Vegetation analysis of rawa singkil wildlife reserve in Rantau Gedang Village, Singkil Distric, Aceh Singkil Regency, Aceh Province

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Abstract. Rawa Singkil Wildlife Reserve plays an important role in protecting the environmental services. It contains, particularly as a protective balance of water systems and natural warehouses for carbon storage to mitigate the effects of global warming. However, the existence of Rawa Singkil Wildlife Reserve is disturbed by human activities without paying attention to the impact of natural balance. The research objective is to identify plant diversity and vegetation cover classification. This study was carried out using a rectangular path method for various stages including seedlings, saplings, poles, and trees. The results provide information on the condition of the vegetation structure and composition of various stages of tree growth. There are 25 types of vegetation found in Rawa Singkil Wildlife Reserve, which consists of three stages, namely saplings, poles, and trees. Based on the Importance Value Index analysis that Nyamplung (Calophyllum inophyllum) has the highest Importance Value Index, the highest Importance Value Index in the pole stage is Beras-Beras (Syzygium zeilanicum), and in the tree stage the highest index of importance was Ubar Susu (Glutta renghas) and Pucuk Merah (Syzigium myrtifolium).

1. Introduction

In Southeast Asia, the area of peatland is more than 26 million ha (69 % of the total area of tropical peatland), most of which are located from 0 m to 50 m asl (above sea level). Based on this total, more than 18.9 million ha are in Indonesia [1]. Peatlands are one of the natural resources that play an important role in the country’s economy, including various forest products in the form of timber and non-timber. Besides, peatlands provide environmental services that are essential to support local people’s life in terms of water supply, flood control, and other benefits. Peatlands are also very important in their role as carbon storage, habitat for important and unique biodiversity, and climate stabilization [2].

In line with the increasing needs of human life, the availability of technology, and the opportunities to cultivate peatlands commercially, several entrepreneurs make use of this peatland by developing oil palm plantations. In the end, it will provide financial benefits for the company in the short term, but it will have a long-term impact on the global and local community because it causes damage to ecosystems, drought and, land fires every time the dry season occurs.

The results of a study in Aceh's Rawa Tripa Peatland showed that due to the loss of biomass, the density of carbon stored above ground has decreased from 158 Mg/ha in 1990 to 67 Mg/ha in 2009 [3].
In addition, peatland degradation also causes carbon stored in peat to be easily oxidized to CO\textsuperscript{2} (one of the most important greenhouse gases) and subsidence [4]. According to WALHI [5], the Gampong Hutan Lestari Foundation (YGHL) found that out of the total area of Rawa Singkil Wildlife Reserve, which is 82,374 Ha, had been expanded by 50 Ha in 2015 [4]. The conversion of land functions coupled with a very rapid decline in land use has resulted in serious conditions for the decline in the welfare of local communities and the destruction of the wildlife protected habitat. Peatland is one of the natural resources that have hydro-ecological and other environmental functions which are important for the life of all living things [6]. The main problem in implementing peatland restoration is the very limited availability of data at the site level, especially regarding the level biodiversity and richness in it, so it is necessary to carry out a more in-depth study, especially to obtain further and detailed information to support the implementation of future rehabilitation and management programs.

2. Materials and methods

This study was carried out in Rawa Singkil Wildlife Reserve (Figure 1), from February to August 2020. Rawa Singkil Wildlife Reserve is located in Aceh Singkil Regency, approximately 664 km from Banda Aceh.

A rectangular path method was used to identify a diversity of flora and vegetation cover classification. There are five lines for diversity analysis, with each a length of 1000 m and a width of 20 m. The distance between lines for this vegetation analysis is 1000 m. Then, a nested plot was made for each plant habitus that was placed in the lines. The trees in the vegetation types were classified into four growth stages including seedlings (saplings 1.5 m high; plot area 2 m x 2 m), saplings (saplings > 1.5 m high up to 10 cm stem diameter; plot area 5 m x 5 m), poles (young trees with trunk diameter > 10 cm to 20 cm; plot area 10 m x 10 m), and trees (trees with trunk diameter > 20 cm; plot area 20 m x 20 m) as shown in Figure 2.
Figure 2. Scheme of plant diversity analysis sampling.

The collected data were used to analyze the frequency, abundance, species dominance, and importance value index [8].

**Importance Value Index**

\[ IVI = RD + RF + RD \]

where:

- \( RD \) = Relative Density = \( \frac{\text{Density of individual species}}{\text{Total Density of all species}} \times 100\% \)
- \( RF \) = Relative Frequency = \( \frac{\text{Frequency of individual species}}{\text{Total frequency of all species}} \times 100\% \)
- \( RD \) = Relative Dominance = \( \frac{\text{Dominance of individual species}}{\text{Total dominance of all species}} \times 100\% \)

3. Results and Discussion

3.1 Structure and composition of vegetation types

The research was conducted based on the existing land cover in the Rawa Singkil Wildlife Reserve, precisely in Rantau Gedang Village. Almost all sampling locations have swamp characteristics with peat soils. Swamp is the name for all waterlogged areas, where the puddle is seasonal or permanent and is overgrown by plants. Swamp waters are characterized by a thick layer of organic soil (peat) and soil physicochemical conditions that affect the physical, chemical, and biological conditions of the waters. Sampling was carried out on the land cover type of primary swamp forest. The condition of swamp primary forest is a condition that has not shown human intervention in it, such as logging or any exploitation, so that the condition of the forest is still natural. A sampling of primary swamp forest types was carried out in Rantau Gedang Village, there were 36 tree species at several stages of growth such as saplings, poles, and trees with the number as shown in Figure 3.
3.2 Importance value index (IVI)

The Importance value index is a measure of how dominant a species is at one growth level. The result of the important value index in this study are presented in Table 1.

| No | Type and scientific name                  | IVI (%)       |
|----|-------------------------------------------|---------------|
|    |                                           | Saplings | Poles | Trees |
| 1  | Kelat (Euginia biflora)                   | 0,71    | 0,50  | 0,25  |
| 2  | Beras-Beras (Syzygium zeilanicum)         | 0,29    | 11,20 | -     |
| 3  | Ubar Susu (Glutta renghas)                | 0,32    | 0,48  | 26,14 |
| 4  | Nyamplung (Calophyllum inophyllum)        | 1,06    | -     | -     |
| 5  | Kayu Cengal (Hopea sangal)                | 0,31    | -     | -     |
| 6  | Serenihan (Peronema canescens)            | 0,31    | -     | 0,14  |
| 7  | Pete-Petean (Leguminaceae)                | -       | 0,08  | -     |
| 8  | Malaka/ Ara (Ficus racemos)               | -       | 0,39  | 0,05  |
| 9  | Rukam (Flacourtia rukam)                  | -       | 0,16  | -     |
| 10 | Uginea (Eugenia sp)                       | -       | 0,11  | -     |
| 11 | Sung                                      | -       | 0,21  | 0,76  |
| 12 | Jambu-Jambuan (Euginea involucrat)        | -       | 0,54  | 0,64  |
| 13 | Merak 3 Jari (Macaranga sp)               | -       | 0,08  | -     |
| 14 | Bacang (Mangifera foetida)                | -       | 0,07  | 0,05  |
| 15 | Kayu Ulin (Eusideroxylon zwageri)         | -       | 0,07  | -     |
| 16 | Medang Kresik (Phoebe hunanensis)         | -       | -     | 0,31  |
| 17 | Kayu Guranji (Syzygium cumini)            | -       | -     | 0,07  |
| 18 | Beringin (Ficus benjamina)                | -       | -     | 0,26  |
| 19 | Meranti (Shorea sp.)                      | -       | -     | 0,05  |
| 20 | Udang-Udang                              | -       | -     | 0,05  |
| 21 | Medang Sereh (Phoebe hunanensis)          | -       | -     | 0,09  |
| 22 | Rengas (Gluta renghas)                    | -       | -     | 0,05  |
| 23 | Pucuk Merah (Syzigium myrtifolium)        | -       | -     | 26,15 |
| 24 | Kratom (Mitragyna speciosa)               | -       | -     | 0,05  |
| 25 | Aluminjuk                                 | -       | -     | 0,05  |
Based on the Importance Value Index analysis, which is calculated from the stage of saplings, poles, and trees, several types of plants have high IVI value. This shows that in the sapling stage, Nyamplung (*Calophyllum inophyllum*) has the highest Importance Value Index. Furthermore, the highest Importance Value Index in the pole stage is Beras-Beras (*Syzygium zeilanicum*) or known as rice. This species has good adaptability in nature, especially in the type of primary swamp land cover, besides that this species has the ability to regenerate quite easily and this type bears fruit all year round.

![Figure 4. Forest conditions in primary swamp forest.](image1)

![Figure 5. Standings conditions in primary swamp forest.](image2)

![Figure 6. Site conditions in primary swamp forest.](image3)
In the tree stage, the highest index of importance was Ubar Susu (Glutta renghas) or sweet potatoes and Pucuk Merah (Syzygium myrtifolium) or red shoots. These species have a high IVI because they have high competitiveness against others that grow around them, namely competition related to light absorption, growth space, and absorption of soil nutrients. Furthermore, with good growth and supported by the ability to compete with other plants so that these species will have a high level of dominance, especially in the tree growth stage. There are several types for tree phases that have the smallest IVI such as Malaka/Ara (Ficus racemosa), Bacang (Mangifera foetida, Meranti (Shorea sp.), Udang-udang Trees, Rengas (Gluta renghas), Kratom (Mitragyna speciosa), Aluminjuk Trees. Small IVI indicates that these species do not have sufficient ability to compete with other types that have a high IVI value, this is due to several things such as having slow growth, not getting enough nutrients from the soil and not getting enough sunlight. because of header competition

4. Conclusions
There are 25 types of plants found in Rawa Singkil Wildlife Reserve, consisting of 3 growth stages, namely saplings, poles, and trees. Nyamplung (Calophyllum inophyllum) had the highest IVI value in the sapling growth stage, Beras-Beras (Syzygium zeilanicum) had the highest IVI value in the pole growth stage, and Ubar Susu (Glutta renghas) and Pucuk Merah (Syzygium myrtifolium) had the highest IVI values at tree growth stage.

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