Towards Aceh development revitalization based on ecological and biodiversity evidences: the two pieces of terrestrial and marine beyond the facts

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Abstract. The development vision of Aceh Hebat is to accomplish the realization of a peaceful, prosperous Aceh, through a clean, fair, and functioning government. One of the efforts to achieve this mission is by the revitalization the regional planning function with effective, efficient, and sustainable principles of Evidence-based Planning. This study aims to provide information on the evidence of biodiversity and landscape of habitat that are traced for the period of 2013 to 2018. The method being used is Time-based Process mapping approach to show the condition of biodiversity evidence in five-year period. The results of this study indicate that in Aceh’s seascape there is an evidence of 285 species of marine species such as reef fish, sharks, and rays found in the area. Whereas, according to the IUCN Redlist, out of 285 species, 5 species are endangered (EN), 10 species are Vulnerable (VU), and 8 species of Near Threatened (NT). In addition, various key species such as sea turtles, dolphins, dugongs, and whales are also detected in areas recommended for further management and protection. In forest landscapes, biodiversity evidences found in ecological unit are including 38 species, consisting of felids, ungulates, primates, small carnivores, and apes.

1. Introduction
Aceh is located on the northern side of Sumatra island 01° 58' 37,2"-06° 04' 33,6" North Latitude and 94° 57' 57,6"–98° 17' 13,2" East Longitude with an average height of 125 meters in above sea level and is the most western province in Indonesia which has an area of 5,677,081 ha. The area of Aceh is divided into various designation areas and functions, one of which is forest area. The Aceh forest area reaches 3.5 million ha [1] and owns a high biodiversity consisting of flora, fauna and the value of environmental services [2]. The forest areas and water conservation of Aceh Province include Nature Reserve areas, Protected Forest areas, Limited Production Forest areas, Production Forest areas and Convertible Forest areas [3].

Ulu Masen is a forest area [4] to the north of the Leuser ecosystem, covering four districts - Aceh Besar, Aceh Barat, Aceh Jaya and Pidie [5] [6]. The Ulu Masen area consists of low land forest and high land forest. This has become a unique feature of the region [7]. Based on research in 2013, the biodiversity richness of the Ulu Masen region included at least 380 species from bird habitat, 129 high-level mammal species such as the Sumatran Tiger, Sumatran elephants, and tapirs that are globally very important [8]. For a long time ago, the community has utilized the forest ecosystem services such as soil protection, water storage, and as a provider of oxygen, sources for non-timber forest products and as a home to wildlife and various species of plants.

Aceh does not only have terrestrial areas or forest landscapes but also has territorial waters with an area of 295,370 km² with a coastline of 2,666.3 km². With the vast area of these waters, Aceh has enormous marine or maritime economic potential. One of the waters of Aceh that is important for biodiversity is Simeulue which is located between 02° 02’ 03”-03° 02’ 04” North Latitude and 95° 22’ 15”– 96° 42’ 45” East Longitude [9]. Simeulue Island is surrounded by waters, where the west is bordered by the Indian Ocean, the north is with the Indian Ocean and the waters of West Aceh Regency, the East with the Indian Ocean and the waters of South Aceh Regency, and the South with the Indian Ocean.
Ocean [10]. Terrestrials and Marine are sources of livelihood for the people of Aceh, totaling 5,189,466. The community has relied on forests and sea products as a support in their survival. In 2016, the fish that had been caught by the fishermen in Simeulue reached 14,653 tons [11].

The potential of terrestrial and marine area of Aceh is the foundation of the development and continuity of the life of the people of Aceh. Aceh’s development requires planning based on the noble values and potential of Aceh. Aceh has established a development vision and mission called the Great Aceh. The vision and mission of Great Aceh is the realization of a peaceful and prosperous Aceh through a clean, fair government that serves community [12]. One of the fifteen policies towards Great Aceh is the revitalization of the regional planning function with the principle of evidence based planning that is effective, efficient and sustainable. One of the ideal principles in that the planning is based on data and factual evidence of a condition. The evidence based planning approach covers its attention to two conditions; the existing or current conditions) and the expected or desired conditions. Current conditions are important to be identified and analyzed because they are the starting point of change, while the expected conditions are important to be formulated specifically and clearly because they are targets to be achieved [13].

The purpose of this paper is to provide recommendations for infrastructure development plans in Aceh. Development on aspects of the use of terrestrial and marine landscapes related to biodiversity conservation and its protection needs to be the basis of development in Aceh. The development planning action of Aceh must be based on the fact that Aceh is an important area as a provider of environmental services. The facts of the existence of biodiversity in the terrestrial and marine area are believed to be proposed as a basis for Aceh's infrastructure development planning. FFI (Fauna and Flora International) Aceh programs within 5 years from 2013-2018 have managed to carry out a variety of surveys and research activities to support the implementation of planning-based revitalization of development and evidence related to the landscape of habitat and ecosystem that are presented for Aceh development planning.

2. Research Methods

The parameters used in terrestrial areas covered the signs of endangered animals’ presence, the results of identification from the animals finding, the locations of findings, the disturbance of forest habitats such as illegal logging and poaching, as well as areas that have been degraded. While marine coverage includes the location of endangered marine animals and the locations of vulnerable coral reefs. Overall, the facts of the ecological situation, the biodiversity along with the facts of the findings of potentially high ecological destructive activities will be compared with the data on the infrastructure development plans in the 2017-2022 medium-term Aceh strategic development plan. The results of the comparison of facts with the planned revitalization of development planning are expected to contribute to the management of forest and marine resources in Aceh. The following is a map of the location of the Ulu masen forest and the PiSiSi waters region as presented in Figure 1.
Data were collected in five year periods (2013 – 2018) regarding the ecological condition of Ulu Masen forests and marine conservation areas in Simeulue, especially PiSiSi areas so that the data presented can support the commitment of the Aceh government to advance the development of infrastructures.

3. Result and discussion

3.1 Facts on ecology and biodiversity in Ulu Masen

Reflectance Ulu Masen is the name or designation given to the forest landscape ecosystem that extends along Aceh Besar, Pidie, Pidie Jaya, Aceh Barat, Bireun and Aceh Jaya Regencies. Management of forest areas is currently under a forest management unit (FMU). The management of the Ulu Masen forest area automatically becomes the authority for FMU. Ulu Masen Forest is in the management of Regional I and Regional II FMU. In the management section of FMU, region I covers the portion of Aceh Besar (±2,974.12 km²), Pidie (± 3,562.14 Km²), some part of Pidie Jaya (± 1,162.84 km²) and Aceh Jaya (± 3,727km²). Region II FMU is also authorized to manage other forest areas in the Leuser ecosystem landscape such as Central Aceh, North Aceh, Bener Meriah, Nagan Raya with a total area of 254,959 ha.

The evidence of the discovery of rare flora was found from the survey results conducted in 2015 - 2018. In the Ulu Masen area there were found 2 species of rare trees from the Magnoliaceae family, namely *Magnolia montana* and *Magnolia ashtonii*. The two rare species were identified as growing in the Ulu masen forest at an altitude of 500-1,000 masl, with an average rainfall of 2,550-3,600 mm / year. This species grows in climatic Oldeman classification with precipitation rate > 200 mm. this species grows in entisol, andisol and inceptisol soil types. In the status of IUCN, this plant is included in a rare classification but the data, information, and the category are not available.

Conservation status of various species can be found out in the IUCN (International Union for Conservation of Nature and Natural Resources) classified as the IUCN Red List so that we can find a list of the status of a species' scarcity. This status includes all species throughout the world so that all groups, whether public or policy makers can participate in conservation activities and become part of the international community in improving the status of species scarcity.

Obtained result showed that 17,291 species from 47,677 species are considered as endangered (EN) include 21% of all known mammals, 30% of amphibians, 12% of apes, 28% of reptiles, 37% of freshwater fish, 70% plants, and 35% of invertebrates assessed so far are under threat. The key species in Ulu Masen are Sumatran Tigers and Sumatran Elephants which are very unfortunate that both are critical status (CR). The evidence of marine biodiversity came from a survey conducted by researchers in the Simeulue PiSiSi region. From the research results through surveys and studies the researchers...
found that there were 285 species; five species in the status of endangered (EN), nine species in the status of vulnerable (VU), and seven species in the status of near threatened (NT). The key species in PiSiSi islands are sea turtles, dolphins, dugongs and whales as shown in Table 1. The four marine species were not specifically examined for their exact numbers in marine conservation areas but their presence was seen when fishermen or survey teams carried out sea patrols.

Tabel 1. List of species reef fish found in the areas of Pinang, Siumat and Simanaha Island (PiSiSi)

| No. | Species                        | Species                               | status |
|-----|--------------------------------|---------------------------------------|--------|
| 1   | Humphhead wrasse                | Napoleon wrasse                       | EN     |
| 2   | Leopard Coral grouper           | Plectropomus Leopardus                | NT     |
| 3   | Highfin Coral grouper           | Plectropomus ologocanthus             | NT     |
| 4   | Roving Coral grouper            | Plectropomus Pessuliferus             | NT     |
| 5   | Blacksaddled Coral grouper      | Plectropomus Laevis                   | VU     |
| 6   | Malabar grouper                 | Epinephelus Malabaricus              | NT     |
| 7   | White-edged grouper             | Epinephelus Albomarginatus            | VU     |
| 8   | Giant grouper                   | Epinephelus Lanceolatus               | VU     |
| 9   | Squartail coralgrouper          | Plectropomus Areolatus                | VU     |
| 10  | Dusky Grouper                   | Epinephelus Marginatus               | EN     |
| 11  | Green Humphhead Parrotfish      | Bolbometopon muricatum               | NT     |
| 12  | Yellowtail Parrotfish           | Scarus hypselopterus                  | NT     |
| 13  | Batuna Damsel                   | Amblyglyphidodon batunai              | VU     |
| 14  | The Great Damsel                | Amblyglyphidodon ternatensis          | VU     |
| 15  | Duskytail grouper               | Epinephelus bleekeri                  | NT     |
| 16  | Nassau grouper                  | Epinephelus Striatus                 | EN     |
| 17  | Sphyrna lewini                  | Scalloped hammerhead                 | EN     |
| 18  | Giant guitarfish                | Rynchobatus djiddensis                | VU     |
| 19  | Bigeye thresher shark            | Alopias superciliosus                | VU     |
| 20  | Bluespotted Fantail Ray         | Taeniura lymma                       | EN     |
| 21  | Silvertip shark                 | Carcharhinus albimarginatus           | VU     |

The legal basis for determining the waters of Puluau Pinang, Siumat, and Simanaha (PiSiSi) as Regional Marine Conservation Areas is the Decree of Simuelue Regent No. 523.1/104/ SK/2006 issued on April 9, 2006. The Regional Marine Conservation Areas are directed to marine protected areas and marine tourism parks. The mission of determining the Regional Marine Conservation Areas as areas of preservation, tourism, education/research, and as community economic activities.

3.2 Findings on the potential threats of ecology and biodiversity
Since 2012, Fauna & Flora International Aceh has gradually provided special training to local communities living in the area around the Ulu Masen forest area. The community is given training in forest knowledge, threats and methods of monitoring and protecting the forest. A total of 351 people from 18 mukim (sub division of a district) spread across Aceh have been selected and appointed as forest rangers who are expected to be able to become a wall in defending forests from deforestation and degradation. Up to 2018, there were a lot of findings regarding illegal logging, illegal hunting, illegal encroachment, and signs of the key animals’ existence.

Based on the monitoring patrol data recorded by the FFI-Aceh Program within the five years that have been collected by the ranger in the Ulu Masen area, there have been high findings of logging cases. In 2012, based on the collected data, it had a finding index of 0.26 cases along 1 km of patrol distance.
as shown in Figure 2. This indicates that one case of logging was found within a radius of approximately 4 km of patrol distance. While the lowest index of case findings occurred in 2015, which was around 0.07 indications of logging as far as 1 km patrol. In 2017 there is an index of 0.18.

![Figure 2. Map of illegal logging activities](image)

The construction of a number of roads is expected to be able to provide a splendid impact and benefit the community, especially for improving the economy of the community. All implementation of infrastructure development is in accordance with the Aceh Medium Term Development Plan and its main foundation refers to the Aceh Government's vision proclaimed by the Governor and Vice Governor of Aceh during the 2017-2022 term. As for the rejuvenation of the sea and coastal areas, the government also has a program to protect and conserve marine and fisheries resources, which in order to undergo this program, government needs to realize which parts are designated as marine conservation. In this paper we present data that provides information on locations where many coral reefs have been damaged.

4. Conclusion
The Nature development and conservation must be in line. Acehnese society requires continued infrastructure development, but it is undeniable that human needs for forests are also a priority, especially for the people of Aceh because people living around forests and the sea depend on their livelihoods from forests and the sea. The government in carrying out the planning and development program is expected to seriously consider the land and place of implementation so the habitat of key animals is safe and minimize the conflicts between animals. It is hoped that the terrestrial and marine survey data presented by FFI Aceh for the past five years can be a reference for the government in establishing infrastructure development and the government can carry out renovations or rehabilitation right on target because it is based on evidence planning.

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