



Sea Turtles Conservation Centre with Ecological Architecture Approach

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Abstract. *Turtles are integral components of two ecosystems, both coastal and marine. They play a crucial role in maintaining a healthy marine ecosystem. A nutritious sea fosters millions of fish, serving as a significant protein source for humans. However, this is increasingly at odds with the presence of turtles, which are gradually becoming endangered. This issue stems from various factors, including large-scale commercial fishing activities near turtle nesting sites and worsening climatic changes. These factors have the potential to disrupt the balance of marine ecosystems. The approach adopted in this design is an ecological architecture approach. It aims to restore turtle habitats in coastal conservation areas to attract nesting turtles and sustainably develop tourist facilities that harmonize with the surrounding environment..*

Keywords: *Ecological Architecture, Ecosystem, Endangered Species, Turtle*

1. INTRODUCTION

Turtles are essential for coastal and marine ecosystems, crucial in maintaining healthy seas that support abundant fish populations, and vital for human protein needs. The Green Turtle (*Chelonia Mydas*), for example, plays a crucial role in sustaining seagrass and seaweed by grazing on them, enhancing their productivity. This helps prevent overgrowth that can block ocean currents and sunlight, ensuring the health of underwater habitats. Another example is The Hawksbill Sea Turtles, by consume sponges that compete with coral reefs, thus facilitating coral growth and providing habitat and food for marine fish. This underscores the importance of turtles in preserving marine ecosystems.[1]

However, this is inconsistent with the gradual endangerment of turtles. This issue is exacerbated by human activities such as large-scale commercial fishing in turtle nesting areas, compounded by natural factors such as worsening climate change. Consequently, this has the potential to disrupt the balance of marine ecosystems.

Pariaman City, located on the west coast of West Sumatra Province, hosts nesting sites for Olive Ridley, Green, and Leatherback turtles. In 2007, the local Department of Marine Affairs and Fisheries established a turtle conservation area. In 2021, the Ministry of Marine Affairs and Fisheries, through Kepmen KP no. 106 Tahun 2021 [2], designated the marine waters of Pariaman City as a Marine Park that must be protected, with conservation targets including coral reefs and turtles. This initiative aims to educate and raise awareness among the

community on turtle conservation practices, ensuring that turtle eggs and turtles in the area are not hunted or sold. From 2013 to 2020, this conservation effort has successfully saved 77,296 turtle eggs in the marine waters of Pariaman City. [3]

Over time, government attention and financial constraints have hampered turtle conservation operations in Pariaman City, leading to deteriorating facilities. Neglected conservation conditions affect turtles and also reduce tourist interest. Water quality in Pariaman's turtle breeding grounds falls short of natural habitat standards. Threats to turtle populations include habitat destruction, natural disasters, predators, human activities like illegal trade, poor conservation management, and climate change.

The approach used in this design is ecological architecture, aiming to restore turtle habitats in coastal conservation areas and create sustainable tourist facilities that blend with the environment. Ecological architecture is ideal for ecotourism as it emphasizes environmentally conscious design principles, leveraging natural potential. It follows four main principles: holistic integration, human experiential engagement, process-oriented development, and collaboration with the surrounding environment [4].

Based on the discussion above, designing a supportive area for turtle ecotourism on Turtle Beach in Pariaman City is crucial. The design should address two vital aspects: turtle conservation and tourist accommodation. Therefore, employing principles of ecological architecture aligns with the objectives of designing the Turtle Conservation Center in Pariaman City.

2. METHOD

The methodology for designing the Sea Turtles Conservation with Ecological Architecture Approach in Pariaman City employs descriptive methods to present, outline, and explain both primary and secondary data based on factual information. It involves direct field observations for primary data and literature studies including theories, expert opinions, and government regulations for secondary data. Comparative studies are also conducted to extract positive design elements from similar projects for benchmarking purposes. These methods are crucial for developing a comprehensive and well-informed design concept.

3. RESULT AND DISCUSSION

Location

The project titled “Design of Sea Turtle Conservation Center with Ecological Architecture Approach”, located in Ampalu Village, North Pariaman, Pariaman City. Ampalu Village is a tourist village with a concept of nature, culture, and local wisdom.



Figure 1: Location

Source: Google Maps

Site Boundaries :

- West : Coastal pine forest and the Indian Ocean
- East : Mangrove forest
- North : Mangrove pier
- South : Residential areas

A. Regulation



Figure 2: KKPD Zoning Map of Pariaman City [5]

The Turtle Beach area is part of the marine conservation area zoning plan. The protected coastal area constitutes 20-30% of the land. In Kota Pariaman, the core conservation area is Pulau Kasiak, located 4 km from the turtle beach. According to the Keputusan Gubernur Sumatera Barat No. 523.6/150-2017 regarding the Reserve of Regional Conservation Areas, the area of Kota Pariaman's Regional Kawasan Konservasi Perairan Daerah (KKPD) spans

11,776.63 hectares [6]. The current utilization of KKPD Pariaman City includes capture fisheries, marine tourism, shipping lanes, coral reef conservation, and turtle conservation.

The building specifications according to the City Spatial Planning Regulation (RDTR) of Kota Pariaman [7] :


- Project Owner : Pariaman City Government
- Land Area : 6.55 hectares
- Contour : Swamp Area
- KDB : 30%
- KLB : 0.6
- KDH : 40%

B. Context

Conservation originates from the term "natural conservation," meaning preservation or protection of nature. In terms of energy, conservation refers to storage or sustainability. According to the KBBI (Kamus Besar Bahasa Indonesia), conservation means the regular maintenance and protection of something to prevent damage and destruction by means of preservation or protection. The concept of conservation can be traced back to when the English word "conservation" was first used, implying the act of maintaining or safeguarding from harm [8]. According to Peraturan Kementrian Kelautan dan Perikanan Republik Indonesia Nomor 31 tahun 2020 Pasal 1, Conservation Areas are areas characterized by specific features as a unified protected ecosystem, preserved and sustainably utilized [9]. Turtle-based tourism management, based on the 2009 Technical Guidelines, includes designing eco-friendly facilities, using natural materials, and minimizing disturbances like light and noise to protect turtle habitats. It also involves promotion through media, collaboration with local stakeholders, and ensuring tourism activities prioritize turtle well-being [10].

Comparative Study of Similar Function:

Table 1 Table 1 Comparative Study of Similar Function

NO	Comparative Study	Turtle Sanctuary at Kalba Mangrove Reserve [11][12]	KÂAT Architects to Design Research & Rehabilitation Center for Sea Turtles [13][14]
1			
2	Location	Sharjah, United Arab Emirates	Mugla, Turki
3	Year	2021	2019
4	Space	Visitor Drop-off, orientation, admin Office, staff facility, café, terrestiall exhibiton, marine exhibition, intersitial building, indoor and outdoor classroom, turtle pool, wildfire Care Facility	emergency room, x-ray room, lab, operation room, intensive care room, tank area, visitor center, receptionist, museum & exhibition, staff office, food storage, feeding area

Source: Author's (2024)

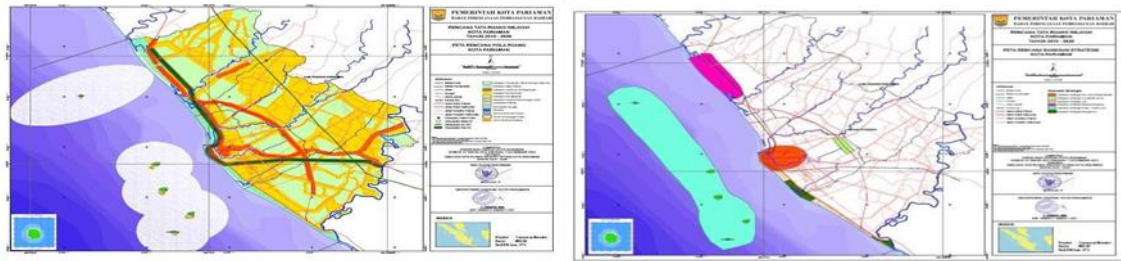





Figure 3 Spatial Pattern Plan Map and Strategic Area Plan Map of Pariaman City Source: RTRW Pariaman City [15]



According to the spatial planning plan of Pariaman City for the period 2010-2030, this area is designated as a strategic area for its functional purposes and environmental sustainability. Specifically, it is designated as a strategic area for tourism and turtle conservation in Turtle Beach, South Pariaman District.

Design Analysis

The design analysis involves assessing accessibility, parking, noise, sun path, and Vegetation. The analysis results are presented in Table 3.

Table 2 Design Analysis

No	Analysis	Response
1.	<p>Accessibility</p> 	<ul style="list-style-type: none"> - The main access route in and out is through the pier road, then entering Siti Manggopoh Street. Service access enters from Beach Road number 2 - Pedestrian access is maximized here because vehicles are prohibited from approaching the conservation area - Provision of access for bicycles
2.	<p>Parking</p> 	<p>The response implemented is to place the parking area at the entrance of the area, far from the conservation buildings, due to the sensitivity of turtles to vibrations and noises from vehicles.</p>
3.	<p>Noise</p> 	<ul style="list-style-type: none"> • Placing conservation buildings away from noise centers • Planting vegetation as noise filters • Placing service buildings near noise sources

4.	Sun path	 <p>The site, located on the coast with the longest side facing west. Responses implemented:</p> <ul style="list-style-type: none"> • Planting vegetation around the beach for shading from light • Using double facades and materials that reduce heat • Optimizing natural light because turtles are susceptible to artificial light
5.	Vegetation	 <p>On the beach area site, there are coastal pine trees, coconut trees, and mangroves. Coastal pine trees are preserved to maintain the coastline, and mangrove forests are developed for mangrove tourism areas.</p>

Source: Author's Analysis (2024)

Program

Table 3 Recapitulation of Space an Parking Requirements

No	Space	Area
1	Parking	1812 m ²
2	Turtle Conservation	2134,05 m ²
3.	Turtle Education	2776,15 m ²
4.	Staff Housing	340 m ²
5	Library	998 m ²
6	Marine Exhibition	1287 m ²
7	Outdoor Meeting Facilities	468 m ²
8	Management Facility	382 m ²
9	Prayer Room	195,08 m ²
10	Tourist Area	13.007,8
11	Service	201,9 m ²
12	Security	257,8 m ²
Total		23.858,98 m²

Source: Author's Analysis (2024)

Design Result

A. Massing



Figure 4 Massing

Source: Author's (2024)

The building's form is inspired by coral reef structures. This design symbolizes and integrates with Pariaman City's maritime area. According to the Ministry of Marine Affairs decision, Pariaman has a protected marine tourism area, which includes sea turtle conservation and coral reefs.

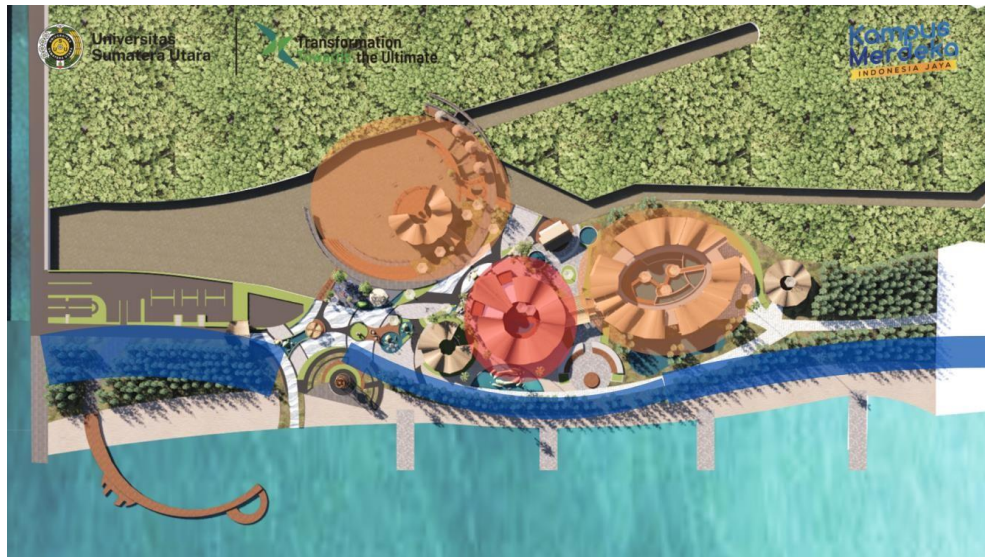







Figure 5 The Sea Turtle Conservation Area
Source: Author's (2024)

B. Theme Implementation

The application of ecological architecture in designing a turtle conservation center includes several approaches that prioritize environmental sustainability and marine ecosystem balance. Here are its implementations:

Table 4 Theme Implementation

No	Design Picture	Description
1		Environmentally friendly building design: The turtle conservation center should be designed considering ecological principles such as using local and environmentally friendly building materials, employing renewable energy sources, and ensuring proper waste management.
2		Optimal natural lighting: Given that turtles are highly sensitive to artificial light, which can cause stress, optimizing natural sunlight as the primary light source is essential.
3		Restoration of coastal landscapes: Plants along the coastline influence turtle nesting preferences. Replanting and restoring coastal ecosystems are crucial steps to attract turtles for nesting in the coastal areas of this turtle conservation site.

4		Wastewater and rainwater management: Rainwater harvesting and wastewater recycling for irrigation and toilet flushing.
5		Education on ecology: Beyond technological solutions, education should also be directed at the community to raise awareness about environmental conservation among both the public and users of the building.

Source: Author's (2024)

4. CONCLUSION

Designing the Sea Turtle Conservation Center in Pariaman City as a facility for learning, research, and turtle tourism. Furthermore, the implementation of ecological architecture is expected to create a building that responds to the environment by integrating crucial aspects between humans and the turtles themselves.

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REFERENCE

- Dermawan, A., & Nyoman, I. (2009). *Technical guidelines for turtle conservation management*. Jakarta, Indonesia: Directorate of Conservation and Marine National Parks.
- Dinas Kelautan dan Perikanan Provinsi Sumatera Barat. (2019). *Data Statistik Kelautan, Pesisir dan Pulau-Pulau Kecil*. Padang.
- Direktorat Konservasi dan Taman Nasional Laut; Direktorat Jenderal Kelautan, Pesisir dan Pulau-Pulau Kecil; Departemen Kelautan dan Perikanan Republik Indonesia. (2009). *Pedoman teknis pengelolaan konservasi penyu*. Jakarta, Indonesia.
- Frick, H. (1998). *Fundamentals of ecological architecture*. Yogyakarta, Indonesia: Kanisius.
- Harrouk, C. (2019). KÂAT Architects to design research & rehabilitation center for sea turtles. *ArchDaily*. Retrieved from <https://www.archdaily.com/930651/kaat-architects-to-design-research-and-rehabilitation-center-for-sea-turtles>

- Hopkins Architects. (2021). Hopkins Architects creates cluster of shell-like pods for turtle sanctuary on Sharjah coast. *Dezeen*. Retrieved from <https://www.dezeen.com/2021/05/04/khor-kalba-turtle-wildlife-sanctuary-hopkins-architects-sharjah-uae/>
- Ilhami, A. P., & Fitrisia, A. (2022). The impact of the UPTD sea turtle conservation in Kota Pariaman on the socio-economic conditions of the community (2013–2020). *Jurnal Chronology*, 4(3), 325–337. <https://doi.org/10.24036/jk.v4i3.250>
- KÂAT Architects. (n.d.). *Research & rehab. center for sea turtles*. Retrieved from <https://www.kaat.co/works-item/research-%26-rehab.-center-for-sea-turtles>
- Kamus Besar Bahasa Indonesia (KBBI). (2016). *Kamus Besar Bahasa Indonesia* (5th ed.). Jakarta, Indonesia: Ministry of Education and Culture. Retrieved from <https://kbbi.kemdikbud.go.id>
- Kementerian Kelautan dan Perikanan. (2020). *Peraturan Menteri No. 31 Tahun 2020 Pasal 1 tentang Kawasan Konservasi*. Jakarta, Indonesia: KKP.
- Kementerian Kelautan dan Perikanan. (2021). *Keputusan Menteri No. 106 Tahun 2021 tentang Kawasan Konservasi di Perairan Kota Pariaman, Provinsi Sumatera Barat*. Jakarta, Indonesia: KKP.
- Pemerintah Kota Pariaman. (2023). *Naskah akademik rancangan peraturan daerah RTRW*.
- Peraturan Daerah (Perda) Kota Pariaman Nomor 5 Tahun 2022 tentang Rencana Tata Ruang Wilayah Tahun 2022-2042.
- Pintos, P. (2021). Turtle sanctuary at Kalba mangrove reserve / Hopkins architects. *ArchDaily*. Retrieved from <https://www.archdaily.com/961350/turtle-sanctuary-at-kalba-mangrove-reserve-hopkins-architects>
- Wilson, E. G., Miller, K. L., Allison, D., & Magliocca, M. (2014). *Why healthy oceans need sea turtles: The importance of sea turtles to marine ecosystems*. Oceana Report.