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DEVELOPMENT OF ECOTOURISM IN THE MANGROVE AND PROBOSCIS CONSERVATION AREA OF TARAKAN CITY - NORTH KALIMANTAN, INDONESIA

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Abstract

Mangrove and Proboscis Conservation Area (MPCA) is a mangrove ecosystem and rehabilitation site for proboscis monkeys in Tarakan City, North Kalimantan Province, Indonesia. This location is an ecotourism destination in Indonesia with sub-optimal management. This study aims to develop MPCA ecotourism through several analyses, including suitability analysis as an ecotourism destination, carrying capacity analysis, and analyzing ecotourism concepts and master plans. The results showed that 91% of the total MPCA area was suitable as an ecotourism area. Activities that can be developed are tracking mangroves and proboscis monkeys with a carrying capacity of 203 people per day, bird watching with a carrying capacity of 194 people per day, river boating, and beach recreation with a carrying capacity of 382 people per day. The MPCA ecotourism destination has a maximum capacity of 90 visitors per hour or 1,170 people per day. This research also resulted in 9 management strategies that can be implemented in the development of ecotourism in Tarakan City MPCA. The formulation of the master plan is focused on the design and placement of 13 facilities and infrastructure to support the achievement of an ecotourism area that is comfortable for visitors and sustainable.

Keywords*: Ecotourism; Carrying capacity; Conservation area; Suitability of tourism; Proboscis; Mangrove; Masterplan*

Introduction

Mangrove forests, as natural ecosystems, have essential ecological functions and high economic value [1]. This forest is also a rare ecosystem in the world because it covers only 2% of the earth's surface[2, 3]. Mangrove ecosystems are open access, fragile, and vulnerable to environmental changes. Behind its fragility, the mangrove ecosystem also has environmental services that can optimize the benefits of its natural beauty as an ecotourism destination without damaging the ecosystem [4, 5]. According to Yulianda [6], and Cahyono, Yulianda and Samosir [7], the concept of ecotourism development can maintain the sustainability of the ecological process [8]. According to Beaumont [4] and Lacher *et al.* [8], ecotourism is an alternative to improve community welfare. Ecotourism is also a method that government institutions and environmental managers can use to provide job opportunities for local communities [9].

Nature-based tourism development is one of the alternatives to overcome resource utilization problems that can threaten its sustainability [10].

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One of the mangrove ecosystems that can be developed for ecotourism is the 9 Ha Mangrove and Proboscis Conservation Area (MPCA) in Tarakan City, Tarakan Island, North Kalimantan Province, Indonesia. MPCA safeguards began in 2001 through the Mayor of Tarakan's Decree Number 591/HK-V/257/2001 with an area of only 3ha. In 2002, efforts to protect its habitat were regulated in the Regional Regulation of the City of Tarakan Number 04 of 2002. On June 3, 2003, it was inaugurated as a conservation area and as a Nature Reserve Area, City Green Open Space, and Nature Tourism (Regional Regulation Number 04 of 2012 concerning Spatial Plans for the City of Tarakan in 2012 – 2032. The management authority was transferred from the City Government of Tarakan to the Tourism Office of the Provincial Government of North Kalimantan) to implement the Law of Republic of Indonesia Number 23 of 2014.

Although MPCA already has regulatory provisions, it still requires management integration to optimize its utilization because there are complex and interrelated environmental aspects. It is because MPCA, which has mangrove and proboscis's monkey conservation function, is located downtown and is surrounded by dense settlements. Moreover, the involvement of the surrounding community in ecotourism activities is still low, cooperation with parties who play an important role is still insufficient. Besides, visitors' understanding of ecotourism is still low. As a result, there is a systematic destruction of mangroves, dumping of garbage and waste around the site. Even the carrying capacity of the MPCA to the current number of visitors is still unknown. Based on these problems, this requires a concept of developing MPCA as an ecotourism destination. This study aims to analyze the biophysical conditions, suitability and carrying capacity as ecotourism, and development strategies and formulate the concept of the master plan.

Materials and Methods

Study Area

The study was conducted at the MPCA, which is located in Karang Rejo Village, West Tarakan District, Tarakan City, North Kalimantan Province, Indonesia (Fig. 1).

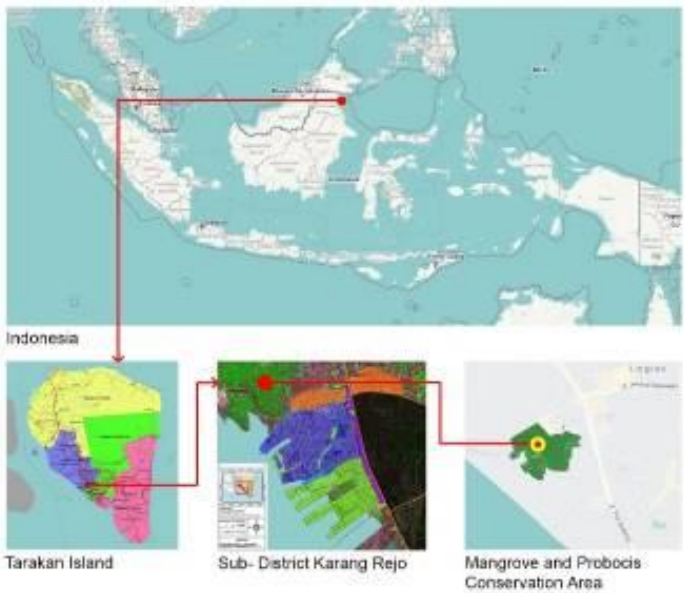

Fig. 1. Tarakan City MPCA Ecotourism Research Locations

Geographically it is located at the position of 3°14'30"-3°25" North Latitude and 117°31'45"-117°38" East Longitude. The study area is 9 hectares. The MPCA area is in the center of Tarakan city, and there are traditional markets, Ramayana modern shopping center - Gusher Plaza, and hotels to the east of the site. In the north, it is directly adjacent to Jalan Gadjah Mada, the sub-terminal of the City Transportation and the residential areas of the Karang Anyar Pantai Village. In the western part, it is bordered by the Tengkayu II Fishery Port area, Fish Auction Place, Fish Processing industrial area, and Cold Storage.

Data collection

The data used in this study consisted of primary and secondary data. Primary data were collected through direct observation in the field by measuring the biophysical potential of the MPCA and interviewing visitors and local communities with a questionnaire. Secondary data collection is traced from research results, laws and regulations, and supporting documents issued by related institutions. The type of data collected was made into four groups according to the aspects studied (Table 1).

Table 1. Types and Data Collection Methods

No	Study Objectives	Data Types	Data Source	Method Of Collecting Data
1.	Analyzing the suitability of the MPCA ecosystem for ecotourism activities	Density, thickness, species, important value of mangroves, and fauna, especially probosci's monkeys	MPCA Ecosystem	Field Survey
2.	Calculating the carrying capacity and design of the MPCA ecosystem for ecotourism activities	areas that can be used for ecotourism activities at MPCA	The suitability of the MPCA ecosystem	Measurement of potential locations and areas for MPCA ecotourism activities
3.	Formulate the MPCA ecotourism concept and master plan	Strength, Weakness, Opportunity, and threat at MPCA ecosystem.	MPCA ecotourism conditions	Do observation and interviews of respondents who are visitors and the community in the MPCA area.

Vegetation and animal data collection is carried out using the plotting line method. The direction of the line of observation is perpendicular to the coast inland. In each mangrove zone located on each line transect, square plots are placed with a size of 10 x 10m for the tree level (diameter > 4cm), 5 x 5m for the sapling level (1.5 - 4cm), 2 x 2m (seedlings or understored), and the distance of each mangrove zone is 50m (Fig. 2).

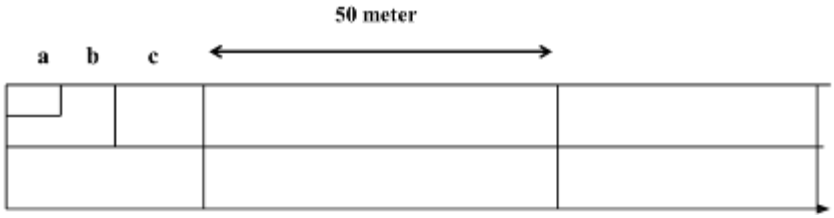

Fig. 2 Sampling plot
Where: a. 2 x 2m plot for seedling level; b. 5 x 5m plot for the stake level;
c. A plot of 10 x 10m for the tree level

Mangrove density data are taken at tree-level plants with a diameter of > 10cm. The observed parameter is the number of trees per sample plot area. Thickness measurements are carried out using spatial analysis by drawing the initial line of vegetation near the coast to the final boundary on land. For mangrove species data, it is obtained by identifying trees in the sample plots. Data on species, number of individuals, and diameter of mangrove trees are recorded on the form, then processed to obtain species density, species frequency, area of cover, an important value of species, and species diversity [11, 12].

Determination of the suitability of ecosystem tourism is carried out by dividing the area into several station zones, considering that not all areas have the same suitability status. Determination of the carrying capacity for ecotourism activities is determined through several things, including calculating the area to be used for ecotourism activities, the length of time it opens in a day, and the time required for each visit. To formulate a development strategy and formulation of the ecotourism master plan, MPCA collected internal and external data that affect ecotourism. The visitor perception data is collected through interviews with tourist respondents determined by purposive sampling, as much as 5% of the average daily visitors. Meanwhile, the perceptions and preferences are collected through interviews regarding the understanding of ecotourism and participation in ecotourism development activities. Respondents are determined by purposive sampling from the population in Karang Rejo Village (1,864 people) to obtain a sample size of approximately 95 people.

Tourism Suitability Index Analysis and Analysis

Ecosystem suitability aims to obtain an overview of the development direction of the MPC so that it remains by natural conditions and is based on existing potentials. The calculation of the Tourism Suitability Index (TSI) uses the following formula

$$\text{TSI} = \sum \left(\frac{V_i}{V_{Max}} \right) x\ 100\% \quad (1)$$

where: TSI: Tourism Suitability Index; Vi: Parameter Value-i (weight x score); V $_{max}$: The Maximum Value of an Ecotourism Category.

Table 2 Tourism Suitability Matrix for Coastal Ecotourism

Num	Parameter	Value	S1 category	score	S2 category	score	S3 category	score	NS category	score
1	Mangrove thickness (m)	5	>500	3	>200 - 500	2	50-200	1	<50	0
2	Mangrove Density (per 100 m2)	3	>15-20	3	>10 – 15 & >20	2	5-10	1	<5	0
3	Types of mangroves	3	> 5	3	3-5	2	1-2	1	0	0
4	Ebb and flow	1	0-1	3	>1-2	2	>2-5	1	> 5	0
5	Fauna Object	1	Fish, shrimp, crab, molluscs, reptiles, birds	3	Fish, shrimp, crab, molluscs	2	Fish, molluscs	1	One of the aquatic fauna	0

Source: Author 2020, Yulianda, 2020.
Where: Maximum value: 39; S1 (very suitable): the value between 75%-100%; S2 (suitable): the value between 50% - <75%; S3 (appropriate but conditional): the value between 25%- <50%, and NS (not suitable): the value is < 25%

Carrying capacity analysis is the maximum number of tourists that can be accommodated at a specific time and area without causing damage to resources or humans [6], which can be calculated using the following formula:

$$CCA = K\ x\ \frac{A_p}{A_t}\ x\ \frac{T_t}{T_p} \quad (2)$$

where: CCA = Carrying Capacity of Area; K = Potential Ecological visitors per area unit; Ap = Area or Length of the usable area (m or m^2); At = Area or Length unit for a specific category (m or m^2); Tt = time provided by the ecosystem for ecotourism activities in one day (hours); Tp = time spent by visitors for any particular activity (hours).

Space requirements will determine the size of the facilities that need to be built to serve the needs of tourists. There are several individual standards used to determine the carrying capacity of visitors to the ecotourism area, including (1) carrying capacity where the area of land used is divided by the average individual standard; (2) total visitors per day where the carrying capacity is multiplied by the turnover coefficient; and (3) the cycle coefficient is equal to the number of hours per day divided by the average visit time.

Potential and SWOT analysis

The analysis of ecotourism potential is analyzed based on several parameters: the attractiveness of beauty, the uniqueness of natural resources, market potential, relationships and accessibility, environmental conditions, socio-economy, and community services. In addition, there are also parameters of the influence of climate on visit time, the number of hotel rooms within a 15km radius of the object, the completeness of supporting facilities and infrastructure, the availability of clean water, security guarantees, and relationships with other ecotourism [13]. The overall assessment resulted in the criteria of being very feasible, feasible, decent enough, less viable, and not viable [14]. Then proceed with analyzing the strategy of MPCA management policies for the City of Tarakan using a SWOT analysis.

Results and discussion

MPCA ecosystem conditions

The MPCA area of Tarakan City, covering an area of 9 ha, is managed by the Provincial Government of North Kalimantan. The study area is an integral part of the conservation area next to it (covering an area of 12ha), which the Tarakan City Government manages (Fig. 3).

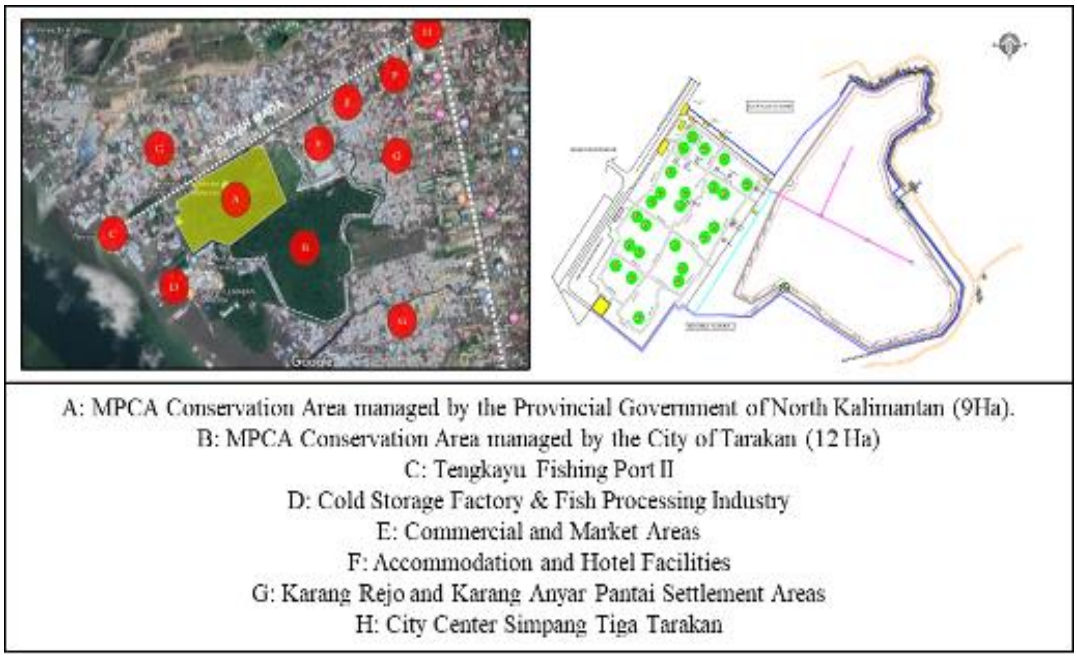

Fig. 3 Map of MPCA Area in Tarakan City

The MPCA ecosystem, which is still maintained naturally, positively impacts the wealth of flora and fauna. However, the sustainability of the MPCA ecosystem can also be threatened because it is located downtown and is located between dense settlements. MPCA is located between Karang Rejo Village, Karang Anyar Pantai Village, and Selumit Pantai Village and is also surrounded by various fast-growing urban facilities. Threats to the sustainability of the

MPCA ecosystem also exist due to the disposal of plastic waste and the destruction of mangrove plants. Currently, ecotourism activities at MPCA are already running, but the management is not optimal. The existing facilities and infrastructure are also not representative. Many are not well maintained and are damaged so that it becomes visual pollution.

Mangroves and Fauna at MPCA Tarakan City

The mangrove ecosystem in MPCA consists of 6 families and 13 species, most of which are dominated by the Rhizophoraceae, Sonneratiaceae, and Aegiceraceae families.

At the station - zone 1, there are five families with seven types of mangroves (dominated by *Rhizophora apiculata*, and *Sonneratia alba*). Meanwhile, mangroves in zone 2 were more varied, namely six families and 13 species with the highest number of *Rhizophora apiculata*, then *Bruguiera gymnorrhiza*, *Sonneratia alba*, *Xylocarpus granatum*, and *Aegiceras corniculatum*. Finally, at station - zone 3, there are five families and nine types of mangroves with the highest number of *Rhizophora apiculata*, then *Aegiceras corniculatum*, *Bruguiera parviflora* and *sonneratia alba*.

Rhizophora apiculata and *Sonneratia alba* have an important role in the formation of the mangrove ecosystem as shown by IVI (Cavalcanti et al, 2009). *Rhizophora apiculata* has IVI of 99.93 - 166.47% and *Sonneratia alba* (33.36 - 66.07%). At station - zone 1, *Rhizophora apiculata* has the highest IVI (160.47%) and Sonneratia alba (66.07%). In zone 2, the plant species with the highest IVI is *Rhizophora apiculata* (99.93%), other species are evenly distributed, among other species the highest is *Sonneratia alba* (33.36%). At zone 3 stations that has the highest IVI are Rhizophora apiculata (110.29%), and then *Bruguiera parviflora* (40.44%) and *Sonneratia alba* (38.86%) (Table 3).

Table 3. Spread & Mangrove Important Value Index (IVI) at Station-Zones at MPCA

No	Species Mangrove	Mangrove & Proboscis Conservation Area Tarakan City											
		Station-Zone 1				Station-Zone 2				Station-Zone 3			
		Var	Sd	f	IVI	Var	Sd	f	IVI	Var	Sd	f	IVi
1	*Rhizophora apiculata*	****	98,04	83,33	160,47	****	27,94	41,67	99,93	****	65,11	44,44	110,29
2	*Rhizophora mucronata*	**	1,96	16,67	15,78	*	1,47	8,33	4,93	**	4,65	11,11	890
3	*Bruguiera gymnorrhiza*	-	-	-	0	***	2,94	8,33	29,02	*	-	-	6,37
4	*Bruguiera sexangula*	-	-	-	0	**	1,47	8,33	20,82	-	-	-	0
5	*Bruguiera parviflora*	-	-	-	0	*	55,88	16,67	5,39	***	23,25	33,33	40,44
6	*Bruguiera cylindrica*	-	-	-	0	**	2,94	8,33	23,66	**	-	-	23,01
7	*Avicennia marina*	**	-	-	10,32	**	-	-	9,91	-	-	-	0
8	*Avicennia lanata*	**	-	-	15,57	*	-	-	5,20	**	-	-	9,69
9	*Avicennia alba*	-	-	-	0	**	7,35	8,33	20,73	**	6,97	11,11	32,48
10	*Sonneratia alba*	***	-	-	66,07	***	-	-	33,36	***	-	-	38,86
11	*Xylocarpus granatum*	-	-	-	0	***	-	-	18,93	-	-	-	0
12	*Nypa fruticans*	**	-	-	12,35	*	-	-	4,52	-	-	-	0
13	*Aegiceras corniculatum*	**	-	-	19,41	***	-	-	23,57	***	-	-	29,94
	Total				300				300				300

Additional: - = no plants; * = there are plants; ** = little vegetation; *** = quite herbs; and **** = many plants. IVI = Importance Value Index; Sd = Species density; f = frequency of species.

The land fauna in the MPCA area consists of insects, snakes, primates and aves that live and adapt to tall trees. There are two types of aquatic fauna, namely: those that live in the water column (fish and shrimp), and those that occupy the substrate (roots and trunks of mangrove trees, mud), such as crabs, shellfish and other types of invertebrates. The dominant mammals are proboscis monkey (*Nasalis larvatus*), black monkey *(Trachypithecus villosus)* and beaver *(Aonyx cinerea)*. Proboscis monkeys are the rehabilitated mammals in this area. The behavior of proboscis monkeys in the morning and evening towards the coast, and during the day gather in the middle of the MPCA mangrove forest is an interesting tourist attraction.

The aves animal in the MPCA area consists of 24 species, including protected bird species namely the honey bird (*Anthreptes simplex, Anthreptes singalensis*, and *Sturnus sinensis*). The large number of bird species that exist indicates that the MPCA ecosystem is a suitable habitat for bird animals (Fig. 4). Ecomical fish species found include: *Sphyraena sp, Plotosus sp, Macrones gulio, Chanos chanos, Otolithoides biaurthus, Dendrophysa russeli, Eleunthronema sp, Mugil sp, Lates sp, Therapon jarbua, Siganus spp, Epinephelus sp, Lujanus sp.,* and *Harpodon neherius*. Meanwhile, the dominant crustaceans are crabs (*Scylla serrata, Sesama sp., Parasesamar plitcata, Metaplax sp.*, and *Uca sp*.) and shrimp (*Panaeus monodon, Penaeus merguensis, and Metapeneaus sp*). The types of reptiles found were *Varanus salvator, Crocodililus porosus, Aipysursus eydouxii, Acrochardus granulants, Cerberus Rhncops*, and *Myron Richarsonii*.

Fig. 4. MPCA landscapes with endemic fauna (colored crab and proboscis monkey)

The Potential of Tarakan City MPCA Ecotourism

The elements of MPCA's ecotourism potential that are studied consisted of: (a) attractiveness, (b) market potential, (c) level of affordability, (d) environmental conditions, (e) availability of clean water, (f) condition of lodging (accommodation), (g) supporting infrastructure and facilities, (h) climatological conditions, (i) security, and (j) relationships with other tourist objects.

The elements of attractiveness analyzed are natural beauty, the abundance of prominent resources, uniqueness, integrity and sensitivity of natural resources, choice of recreational activities, scarcity, diversity, cleanliness of the location, and the vulnerability of the area. The natural beauty of MPCA is demonstrated by the view of the lush mangrove forest, which creates a soothing impression. The diversity of mangrove flora and fauna (proboscis monkeys, birds, colored crabs, snakes, crocodiles, lizards, beavers, and black monkeys) is unique. It is the rehabilitation site for the 42 proboscis monkeys.

The level of tourism needs of the residents of Tarakan and North Kalimantan continues to increase. This condition increases with per capita income, welfare, and the level of saturation. As a small island, the city of Tarakan makes its people experience a high level of saturation, especially when the hot air temperature increases the residents' desire to find a comfortable place for relaxation in their spare time. Domestic visitors mostly come from the city of Tarakan itself, followed by the population of North Kalimantan (Bulungan, Tana Tidung, Nunukan, Malinau districts), and Berau (East Kalimantan). At the same time, those from abroad are still relatively small. It is necessary to increase promotion at the regional, national, and international

levels to increase visitors. The elements analyzed in the level of affordability relationship are road conditions, the number of motorized vehicles, the frequency of public vehicles from the center of tourist distribution to the MPCA ecotourism object, and the number of public transportations to the nearest tourist distribution center

The transportation system in Tarakan City includes land, sea and air transportation. The sea transportation used to get to the MPCA location is a speed boat through Tengkayu II Port, which is 400 meters away. Domestic flight routes from Juata Airport connect Tarakan City with the provincial capitals of North Kalimantan (Tanjung Selor), Nunukan, Berau, Malinau, Balikpapan, Samarinda, Palu, Kendari, Makassar, Manado, Surabaya and Jakarta. Meanwhile, international flight routes to Malaysia and the Philippines. Thus, accessibility to the MPCA ecotourism object is relatively easy and affordable

The elements of nature and community environmental conditions within a radius of 1 km studied include land use planning, population density, space for visitors, natural mineral resources, human activities, and community attitudes. The research results found that the community strongly supports the development of ecotourism in the Tarakan City MPCA because it provides business opportunities for the local community.

The existence of clean water is an important factor in the development of tourist objects. The elements assessed are the ease with which water can be brought to MPCA, the distance between the water source and the ecotourism object, the discharge of water sources, the feasibility of consumption, and the year-round availability. The source of water for MPCA ecotourism comes from the village of Kampung Bugis, which is 5 km away, with a discharge of 0.33 liters/second. It means that his needs for ecotourism at MPCA are fulfilled. Tourism activities also require accommodation facilities. The number of hotels in Tarakan City is 33, with 1027 rooms. Some star hotels are very close to the MPCA, thus benefiting visitors because the travel time is short.

The role of environmental facilities and infrastructure is for the convenience and satisfaction of visitors. At MPCA ecotourism destinations, ecological infrastructure and facilities such as "JNE, JNT, Custody Kilat," post offices, and Paramadina Hospital are about 1 km away. The traditional market, Ramayana mall, is 200 meters away. ATM and bank facilities are <1 kilometer apart. There are many restaurants and cafes around MPCA and representatives with a variety of traditional and international menus. The existence of such environmental infrastructure and facilities dramatically supports the development of ecotourism at MPCA.

Security in tourist locations is one of the things that must be secured in traveling because it involves the comfort and satisfaction of tourists. The fauna and flora in the MPCA site are not dangerous, and the soil conditions are stable from tectonic shocks, making it safe for visitors. Assessment of its relationship with other tourist objects and their proximity and the number of tourists visiting these attractions is adequate and easy to achieve. Tourists who visit the Tarakan City MPCA continue to experience an increase and rank second so that this area has the potential to be developed (Table 4).

Table 4 Distance of tourist objects and number of tourists visiting tourist attractions in Tarakan City, September 2019 - August 2020

Number	Tourism Object	The distance from downtown	Number of tourists
1	Amal Beach	11 Kilometer	42.700
2	Tour Ride Embung Persemaian	6 Kilometer	7.891
3	**MPCA**	**300 Meter**	**36.843**
4	Oval City Park	3 Kilometer	21.716
5	Karungan Agro-Tourism	10 Kilometer	3.109
6	World War II heritage bunker, Allied Army Reconnaissance Post	20 Kilometer	295

Source: Rencana Induk Pembangunan Kepariwisataan Provinsi Kalimantan Utara (2019)

Based on the results of the analysis of a number of elements and criteria obtained, namely the value of location attractiveness (1.380), market potential (950), level of relationship/accessibility to the research location (1,500), socio-economic, environmental conditions, and local community services (1.325), water availability cleaning at tourist sites (540), availability of location accommodation facilities (90), supporting facilities and infrastructure (120), climatic conditions (520), security in the location area (120) and relations with other tourism objects (120). All of the elements assessed on ecotourism in the Tarakan City MPCA have a total value of 6,665 (Table 5)**.** Based on the results of this assessment, it can be stated that the MPCA in Tarakan City is very suitable to be developed as an ecotourism area.

Table 5 Assessment of MPCA Ecotourism Potential in Tarakan City

Number	Potential Elements of Ecotourism	Rating Score
1	Attractiveness	1380
2	Market potential	950
3	Level of connection / accessibility	1500
4	Natural environmental conditions, social and community services	1325
5	Availability of clean water	540
6	Accommodation	90
7	Supporting facilities and infrastructure	120
8	Climatological conditions	520
9	Security	120
10	Relationship with other tourism objects	120
	Total	**6665**

Based on the results of interviews with 102 respondents from communities around the MPCA, we obtained suggestions and hopes for the development of MPCA ecotourism in Tarakan City. The highest result, the community wants community involvement in management with a percentage value of 21.11%, then the community wants the enrichment of animals in the location with a percentage of 18.89%. Meanwhile, the lowest score is in the suggestions and expectations of the community, which is the irrigation arrangement in the site, and fishpond construction with a percentage of 1.11% (Table 6).

Table 6. Community Preference for Tarakan City MPCA Ecotourism Development

Number	Type of activity	Percentage (%)
1	Involvement of the community around the site	21,11
2	Increased security	2,22
3	Animal enrichment	18,89
4	Promotion increases	6,67
5	Collaboration with travel	2,22
6	Increased tourist attraction	11,11
7	Improved protection and preservation	2,22
8	Increase in the area of the conservation area	16,67
9	Making a guardrail with a permanent construction	6,67
10	Irrigation and drainage arrangements	1,11
11	Rearranging the location of supporting facilities and infrastructure	2,22
12	Provision of a place to sell on the site	3,33
13	Make it a zoo	2,22
14	Fishpond construction	1,11
15	Addition of tourist attractions	2,22
	Total	**100**

Suitability of Ecosystems and MPCA Supporting Capacity for Ecotourism Activities

The mangrove ecosystem in the Tarakan City MPCA has a very high tourism suitability value for ecotourism activities (Fig. 5). Almost all areas are suitable for ecotourism development. The potential and characteristics of the ecosystem have a suitability value as an ecotourism locus ranging from 76.15 - 89.27%. The suitable area is approximately 91% (81,900,000m^2), and the low to moderate suitability value is around 9% (8,100,000m^2). More than 91% of the total MPCA area is very suitable for ecotourism activities. Only the parts bordering Jalan Gajah Mada, the settlements of Karang Rejo Village, Karang Anyar Pantai, and the Tengkayu Fishing Port, Fish Auction Points, and Cold Storage and Fish Processing Industries have low conformity values. However, along the bordering Jalan Gajah Mada area, it can be optimized as the Main Entrance and Introduction Space and the welcome area. It is following the results of research from Yulianda (2020) which states that an area with a tourism suitability level of more than 50% has the potential to be used as an Ecotourism Destination with ecotourism activities adjusted to the potential of available natural resources.

Fig. 4. The existing condition of the Tarakan City MPCA
Source: Researcher's Documentation, 2020

Carrying capacity can be interpreted as the intensity of maximum use of natural resources that continue without destroying nature [6, 7]. The calculation of the physical carrying capacity for ecotourism in the MPCA of Tarakan City is built with the following assumptions: (1) the area is open for 9 hours per day; (2) the area available to visitors is 9 hectares; and (3) if each visit needs 1 hour and the area is opened 9 hours per day, each person can make 9 visits per day.

The carrying capacity of the MPCA ecotourism destination is the area of land divided by the average individual standard (900 000: 666m^2) = 130.With a rotation coefficient of 9 hours/day, the maximum total visitors per day allowed is = 130 x 9 = 1,170 visitors. per day. In every hour, the Tarakan City MPCA ecotourism can accommodate as many as 90 visitors per hour. The carrying capacity of mangrove and proboscis tracking activities in the Tarakan City MPCA ecosystem is currently only 67 people per day. For this reason, the addition and improvement of the design and facilities of the mangrove track need to be done to optimize the carrying capacity and minimize the damage caused by visitors. Besides, additional tracks need to be added so that all ecosystems suitable for ecotourism activities can be utilized optimally.

The track design is determined based on the distance between the tracks and the mangrove typology, and the existing proboscis monkey life niches. The distance between tracks needs to be at least 50 meters. Simultaneously, the mangrove typology that is taken into consideration is the density, type, and morphology of the mangroves in the area. The existence

of the river has also not been used for boating tourism activities. With several potentials, there will be many things that tourists can enjoy while carrying out ecotourism activities in that place.

Apart from tracking mangroves and proboscis, other activities can be enjoyed in the MPCA Ecotourism ecosystem, namely proboscis monkey watching, bird watching, research, and river boating. Boating activities in the Ecotourism area at MPCA are activities aimed at helping visitors or tourists to enjoy the diversity of mangrove flora and fauna jellies (especially proboscis monkeys) through river waterways and take visitors or tourists to the mangrove & proboscis ecosystem in the area. The river tracing/boating activity takes about 1 - 1.5 hours. The activity is open for 8 hours a day so that the river along the boating activity has a carrying capacity of 382 people per day.

MPCA Ecotourism Development Strategy in Tarakan City

To determine the ecotourism destination development strategy in MPCA Tarakan City, a SWOT analysis (Strengths, Weaknesses, Opportunities, and Threats) was carried out based on internal and external aspects.

Based on Table 7, it is necessary to know which strategies should be prioritized for implementation. Then an alternative strategy is prepared in the SWOT analysis by adding up all the weight codes summarized in one management strategy.

From the results of the SWOT analysis, the ecotourism development strategy in the Tarakan City MPCA is formulated as follows: (1) increasing monitoring of the preservation of the mangrove ecosystem; (2) improve service and comfort to visitors; (3) improving the quality of human resources involved in ecotourism activities; (4) Increasing the promotion of ecotourism areas by utilizing all available media; (5) integrating the area of ecotourism area between those managed by the provincial government of North Kalimantan and the city government of Tarakan; (6) increasing intensive supervision and handling of waste; (7) cooperating with various parties to protect locations from pollution; (8) counseling and guidance for local communities to be directly involved in ecotourism and conservation activities; and (9) increasing supervision, maintenance of tourism potential and maintenance of ecotourism facilities.

Master Plan Formulation for MPCA Ecotourism Destinations

The design of the MPCA City Tarakan ecotourism Masterplan is something that needs to be prepared so that its development has a clear objective. Therefore, after analyzing the potential of natural resources and mapping their location, the area's suitability and proper facilities are provided according to their carrying capacity. Then the facility requirements were determined in a master plan design from the MPCA. The formulation of the master plan rests on the concept of MPCA ecotourism development which is beneficial and supports the welfare of the people of Tarakan City and guarantees the sustainability of its ecosystem.

In the MPCA area, there are currently ecotourism facilities in the form of a 120 meter-long track, guard posts, counters, photo booths, relaxing spots & pavilions, towers, quarantines, information centers, greenhouses, places to eat and drink proboscis monkey, and toilets. Almost all of these facilities were built without a concept. Apart from the track tracks, other facilities are in poor condition and are damaged. There is also a river flow along the 1200 meters on the site, which has not been utilized. Based on the minister of tourism and Creative Economy of the Republic of Indonesia Number 3 of 2018, facilities and infrastructure are important indicators in tourism development. Its existence is a basic requirement needed by visitors. Therefore, The formula of the master plan is focused on the design of the facilities and infrastructure. The land-use plan for MPCA supporting facilities for ecotourism activities is only 5,252 m2 (5.8%), the development of which is based on the concepts of zoning, accessibility & circulation, landscape, and architecture.

Table 7. SWOT Matrix for MPCA Ecotourism Development

		Internal Elements	
		Strengths (S)	**Weaknesses (W)**
		1. the beauty of MPCA 2. the uniqueness of MPCA's natural resources 3. MPCA scarcity 4. the many potential natural resources of the MPCA 5. Choice of recreational activities 6. MPCA diversity 7. spatial object area 8. MPCA land status 9. community support 10. incoming media 11. the influence of climate on the time of visit 12. the average number of dry months per year 13. The average dry and humid months per year 14. whether the water can be discharged to the object or easy to ship from elsewhere 15. distance of water source to object location (km) 16. continuity 17. MPCA security 18. Infrastructure 19. supporting facilities	1. sensitivity to natural resources 2. the integrity of natural resources 3. the vulnerability of the MPCA area 4. unemployment rate (%) 5. livelihoods of the residents 6. Space for visitors (Ha) 7. Low education 8. soil fertility level 9. Natural mineral resources 10. wind acceleration during the dry season 11. average humidity per year (%) 12. air temperature in the dry season (0C) 13. Feasibility of water to be consumed 14. water source discharge (liter/second)
Eksternal Elements	**Opportunities (O)** 1. population (million people) 2. the level of tourist demand 3. road conditions and distances 4. sea road conditions 5. the distance of the air gate 6. (international / regional) 7. travel time to object from the downtown (hours) 8. the frequency of public transportation from 9. the center of the spread of tourism to the object 10. the number of motorized vehicles (pieces) 11. seating capacity 12. accommodation (number of rooms)	**Strategy (SO)** 1. increase supervision of sustainability mangrove and proboscis forest ecosystem in MPCA 2. improve service and comfort to visitors	**Strategy (WO)** 1. waste management and handling around the site MPCA Ecotourism. 2. Integrating the area of MPCA tourism forest (which is managed by the Provincial Government of Kaltara and the City Government of Tarakan) 3. Improving the quality of human resources for the local population.
	Threats (T) 1. relationship with other tourist objects (of a kind) 2. relationship with other tourist objects (not of the same type) 3. human activities around the MPCA area	**Strategi (ST)** 1. increase promotional activities	**Strategy (WT)** 1. maintenance and care of its ecotourism facilities available on the MPCA 2. Cooperating with all parties in the location to preserve the MPCA mangrove forest 3. Counseling and training for local communities to be directly involved in ecotourism activities and mangrove forest conservation

Table 8 Alternative strategies in the MPCA Ecotourism Development SWOT analysis

Strategy	Rating code	Total value	Priority
I.S-O			
1. Supervision of the preservation of the mangrove forest ecosystem	1.1+1.2+1.3+1.4+1.5+1.6+1.10+ 1.14+1.15+1.16+3.1+3.2+3.3+3. 4+3.6+3.7+3.8+3.9	3860	1
2. Improve service and comfort to visitors	1.1+1.2+1.3+1.4+1.5+1.6+1.7+ 1.8+1.9+1.10+1.11+1.12+1.13+ 1.17+1.18+1.19+3.3+3.4+3.5+3. 6+3.7+3.8+3.9+3.10	3810	2
II.S-T			
1. Increase promotional activities	1.1+1.2+1.3+1.4+1.5+1.6+1.7+ 1.8+1.9+1.10+1.11+1.12+1.13+ 1.14+1.15+1.16+1.17+1.18+1.1 9+ 4.1.+4.2+4.3	2650	4
III.W-O			
1. Waste management and handling around the ecotourism site.	2.1+2.2+2.3+2.4+3.1+3.2+3.7+ 3.8+3.9 +3.10	1975	6
2. improving the quality of human resources involved in ecotourism activities	2.1+2.2+2.3+2.5+2.6+2.8+2.9+ 2.10+3.1+3.2+3.3+3.4+3.5+3.6	2820	3
3. Increasing the area of tourism forest by replanting the area of former pond land	2.1+2.2+2.3+2.4+2.7+2.9+ 2.10+2.11+2.12+2.13+2.14+3.1 +3.2	2020	5
IV.W-T			
1. counseling and guidance for local communities to be directly involved in ecotourism activities and mangrove forest conservation	2.1+2.2+2.3+2.4+2.5+2.6+2.7+ 2.8+2.9+2.10+4.1+4.2	1190	8
2. supervision, maintenance and maintenance of tourism potential and facilities	2.1+2.2+2.3+2.5+2.8+2.9+2.10+ 2.11+2.12+2.13+2.14+4.1+4.2	1165	9
3. cooperate with all parties near the location to preserve the mangrove forest	2.1+2.2+2.3+2.4+2.5+2.7+2.9+2 .10+2.11+2.14+4.1+4.2+4.3	1380	7

a. Concept of Zoning, Accessibility and Circulation

The zoning division of the MPCA City Tarakan ecotourism destination is intended to optimize its function as an urban forest and a conservation area. Zoning is done through an ecological approach. As an ecotourism destination type of recreation, the use zone at MPCA is used for nature recreation activities with minimalist facilities. The recreational activities developed are walking tours to enjoy the beauty of the landscape, proboscis monkey-watching & birdwatching, self-portrait, photo hunting, educational & research tours. The protection zone is used for mangrove conservation and rehabilitation of proboscis monkeys and collecting germplasm.

Accessibility and circulation within the MPCA site are designed with an ecological concept and function as links between zones within site. The planned circulation route is in the form of land and water routes. There is only one type of land route, namely the path for pedestrians (track). Meanwhile, the waterway is used as a boat route for research and maintenance activities. The main accessibility to enter the MPCA ecotourism area is only through the touchpoints on Jalan Gajah Mada, which also functions as the Main Entrance and is only for pedestrians.

b. Concept of Landscape and Architecture

Provision of a recreational function from the MPCA site that contributes positively to the urban area in Tarakan City, developed with "sustainable compact development." The elements of mangroves and proboscis monkeys as the main elements are synergized with environmentally friendly recreational facilities and infrastructure [15, 16]. The green area as

forestry landscape is carefully maintained as environmental protection area and buffer zone, and transitional space in the context of urban space. The goal is that the MPCA conservation space becomes a green public space for all levels of society. The promenade is explored in a minimalist way with a wet & riparian concept approach. The existence of the waterside in this area becomes the foreground, middle ground, and background of this conservation area.

Environmentally friendly characters have the concept of integrating the natural landscape, a landscape design approach through conservation function intervention and physical intervention. Both are integrated with the principles of eco-architecture. Conservation function intervention is achieved by applying therapeutic functions to visitors based on the potential of mangrove vegetation in the form of "healing space" (aromatherapy, audio therapy, visual therapy through natural percussion elements. In other words, mangrove vegetation is used at the vertical level and used as pressure. The concept of "greening the platform" reinforces the creation of a "vegetation bed".

Design proposals

The design approach of the MPCA City Tarakan ecotourism master plan is explored with the consideration that it is a conservation area that integrates with the surrounding environment (Fig. 6). Besides, it also uses a linkage approach between the function of the building and its architectural locality. The sustainability of the mangrove ecosystem and the proboscis monkey habitat is a fundamental point so that the architectural approach is adapted to conservation goals.

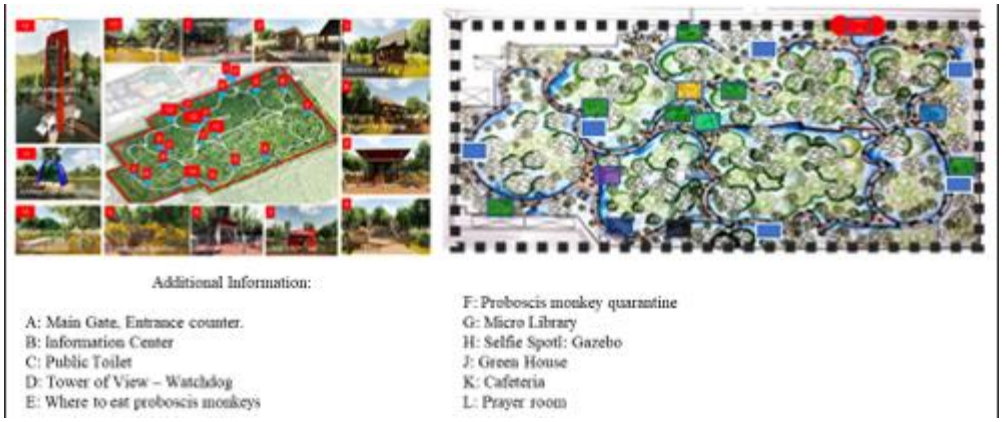

Fig. 5. Tarakan City MPCA Site Plan

The presence of some facilities and infrastructure on the site acts as a network of spaces for visitors. The facilities are designed with architectural principles based on the criteria of "traditional wisdom" and "sustainable architecture" and the use of regenerative materials, reusable materials, and recyclable materials. Especially regarding the presence of the Pandang Tower, it is presented as the main "landmark" of the MPCA ecotourism destination and functioning as a watchtower. The eco-architecture concept is expressed based on the image of the biodiversity conservation institution. The arrangement is approached with the idea of "organic form", where all the concepts of the MPCA City Tarakan.

a. Main gate – Main Entrance

The main access and the only entrance to the MPCA ecotourism destination are from Jalan Gajah Mada (Fig. 7). From area ticketing, visitors are directed by Signage to the Corridor Track. Based on the results of the accessibility analysis, the circulation is only for pedestrians with an organic pattern so that it is integrated and in harmony with natural conditions. The Main Gate is the main entry point for entering the welcome space, designed with the theme "the gateway of nature," where two entrances and exits are presented, accentuated by stair traps. As

an entry area, the floor is exposed to Tarakan's typical decorative paving, equipped with Tarakan's specific ornamental plant planter box, as a softener and plasticity provider for urban space.

Fig. 7. Main Gate Entrance & Ticketing Design for Tarakan City MPCA. Source: Author sketch

A visitor waiting room is provided in the ticketing facility, which is integrated into the management room. The location is not far from the main entrance. A contemporary urban nuance is designed with a glass facade material to present an open, transparent, and friendly impression. The gate is designed with decorative ornaments that are adopted from the distillation of mangrove leaves, made of processed construction made of composite metal frames and transparent glass wire. The appearance is made expressive, which is emphasized by the "signed wall wing" (on the left side of the entrance) with the words "Mangrove & Bekantan" with a natural typology of letters, while on the right side is a proboscis monkey sculpture which is also a separator between the entrance and the exit. Meanwhile, the exit door is designed differently with a contemporary concept to differentiate from the entrance. From the main gate and reception area, visitors are directed to the corridor track to explore and trace the MPCA area.

b. Track Corridor

Currently, the track in the ecotourism destination MPCA Tarakan City is 120m long, with many damaged conditions. In its development framework, an additional 1871.5m is planned so that the total track will be 1991.5m in total. With a width of 2 m, the total area of the track facility will be 3983m^2. The presence of some facilities and infrastructure on the site acts as a network of spaces for visitors. The facilities are designed with architectural principles based on the criteria of "traditional wisdom" and "sustainable architecture" and the use of regenerative materials, reusable materials, and recyclable materials. Especially regarding the presence of the Pandang Tower, it is presented as the main "landmark" of the MPCA ecotourism destination and functioning as a watchtower. The eco-architecture concept is expressed based on the image of the biodiversity conservation institution. The arrangement is approached with the idea of "organic form," where all the concepts of the MPCA City Tarakan.

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the biodiversity conservation institution. The arrangement is approached with the idea of "organic form", where all the concepts of the MPCA City Tarakan.

The track tracks are designed in an Angular pattern, with the underlying construction made of concrete posts (Fig. 8). The distance between the columns is designed wide enough to minimize damage to mangroves and protect the habitat of the aquatic biota. Based on the calculation of the carrying capacity for tracking activities, the maximum capacity value is 203 people per day. This calculation becomes a reference for the maximum number of visitors or tourists who can enter the ecosystem at MPCA for tracking activities. This number can be divided into four groups, with a full time given to each group is 4 hours.

Fig. 8. Track-Pedestrian Design Sketches in the MPCA

c. Information Center and Micro Library

Tarakan City MPCA Ecotourism is a place for educational and recreational activities that utilize the potential of MPCA (natural conservation area assets with native ecosystems, which are used for research, science, education, cultivation support, and tourism purposes). Therefore, the existence of the Information Center facility is expected to become a place for learning and recreation with the objects and subjects of the MPCA collection by involving students and the community to participate in conservation, preservation, rehabilitation of proboscis monkeys and their habitat. To support the targets and objectives of this role, a representative and educational Information Center facility are planned (Fig. 9).

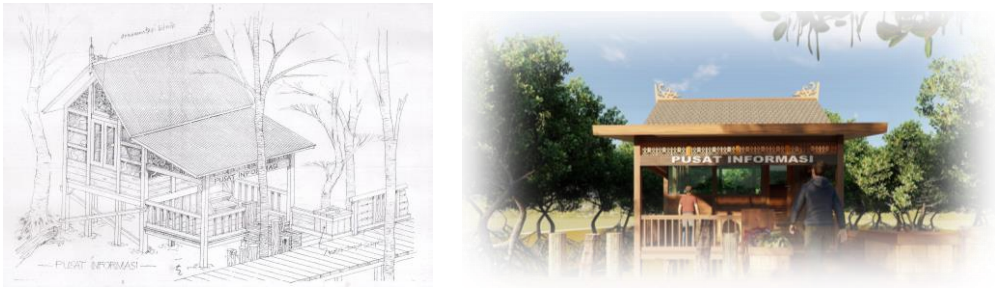

Fig. 9. Sketch of Information Center Design at MPCA City of Tarakan

This Micro Library is an educational facility for tourists, especially learners and researchers, to accommodate their interest in learning and researching the biodiversity of assets from MPCA (Fig. 10). The Micro Library building is filled and equipped with a collection of textbooks, periodicals (newspapers, magazines, newsletters, newsletters, local journals, journals) related to the intricacies of information and science related to the existence of MPCA in Tarakan City in particular, as well as any about mangroves and proboscis monkeys.

Fig. 6. Design Sketches of Micro Library Facilities at MPCA Tarakan City

Through the Micro Library facility, transferring knowledge and technology to children will be carried out according to current and future challenges. In other words, this facility will be a window to the world for visitors. The building is designed with stage construction. With this Micro Library facility, it is hoped that visitors will be stimulated to develop their literary interest in researching mangroves and proboscis monkeys.

d. Gazebo and Selfie Facility - Photo Hunting

Gazebo facilities are designed as a place to observe panoramas and biodiversity in MPCA at specific points (Fig. 11). There are several gazebos that are laid out according to their potential as a "visual vantage point," which also functions as a "sitting area" and a place for visitors to rest. The architectural firm of the pavilion is designed with a contemporary aroma, with sloping columns (pillars inspired by the trunk and branches of a tree). The roof of the gazebo as the central part of the "sheltering space" is designed to be the primary concern in exploring the upward curving "upward" form. The materials used are still using materials or materials that are "environmentally friendly" from wood or similar organic materials and other composite materials.

Fig. 7. Sketch of Proposed Design of Gazebo Facilities in the MPCA Area of Tarakan City

It is necessary to design a facility that provides a means to capture the moments when visitors are recreating and studying at MPCA. It is to give visitors pleasure and memories. These facilities are placed in several spots that have a foreground or background for shooting. The selfie facility spot is designed with a location and signed in the form of letters/typography (Mangrove & Bekantan), which is equipped with a proboscis monkey sitting on the side of the stage. The selfie facility consists of wooden construction (structural framework and floor) and railings from mangrove branches. The selfie facility also functions as a sheltering point (a place

to stop and rest, relieve fatigue and fatigue during the trip) while exploring, enjoying, and studying the biodiversity of the mangrove and probosci's conservation area ecosystems (Fig. 12).

Fig. 8. Design sketches of selfie facilities in the MPCA area of Tarakan City

e. Proboscis monkey eating and drinking facilities

The Proboscis Monkey Food and Drink Facility in the ecotourism area at MPCA Tarakan City is held to pay attention and meet the additional food needs for the proboscis monkey is the icon of this place. This facility is made of organic wood construction materials (taken from fallen mangrove trunks), where its placement is not disturbed by human presence. The choice of design form and placement is intervened in the place between tree stands or mangrove vegetation. In other words, the placement does not require a special site that damages the existing trees. Even the location where the facility is selected is in an area with a living tree trunk. So, the existence of the proboscis monkey's eating and drinking place is still related to the color of the proboscis habitat (Fig. 13).

Fig. 9. Design sketches of proboscis monkey drinking places in the MPCA area of the City of Tarakan

***f.* Pandang Tower - Bekantan Supervisor and Quarantine**

The basic form of the Tower of View plan was chosen to be square to respond to external (city center) and internal (MPCA site) factors. It comes from the outer side to strengthen and represent the existence of one of the landmarks of the city of Tarakan as a streamlined building. Meanwhile, the square shape is created from a solid structural expression from the inner side and treads firmly on the site, a watery wetland. With this choice, this form will not cause visual disturbances to the mangrove forest landscape in the Tarakan City MPCA (Fig. 14).

The shape of the Pandang Tower is in the form of curved upward curves with cross-frame lines. This shape is adapted from the mangrove tree that stands as the main plant in the conservation area. The exploration was inspired by the anatomy and shade of mangrove trees. The triangular shape is the result of crossing wall-formed frames into openings or cross ventilation holes, natural light absorption, as well as the surrounding landscape that can break through visualization. The use of cross frames also functions as a protective screen so that the Pandang Tower does not become a gathering place for certain animals that can interfere with existing spaces. Thus, the function of Pandang Tower is maintained to enjoy the panoramic view and observe the behavior of the proboscis monkeys and the birds. The landscape in the middle is chosen as a symbol of the site center and separates two groups of proboscis monkeys (Micheal and John) which naturally divide into the western and eastern parts of the site (Fig. 15).

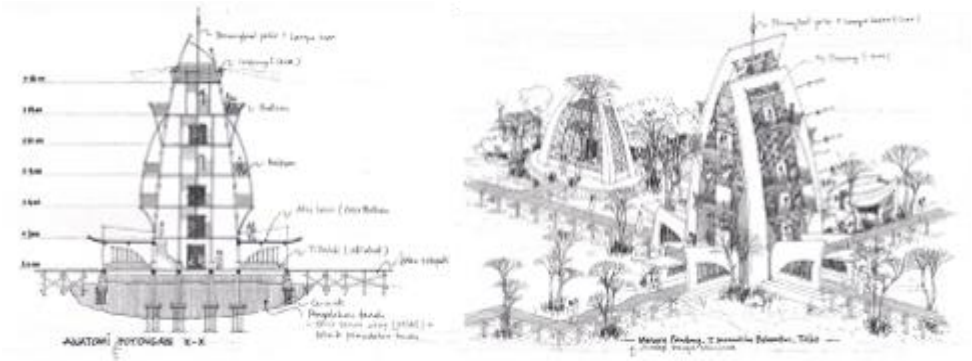

Fig. 10. A sketch of the Tower of View sequence and proboscis monkey quarantine at MPCA, Tarakan City

Fig. 11. Design of PandangTowe and Proboscis Quarantine at MPCA Tarakan City

The design of proboscis quarantine is exposed by emphasizing column accents using transparent walls of wire mesh material so that it is maximally ventilated and visually blends with the environment. The existence of mangrove trees in that facility is maintained as a habitat so that the quarantined proboscis monkeys do not feel the atmosphere of isolation and care. The placement is placed close to the Tower of View but is located between the tracks.

g. Facilities for prayer rooms, cafeteria, and public toilets

The concept of the building adopts the locality of Lamin architecture in Indonesia. That shapes consider the form of a roof and ornaments from the stylized mangrove leaves on the

facade. The processing of the room is open specifically for the prayer room, where the ablution is attached to the outer wall. This building is placed near the main entrance.

The Cafeteria building is designed with the concept of the roof formation adopting Dayak Tidung architecture. The placement and placement of cafeteria facilities around the Menara Pandang area on the north side and become the last facility before visitors leave the MPCA area (Fig. 16).

Public toilet facilities (bathroom/WC) in the MPCA conservation area of Tarakan City are supporting facilities provided in sufficient numbers. It is assumed that even as long as visitors or tourists are active, they are not constrained when they need a place to urinate or defecate. Even though there are toilet facilities in the MPCA area of Tarakan City, because it is not well maintained, the design is not representative and less hygienic. So, the redesign of public toilet facilities becomes a necessity when the existence of this ecotourism becomes one of the mainstays. The placement of toilets is scattered throughout the track to make it easier for visitors.

Fig. 12. Design of Prayer Room, Cafeteria, and Toilet in MPCA City of Tarakan

All facilities and infrastructure to support MPCA's ecotourism activities are designed based on the suitability of the location to visitors' needs. Another consideration is the ease of maintenance and inexpensive, both in terms of material selection and construction age and environmentally friendly.

Conclusion

MPCA in Tarakan City has high suitability for ecotourism activities with a value between 76.15% - 89.27%. The area on the south side adjacent to the coast is the most suitable area, and the further north, the level of suitability decreases. The potential for ecotourism that can be developed in the area is tracking mangroves, proboscis monkeys & bird watching, a recreation of river boating to enjoy biodiversity. The carrying capacity of the Tarakan City MPCA for tracking activities is 203 people per day, proboscis monkeys & bird watching are 194 people per day, and river boating is 382 people per day. The MPCA ecotourism destination has a maximum capacity of 90 visitors per hour or 1,170 people per day.

Strategies that can be implemented in the development of MPCA ecotourism are increasing: (1) monitoring of the preservation of mangrove ecosystems; (2) service and comfort to visitors; (3) the quality of human resources involved in ecotourism activities; (4) promotion of ecotourism; (5) waste supervision and handling; (6) cooperation with various parties to protect locations from pollution; (7) counseling and fostering local communities in ecotourism and conservation activities; and (8) supervision, maintenance of tourism potential and

maintenance of ecotourism facilities; and (9) integrating the extent and spatial planning of ecotourism areas

The master plan design for the development of MPCA's ecotourism destinations in Tarakan City is focused on the placement of supporting facilities and infrastructure for ecotourism, including: (1) Corridor Track; (2) Main gate / main entrance; (3) Information Center; (4) Tower of View - Watchdog; (5) Proboscis monkey quarantine; (6) Green House for mangrove seeding; (7) Proboscis monkey eateries; (8) Selfie Spot Facility; (9) Micro Library; (10) Gazebo; (11) prayer room; (12) Cafeteria; and (13) Public Toilets.

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