IJSRM
INTERNATIONAL JOURNAL OF SCIENCE AND RESEARCH METHODOLOGY
An Official Publication of Human Journals

Human Journals
Research Article
November 2019 Vol.:14, Issue:1

The Structure and Composition of Mangrove Vegetation in Dolago, South Parigi, Moutong

IJSRM
INTERNATIONAL JOURNAL OF SCIENCE AND RESEARCH METHODOLOGY
An Official Publication of Human Journals

I Nengah Korja*[1], Bau Toknok[2], Abdulrasyid Tolangara[3], Moh. Arinal Haq[4]

[1,2]*Lecturer at Faculty of Forestry, Universitas Tadulako,*

[3]*Lecturer at Department of Biology Education, the Faculty of Teacher Training and Educational Biology, Universitas Khairun, Ternate*

[4]*Researcher at the Faculty of Forestry, Universitas Tadulako*

Submission: 22 October 2019
Accepted: 29 October 2019
Published: 30 November 2019

Keywords: Structure, Composition, Mangrove Vegetation, the *Dolago* Village

ABSTRACT

The structure and composition of mangrove vegetation in the *Dolago* village, South *Parigi* District, *Parigi Moutong* Regency were investigated during a 3-month period from March to May 2016. Transects and quadrats were used as sampling methods. Spot check method was employed to complement data collected using the line transect and kuadrat methods. The transect line was laid out across the surveyed area and located perpendicular to the coastline towards the land. Two transect lines were made and each of the lines was 70m in length. Seven continuous plots were put on each transect line and kuadrat, so there were 14 plots in total. On the other hand, three plots were made for the spot check inspection. The results showed that the surveyed mangrove vegetation consisted of 11 plant species from 9 families. *Rhizophora apiculata* was observed as the most dominant species found at all stages of plant growth (42 individuals/ha at the tree level, 2541 individuals/ha at the sapling level, and158 individuals/ha at the seedling level). In addition, the structure of mangrove vegetation in the *Dolago* village could support up to three stratum levels (C, D, and E).

INTRODUCTION

Mangrove forest is a tropical coastal vegetation community that inhabits moist and muddy area, which are affected by tides [1]. Mangroves are plants whose life viability is highly dependent on environmental conditions. Some environmental factors that may affect the growth of mangroves in a particular location include the beach physiography (topography), the tides (duration, range), the waves and currents, the climate (light, rainfall, temperature, wind), the salinity, soil, and dissolved oxygen, soil as well as the availability of the nutrients [2].

Mangroves have seven requirements to grow. They need average air temperatures of no more than 5°C with seasonal fluctuations and of more than 20°C in the coldest month. They cannot live in swift ocean currents but instead thrive in places that are protected from strong wind and strong waves, for example in estuaries, bays, lagoons, deltas. They require a flat/gentle coastal topography with the presence of sea water. The tidal fluctuations where the mangroves dwell should be large enough to associate with the sloping topographic beaches. Furthermore, the presence of mud and volcanic soil is highly important for the development of mangroves [3].

In addition to a variety of mangrove growing places, mangrove plants in Indonesia are also quite diverse. There have been at least 202 species of mangrove plants recorded to inhabit Indonesian lands, including 89 tree species, 5 palm species, 19 vine species, 44 soil herbaceous species, 44 epiphyte species, and 1 fern species [4].

Mangrove forests in Central Sulawesi comprise an area of 46.000 Ha [5], while in Parigi Moutong and the Dolago village, mangrove forests cover areas of 1.339 Ha and ± 15 Ha (but now only ± 10 Ha remains due to land conversion for fish farming), respectively [6]. Even though the mangrove forest area in the Dolago Village is fairly extensive, data regarding the structure and composition of its mangrove vegetation is yet unavailable. [7] state that such data are very much needed in the context of preparing a sustainable management plan and use of mangrove forests. To accommodate these goals, this study aimed to determine the structure and composition of mangrove vegetation in the Dolago village, South Parigi District in Moutong.

I. METHODS

The current study was carried out over a 3 month period from March to May 2016 in the Dolago village, South Parigi, Moutong. Equipment used in this study were a GPS, a roller meter, stakes, fiber ropes, a compass, a measuring tape, and a haga altimeter, while materials used in this study included mangrove vegetation in the surveyed area.

Data collection was performed using the combination of transect and kuadrat lines methods [8]. Spot check method was employed [9] to complement information on species composition, species distribution, and general structure of the mangrove forest that could not be observed with the transect and kuadrat methods. Two lines of transects and kuadrats were laid out across the surveyed area. Each of the lines was 70 m in length and consisted of 7 continuous plots (14 plots in total). On the other hand, 3 plots were made for the spot check investigation. The sizes of each observation plot were 10x10 m, 5x5 m, 2x2 m for tree-level observation, sprout-level observation, and seedling-level observation, respectively. Vegetation growth stages that were observed consisted of woody plants with a diameter of 10cm or more than 10cm, saplings with a height of 1.5 m and a diameter of less than 10 cm, and seedlings with a height of less than 1.5 m [8]. All plant species at the tree-level and sapling-level were recorded and identified. Their heights and circumferences were measured. Identification of seedling species and number of individuals was also conducted.

To provide a description of the horizontal and vertical structures of the mangrove vegetation, a direct observation was carried out using canopy profile diagram (70×10.m). Paint and Photoshop were used to help visualize the conditions on the surveyed field. Data required to describe the horizontal and vertical structures of the mangroves were summarized as follows:

1)..The position of the tree on the line, measured from the same direction consecutively and from the initial point of the tree measurement.

2). The total height and bole length of the tree or both if possible.

3). The crown projection area (tree canopy width).

4). The tree diameter at breast height (130 cm) or a diameter of 10 cm above the plank root (if the tree has plank root).

Tabulated data were analyzed using vegetation analysis method and Importance Value Index (IVI) of each species was calculated. The quantitative values of the vegetation parameters were measured using the following formulas [8]:

1. Species Density (D)

$$(D) = \frac{\sum individuals\ of\ a\ type}{\text{Area of the entire plot}}$$

2. Relative Density of a Species (RD)

$$(KD) = \frac{\text{Density of a type}}{\text{Density of All Types}} x100\%$$

3. Frequency of a Species (F)

$$F = \text{The plot found a type} \quad \text{the whole observation plot}$$

4. Relative Frequency (RF)

$$RF = \frac{\text{Frequency of a type}}{\text{Frequency of All Types}} x100\%$$

5. Basal Area = $^1/_4\ \pi\ d^2$

6. Dominance Index of a Species (D). D is only calculated for the tree level

$$D = \frac{\text{The basic area of a type}}{\text{Area of observation plot}}$$

7. Relative Dominance (RD)

$$(RD) = \frac{\text{The dominance of a type}}{\text{The dominance of all types}} x100\%$$

8. Importance Value Index (IVI)

a..of trees or saplings was

IVI = Relative Density + Relative Frequency + Relative Dominance

b. of seedlings was

IVI = Relative Density + Relative Frequency

The vegetation structure was determined by making vertical and horizontal images as well as graphs of diameter to the number of individuals and the height of the tree to the number of individuals.

II. RESULTS AND DISCUSSION

The identification result showed that mangrove vegetation in the Dolago village comprised 11 plant species from 9 families, such as presented in Table 1.

Table 1: Species Composition at Different Growth Stages

No.	Local Names	Species	Family	Component	Growth Stages		
					Tree	Sapling	Seedling
1.	*Roppa*	*Sonneratia alba* *	Sonneratiaceae	Major	√	√	√
2.	*Tanjung weal*	*Rhizophora apiculata* *	Rhizophoracea	Major	√	√	√
3.	*Tanjung lanang*	*Rhizophora mucronata* *	Rhizophoracea	Major	v		√
4.	*Api-api*	*Avicennia marina* *	Avicenniaceae	Major	√		
5.	*Tongke*	*Bruguiera gymnorrhiza* *	Rhizophoracea	Major	√		
6.	*Nyirih*	*Xylocarpus moluccensis* *	Meliaceae	Minor	√		
7.	*Ketapang*	*Terminalia catapa L**	Combretaceae	Associated	√		
8.	*Waru laut*	*Hibisus tiliaceus* *	Malvaceae	Associated		√	
9.	*Cemara laut*	*Casuarina equisetifolia L* *	Casuarinaceaae	Associated	√		
10.	*Katang-katang*	*Ipomoea pes-caprae* **	Convolvulaceae	Associated			√
11.	*Sesepi, gelang laut*	*Sesuvium portulacastrum* (L.) L **	Aizoaceae	Associated			√

Notes: * Tree, **Ground herbs

Table 1 shows that *Sonneratia alba* and *Rhizophora apiculata* are two plant species that can be found at the seedling, sapling, and tree levels. *Sonneratia alba* is often found at all growth stages due to the appropriate environmental conditions. [10] suggests that clay soil helps *Sonneratia alba* to develop. A fine-textured soil contains 70% minerals as nutrient reserves [11]. In addition, *Rhizophora apiculata* is claimed to be a species that can adapt to the new environment more easily compared to other mangrove species [12]; therefore, this species can be found at all growth stages. On the other hand, *Rhizophora mucronata* can only be found at the tree and seedling levels due to current environmental conditions and human

activity. Biologically, mangrove growth is mainly influenced by the water environmental parameters, such as water salinity, temperature, pH, DO, and substrates [13].

Furthermore, *Avicennia marina, Bruguiera gymnorrhiza, Xylocarpus moluccensis, Terminalia catapa L, Hibiscus tiliaceus and Casuarina equisetifolia* L are identified as vegetation that can only be found at one level of growth due to their low adaptability to for example the soil or weather conditions. [2] mention that the beach physiography (topography), the tides (duration, range), the waves and currents, the climate (light, rainfall, temperature, wind), the salinity, soil, and dissolved oxygen, soil as well as the availability of the nutrients are several factors that can affect the development of mangroves in a certain location. Unfortunately, *Ipomoea pes-caprae* and *Sesuvium portulaca strum* (L.) L, cannot grow into trees or saplings because they are categorized into ground herbs.

The dominance of a species in a community can be determined by calculating the IVI of each of the species present in the area. Species with the highest IVI is considered as the most dominant species in the community [15]. The result of the data analysis on the IVI of the species observed in this study is summarized in Table 2.

Table 2: Importance Value Index of Mengrove Vegetation in the Dolago Village

No.	Species	Number of individuals	IVI		
			Tree	Sapling	Seedling
1.	*Sonneratia alba* *	26	88,22	23,54	6,82
2.	*Rhizophora apiculata* *	207	142,43	254,1	157,78
3.	*Rhizophora mucronata* *	11	19,54	-	11,49
4.	*Avicennia marina* *	4	14,8	-	-
5.	*Bruguiera gymnorrhiza* *	2	9,11	-	-
6.	*Xylocarpus moluccensis* *	2	8,2	-	-
7.	*Terminalia catapa L* *	2	8,04	-	-
8.	*Casuarina equisetifolia L* *	1	9,66	-	-
9.	*Habiscus tiliaceus* *	2	-	22,36	-
10.	*Ipomoea pes-caprae* **	8	-	-	13,36
11.	*Sesuvium portulacastrum* (L.) L **	5	-	-	10,56
Total		270	300	300	200

Notes: * Trees ** Ground Herbs

Table 2 indicates that the most dominant species at the tree, sapling, and seedling levels in the Dolago mangrove community is *Rhizophora apiculata. Rhizophora apiculata* possesses the highest regenerative capacity among other species in the community. This species is also shown to have higher Importance Value Indices at all growth stages because it regularly receives an adequate supply of fresh water [4] claim that *Rhizophora apiculata* prefers to live in tidal waters that have a strong influence on permanent fresh water input. The level of dominance of this species can reach 90% of the vegetation that grows in a particular location.

On the other hand, *Avicennia marina, Bruguiera.gymnorrhiza,.Xylocarpus moluccensis, Terminalia catapa* L, *Casuarina equisetifolia* L, and *Hibiscus tiliaceus* show lower regenerative capacities compared to other species since they failed to report Importance Value Indices at the seedling levels. [14] states that mangrove growth is affected by fresh water supply, salinity, nutrient availability, and substrate stability. The structure of the mangrove vegetation in relation with the tree diameter and number of individuals is depicted in Figure 1.

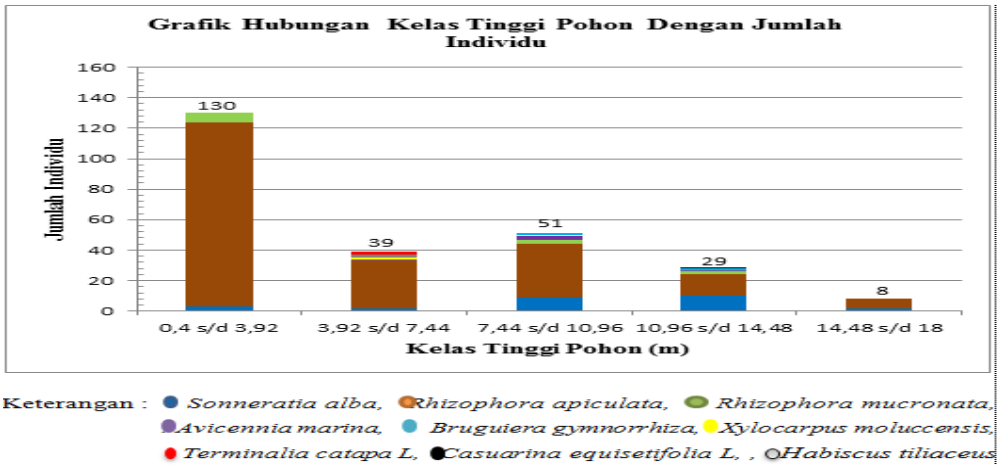


Figure 1: Tree Diameter and Number of Individuals

Figure 1 shows that the majority of the mangrove trees (i.e 238 trees) that can be found in the Dolago coastline has a diameter ranging from 1 to 24 cm. On the contrary, as the category of the tree height improves, the number of the mangrove individuals decreases. The graph that describes such relationship is presented in Figure 2.

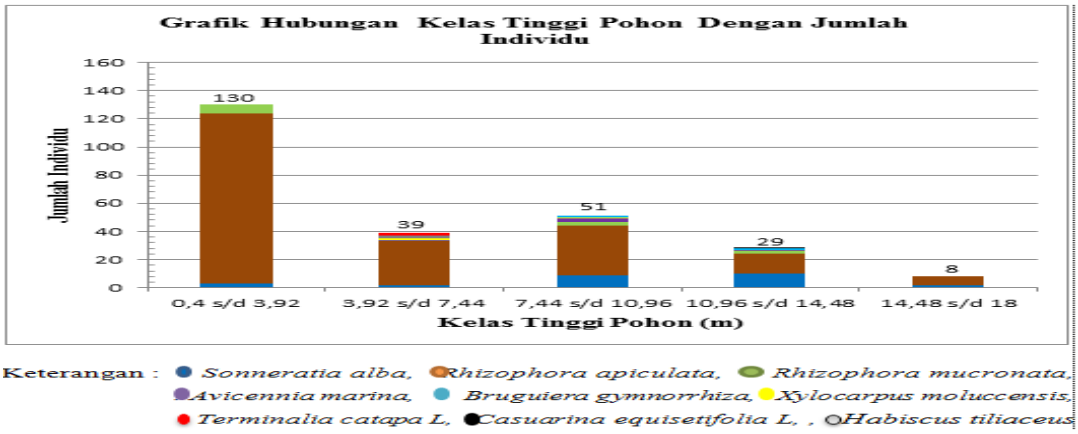
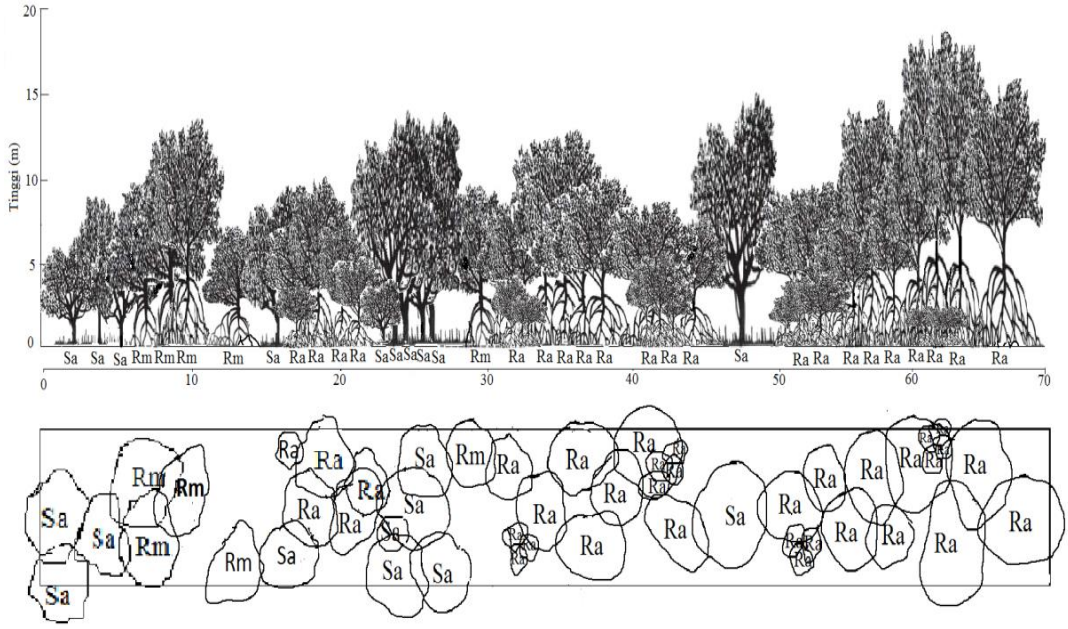


Figure 2: Tree Height and Number of Individuals

Figure 2 shows that in general, mangrove trees found in the Dolago coastlines can reach heights of 0.4 to 3.92 meters(130 trees). Based on Figure 2, it can also be concluded that the forest already disturbed, indicated by lower crown measured from the ground and gaps in the forest canopy. The following figure shows the vertical and horizontal structures of mangrove vegetation in the study area.



Notes :Sa = *Sonneratia alba*, Rm = *Rhizophora mucronata*, Ra = *Rhizophora apiculata*

Figure 3. The Vertical and Horizontal Structures of Mangrove Vegetation in the Study Area

Figure 3 indicates that trees with heights of 0.4 to 18 meters or with C, D and E categories are dominant in this area. Based on the vegetation types, this forest can be considered as a homogeneous forest. The distance between the trees is apparently small and there are branches that can or cannot touch each other. Therefore, it can be said that the trees found along the transect are still in a natural condition.

III. CONCLUSIONS

Based on the results of the study, it can be concluded that:

1. Mangrove vegetation in the Dolago Village, South Parigi, Moutong comprises 11 plant species from 9 plant families.

2. *Rhizophora apiculata* has been found as the most dominant species at the tree, sapling, and seedling levels with 142.43, 254.1, and 157.78 individuals/ha, respectively.

3. The structure of the mangrove vegetation surveyed in this study can support up to three stratum levels that are stratum C, D, and E.

REFERENCES

[1] Harahap N. Penilaian Ekonomi Ekosistem Hutan Mangrove dan Aplikasinya Dalam Perencanaan Wilayah Pesisir. Yogyakarta: Graha Ilmu. 2010.
[2] Alwidakdo A, Azham Z, Kamarubayana L. Studi Pertumbuhan Mangrove Pada Kegiatan Rehabilitasi Hutan Mangrove di Desa Tanjung Limau Kecamatan Muara Badak Kabupaten Kutai Kartanegara. Jurnal AGRIFOR. Volume XIII Nomor 1, Maret. 2014
[3] Kusmana C. Nilai Ekologis Ekosistem Hutan Mangrove (Ecological Values of Mangrove Forest Ecosystem). Media Konservasi Vol. V No. (I), : 17 – 24. 1996.
[4] Noor, R, Y,. Khazali, M,. Suryadiputra, N, N, I,. Panduan Pengenalan Mangrove di Indonesia. Bogor : PHKA/WI-IP. 2012
[5] Antara Sulteng. 28 April. Parigi Moutong Siap Menjadi Tempat Balai Mangrove. 2012
[6] Hidayatullah, M,. Pujiono, E. Struktur Dan Komposisi Jenis Hutan Mangrove Di Golo Sepang Kecamatan Boleng Kabupaten Manggarai Barat. Jurnal Penelitian Kehutanan WallaceaVol.3No.2151– 162 . 2014.
[7] Onrizal. Teknik Survey Dan Analisa Data Sumberdaya Mangrove. Di dalam : Pelatihan Pengelolaan Hutan Mangrove Berkelanjutan untuk Petugas/Penyuluh Kehutanan. Prosinding Balai Pengelolaan Hutan Mangrove Wilayah II bekerjasama dengan Japan International Cooperation Agency (JICA); Tanjung Pinang. 2008,
[8] Ghufron, H. Kordi, K, M. Ekositem Mangrove Potensi, Fungsi, dan Pengelolaan. Jakarta: Rineka Cipta. 2012.
[9] Azis R. Kondisi Fisik Tanah Hutan Mangrove Di Desa Dolago Kecamatan Parigi Selatan Kabupaten Parigi Moutong. Jurnal Warta Rimba. Volume 5, Nomor 1. Maret. 2016
[10] Hardjowigeno S. Ilmu Tanah. Akademika Presindo Jakarta. 2015.
[11] Silaen, F, I. B, Hendrarto dan M. N. Supardjo. Distribusi dan Kelimpahan Gastropoda Pada Hutan Mangrove Teluk Awur Jepara. Journal of Management of Aquatic Resources, 2 (3), 93-103. 2013.
[12] Haya N, Zamani PN, dan Soedharma D. Analisis Struktur Ekosistem. Mangrove di Desa Kukupang Kecamatan Kepulauan Joronga. Jurnal Teknologi Perikanan dan Kelautan. Vol. 6 No. 1. 2015

[13] Kamalia, Raza'i, S, T, Efrizal, T. Struktur Komunitas Hutan Mangrove Di Perairan Pesisir Kelurahan Sawang Kecamatan Kundur Barat Kabupaten Karimun. Jurnal Fakultas Ilmu Kelautan dan Perikanan Universitas Maritim Raja Ali Haji. 2012.
[14] Wahyuningsih, P, E,. Suleman, M, S,. dan Ramadanil. Struktur dan Komposisi Vegetasi Mangrove di Desa Lalombi Kecamatan Banawa Selatan Kabupaten Donggala. Jurnal Biocelebes. Vol. 6 No. 2. 2012