard (*Varanus salvator*), gecko (*Gekko gecko*), Lilian's lovebird (*Agapornis lilianae*), and long-eared owl (*Asio otus*) are also listed under Appendix II. Additionally, the small Asian mongoose (*Herpestes javanicus*) and white-crested Poksay (*Garrulax leucolophus*) are listed under Appendix III. It is also known that the Brontok eagle (*Nisaetus cirrhatus*) and white-crested Poksay (*Garrulax leucolophus*) are included in the list of Protected animals according to the Minister of Environment and Forestry Regulation No. P.106/Menlhk/Setjen/Kum.1/12/ 2018. The observation results indicate that several animals in the aves, herpetofauna, and mammalian groups are included in the conservation status. Therefore, conservation efforts are needed to preserve these animals.

CONCLUSION

The Baseline Assessment is the initial and essential step in protecting biodiversity as part of the PROPER evaluation. Based on the ecological index, the diversity, evenness, dominance, and richness of flora and fauna in the in-situ and ex-situ areas fall into low, moderate, and high categories. PT Pertamina Patra Niaga Integrated Balongan is committed to preserving biodiversity through diverse plantings and conservation efforts for endangered flora and fauna, aiming to maintain environmental balance. The data and information regarding this status serve as the foundation for policy setting, planning, and the implementation of biodiversity protection programs in the future.

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