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ANALYSIS OF MANGROVE FOREST VEGETATION IN SINGA GEWEH VILLAGE, EAST KUTAI DISTRICT, EAST KALIMANTAN PROVINCE

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ABSTRACT

Mangroves have a very important role in protecting beaches from waves, sea winds and storms, protecting settlements, buildings and agriculture from strong winds or sea water intrusion and have also been proven to play an important role in protecting coasts from storms. Plant vegetation analysis is a way to study the composition of species and the form of vegetation structure.The aim of this research is to determine the composition of mangrove species, Importance Value Index, species diversity index, species evenness index, species dominance index and mangrove vegetation structure in Singa Geweh Village. This research was conducted for approximately 3 months.The Singa Geweh sub-district area is the object of research for analysis of mangrove forest vegetation using the stratified random sampling plot method which will be studied as many as 36 plots.The results of the research found 4 families, namely Avicenniaceae, Lythraceae, Rubiaceae and Rhizophoraceae, consisting of 8 species, namely Avicennia lanata, Phemphis acidula, Scyphiphora hydrophyllacea, Bruguiera sexangula, Ceriops zippeliana, Ceriops tagal, Rhizophora apiculata, and Rhizophora mucronata with a total number of 859 individuals. The highest importance value is the Rhizophora apiculata type at 230.40% for tree level, 168.20% for pole level, 103.95% for sapling level and 146.61% for seedling level. Species diversity at the tree and seedling level is low, while at the pole and sapling level it is moderate. Species evenness at the tree level is classified as low, while for the pole, sapling and seedling level it is classified as moderate. The dominant type is the Rhizophora apiculata type with a value for tree level of 0.77077, pole level of 0.29075, sapling level of 0.21910 and for seedling level of 0.49593.The horizontal stand structure of mangrove vegetation at tree level forms an L Form or inverted J pattern curve indicating that the tree population at the research location in the mangrove forest of Singa Geweh Subdistrict tends to develop towards uneven-age balanced forest (forest of all ages which is balanced), namely the larger the tree diameter. the fewer the number of individuals. The vertical stand structure of mangrove vegetation at tree level consists of 2 canopy layers, namely stratum B and C.

KEYWORDS:

Mangrove Forest Vegetation, Singa Geweh Village, East Kutai District.

INTRODUCTION

The mangrove ecosystem is a unique ecotone (transitional area), which connects land and marine biota. The ecological function of the mangrove ecosystem is very unique and its position cannot be replaced by other ecosystems. Mangrove forests, which are a transitional ecosystem between land and sea, have long been known to have dual functions and are a very important link in maintaining the balance of biological cycles in waters (Ramses, 2016).

As a transition area between sea and land, mangrove forests have a very extreme gradient in environmental properties. The tides of sea water cause changes in several major environmental factors, especially temperature and salinity. Therefore, only a few types of plants that have a high tolerance for extreme environments are able to survive and develop in them. This condition also causes low species diversity, but on the other hand, the population density of each type is generally high (Pramudji, 2001 in Ramses, 2016).

Mangroves have a very important role in protecting beaches from waves, sea winds and storms, protecting settlements, buildings and agriculture from strong winds or sea water intrusion and have also been proven to play an important role in protecting coasts from storm attacks (Nurhasanah et al., 2018). Mangrove roots are able to bind and stabilize mud substrates, mangrove forests also have biological functions as a food source, breeding place, protection and maintenance of aquatic biota, birds and mammals (Ezwardi, 2009 in Dekky et al., 2016).

Plant vegetation analysis is a way of studying the arrangement (species composition) and form (structure) of vegetation (Indriyanto, 2006; Irwanto,2007 in Ndede et al., 2016). Vegetation analysis requires quantitative data to determine the importance index and diversity index of the components of a forest community so that quantitative information can be obtained about the structure, abundance of species, distribution of vegetation in an ecosystem, as well as the relationship between the presence of plants and environmental factors. Vegetation analysis in mangrove forests is a tool that can support conservation activities, especially in terms of collecting data regarding the ecological characteristics of mangrove forests and their diversity so that policies taken for mangrove forests can run well.

Singa Geweh Village is one of the villages in East Kutai Regency, East Kalimantan Province, although it has quite extensive mangrove forests, so far the availability of data related to mangroves is still very minimal, including those related to the composition and structure of mangrove forests in the area. This data is very necessary in the context of preparing management and utilization plans for mangrove forests, so that their functions and benefits can be enjoyed sustainably. This is what prompted research on the composition and structure of mangrove forests in Singa Geweh Village, East Kutai Regency, East Kalimantan Province.

The research objectives are to determine: (1) the composition of mangrove species, (2) the importance value index, species diversity index, species evenness index and dominance index of mangrove vegetation types; and (3) the structure of mangrove vegetation in Singa Geweh Village, East Kutai Regency, East Kalimantan Province, Indonesia.

RESEARCH METHODOLOGY

A. Place and Time of Research

This research was carried out from October – December 2022 in Singa Geweh Village, East Kutai Regency, East Kalimantan Province, Indonesia.

B. Materials and Tools

The materials and tools used are: Tally Sheet, GPS, Compass, Laser meter/measuring rope (meter), diameter tape (phi band), stationery. Data processing is carried out using a portable computer (laptop) equipped with Microsoft Office and ArcGIS programs as well as digital printing equipment (printer).

C. Field Data Collection Method

The placement of sample points for field checking was carried out using the purposive random sampling method, namely by placing the sample points to be studied based on the land cover conditions in the mangrove forest. The sampling intensity used for forest groups area of 1,000 ha or more, the sampling intensity used is 2%, Meanwhile, if it is less than 1,000 ha then the sampling intensity5% - 10% is used (Hadjar, 2017 in Pratama, 2018). The sampling intensity used in this research was 5% of the mangrove forest area to be studied, namely 72 ha, the research sampling plot was circular with a radius of 17.8 m. So, to find out the number of samples needed, it can be determined using the following formula (Latifah, 2005 in Nurfansyah et al., 2019): n = (IS x N): Area of Sample Plot

Description: n = number of sample plots; IS = Sampling Intensity; N = area to be studied;

From these calculations it is known that the number of plots used was 36 plots, to place these plots using systematic random sampling with random start.The parameters measured according to the size class on the plot within the radius of the circle are as follows:

1. Measure the level of seedlings at a radius of 1 m from the center of the plot by recording the number and type of woody stands under 1.5 m high.
2. Measure the level of stakes at a radius of 2 m from the center of the plot by recording the number and type of woody stands with a height above 1.5 m and a diameter below 5 cm.
3. Pillar level measurements at a radius of 5 m from the center of the data collection plot are carried out on woody stands with a diameter of 5 - < 10 cm.
4. Tree level measurements at a radius of 17.8 m from the center of the data collection plot were carried out on woody stands with a diameter of ≥ 10 cm.

The enumeration radius can be seen in Figure 1 as follows

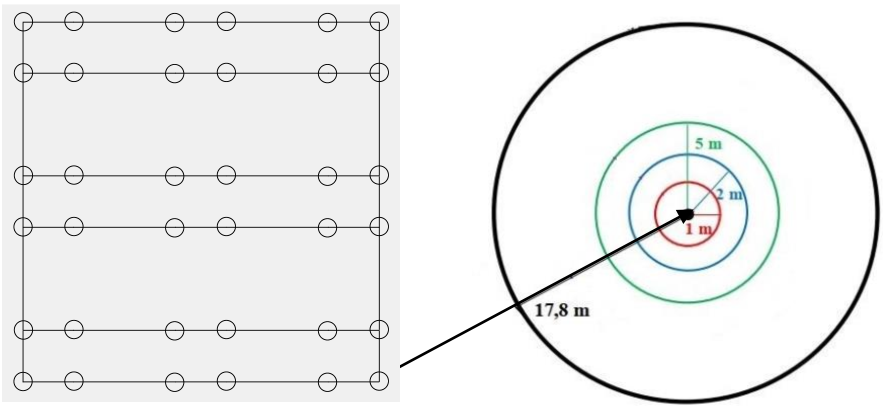

Figure 1. Enumeration Radius

D. Data Analysis

The analysis in this study used quantitative descriptive analysis. Quantitative analysis was carried out to calculate the Importance Value Index, Species Diversity Index, Species Evenness Index and Dominance Index of mangrove vegetation types. To identify the name of the type, use the mangrove introduction guidebook.

The data obtained from the results of measurements in the field are then carried out by calculating the analysis of density and relative density, frequency and relative frequency, basal area (LBD), domination and relative domination, as well as the Important Value Index (INP) obtained from the Soerianegara and Indrawan formula in Juniarti et al., (2017), namely:

1. **Density (K) and Relative Density (KR)** of a type are calculated using the following formula:

Density (K) =
[Number of individuals of a type]/[Area of all sample units]
Relative Density (KR) =
[Density of a type]/[Density of all types] x 100 %

2. **Frequency (F) and Relative Frequency (FR) of a type**
   Frequency (F) shows the number of distributions where a type is found from all measuring plots obtained from the following formula :
   Frequency (F) =
   [Number of plots found for a type]/[Number of all plots]
   Relative Frequency (FR)=
   [Frequency of a type]/[Frequency of all types] x 100 %
3. Base Area (LBD)
   To obtain the base area value for dominance calculations, the following formula can be used :

$$LBD = \frac{1}{4}\pi d^2$$

Description:
LBD = base area (m2); d = tree diameter at breast height (cm);and
Л = phi which is 3.14.

4. **Dominance (D) and Relative Dominance (DR) of a type**
   Dominance (D) is used to determine which species grow more/dominate in a place. Growth is carried out at the growth level of poles and trees based on the following formula:

Domination (D) = [Base area of a type]/[Area of all sample units]
Relative Dominance (DR) =
[Domination of a type]/[Domination of all types] x 100 %

5. **Important Value Index (INP)**
   The Importance Value Index (INP) reflects the ecological position of a species in its community, which is useful for determining the level of dominance of one species over other species in a plant community. The INP calculation is calculated using the following formula
   For seedling and sapling levels, these areINP = KR% + FR %

Description:
KR = Relative Density; FR = Relative Frequency
For the level of poles and trees isINP = KR% + FR% + DR%"
Description:
INP = Important Value Index; KR = Relative Density; FR = Relative Frequency; and DR = Relative Dominance

The species diversity index is calculated using the Shannon – Wiener diversity formula (Bengen, 2000 in Kresnasari et al., 2021) as follows

$$H' = -\sum_{i=1}^{n}\left[\frac{ni}{N} \times \ln\left(\frac{ni}{N}\right)\right]$$

Description:
H′ = Shannon–Wiener Diversity Index
Ni = Number of individuals of each type i
N = Total individuals of all types

The results obtained can then be categorized, namely
If H′ < 1 then the diversity index is categorized as low
If 1 < H′ < 3 then the diversity index is categorized as medium
If H′ > 3 then the diversity index is categorized as high

The Species Evenness Index (E) shows the level of evenness of individuals per species. The E value (Pielou, 1975 in Ghufrona et al., 2015) is calculated using the following formula :

$$E = \frac{H'}{\ln (S)}$$

Description:
E = Species Evenness Index; H′ = Species Diversity Index, and
Ln (S) = Number of Species found
According to Magurran (1988) in Ghufrona et al. (2015) the results obtained can then be categorized as follows
E < 0.3 = low species evenness
0.3 < E < 0.6 = medium type evenness
E > 0.6 = high species evenness

The dominance index is calculated using the following formula

$$C = \sum_{i=1}^{n}\left(\frac{ni}{N}\right)^2$$

Description:
C = Dominance Index; ni = Number of individuals of each type I; and
N = Total individuals of all types
If the dominance index value is high, then dominance (control) is concentrated in one species. However, if the dominance index value is low, then dominance is concentrated in several species. The dominance index criteria (Simpsons, 1949; Odum, 1993 in Nuraina et al., 2018) are0 < C < 0.5 = no dominant type; and 0.5< C < 1 = there is a dominant type

RESULTS AND DISCUSSION

A. General Description of the Research Location

Singa Geweh Village is one of the Villages in South Sangatta District, East Kutai Regency. In terms of government administration, Singa Geweh Village borders the Sangatta River to the North, the Makassar Strait to the East, Sangkima Village, South Sangatta Village to the South and South Sangatta Village to the West.

The area of Singa Geweh Village is 4,627.54 Ha. The Singa Geweh sub-district area is geographically seen from the topographic heights.

The Singa Geweh Village area is at 0-50 m height above sea level with an average rainfall of 110-114 mm/year, and the average temperature per year is 30º C. The map of the research location in Singa Geweh Village is presented in Figure 2 as follows

Figure 2. Map of research locations

B. Composition of Mangrove Types in Singa Geweh Village

The total number of individuals found in Singa Geweh Village was 859 individuals, with a total of 8 species originating from 4 mangrove families. The research data is presented in Table 1 below:

Table 1. Number of Mangrove Types Found at the Research Location

No	**Family**	**NameType**	**Number of Individuals**
1	Avicenniaceae	*Avicennia lanata*	17
2	Lythraceae	*Phemphis acidula*	11
3	Rubiaceae	*Scyphiphora hydrophyllacea*	5
4	Rhizophoraceae	*Bruguiera sexangula*	52
5	Rhizophoraceae	*Ceriops tagal*	64
6	Rhizophoraceae	*Ceriops zippeliana*	11
7	Rhizophoraceae	*Rhizophora apiculata*	688
8	Rhizophoraceae	*Rhizophora mucronata*	11
Total			**859**

The mangrove families found consist of: Avicenniaceae (1 type), Lythraceae (1 type), Rubiaceae (1 type), and Rhizophoraceae (4 types). The most numerous type is Rhizophora apiculata with 688 individuals, followed by the Ceriops tagal type with 64 individuals, and the Bruguiera sexangula type with 52 individuals, the other types range from 5 – 17 individuals.

To find out the number of individuals found at each growth level, see Table 2.

Table 2. Number of Mangrove Types Based on Growth Level

No	NameType	Number of Individuals			
		Seedling	**Sapling**	**Pole**	**Tree**
1	*Avicennia lanata*	0	0	5	12
2	*Bruguiera sexangula*	4	6	16	26
3	*Ceriops tagal*	15	15	19	15
4	*Ceriops zippeliana*	0	0	0	11
5	*Phemphis acidula*	0	0	7	4
6	*Rhizophora apiculata*	50	22	55	561
7	*Rhizophora mucronata*	2	4	0	5
8	*Scyphiphora hydrophyllacea*	0	0	0	5
Total		**71**	**47**	**102**	**639**

Based on Table 2, the total number of species at the seedling level is 71 seedlings coming from 4 types of mangroves, at the sapling level there are 47 saplings coming from 4 types of mangroves, at the pole level there are 102 poles coming from 5 types of mangroves, at the tree level there are 639 trees coming from of 8 types of mangroves. *Rhizophora apiculata* is the most frequently found type, while *Scyphiphora hydrophyllacea* is the least common type. This was stated by Kazali (2012) in Pratama (2018) that *Rhizophora apiculata* is a true mangrove whose discovery rate is 90% in a swamp mangrove habitat compared to other vegetation that grows in the same location. Furthermore, Onrizal (2008) stated in Pratama (2018) that *Rhizophora apiculata* grows in areas with fine muddy habitats and is flooded at high tide.

C. Important Value Index (INP)

The results of the analysis of the importance value index at the complete data tree level are presented in Table 3 as follows

Table 3. Recapitulation of Tree Level Important Value Index Analysis Results

No	NameType	Density	KR (%)	Frecuency	FR (%)	Domination	DR (%)	INP
1	*Avicennia lanata*	3,35	1,88	0,08	4,76	0,149	1,90	8,54
2	*Bruguiera sexangula*	7,26	4,07	0,28	15,87	0,304	3,87	23,81
3	*Ceriops tagal*	4,19	2,35	0,17	9,50	0,051	0,65	12,52
4	*Ceriops zippeliana*	3,07	1,72	0,08	4,80	0,107	1,36	7,84
5	*Phemphis acidula*	1,12	0,63	0,03	1,60	0,003	0,04	2,25
6	*Rhizophora apiculata*	156,64	87,79	0,94	53,97	6,964	88,63	230,40

No	NameType	Density	KR (%)	Frecuency	FR (%)	Domination	DR (%)	INP
7	*Rhizophora mucronata*	1,40	0,78	0,11	6,30	0,146	1,86	8,99
8	*Scyphiphora hydrophyllacea*	1,40	0,78	0,06	3,20	0,133	1,69	5,65

Based on the results of data analysis on the importance of mangrove vegetation at tree level, the type that has the highest INP is *Rhizophora apiculata* at 230.40% and the type that has the lowest INP is *Phemphis acidula* at 2.25%.

The results of the analysis of the important value index at the pole level, the complete data is presented in Table 4 as follows.

Table 4. Recapitulation of Analysis Results of the Important Value Index at Pole Level

No	NameType	Density	KR (%)	Frecuency	FR (%)	Domination	DR (%)	INP
1	*Avicennia lanata*	17,69	4,90	0,08	8,57	0,111	7,01	20,49
2	*Bruguiera sexangula*	56,62	15,69	0,11	11,43	0,183	11,56	38,67
3	*Ceriops tagal*	67,23	18,63	0,14	14,29	0,293	18,46	51,37
4	*Phemphis acidula*	24,77	6,86	0,06	5,71	0,138	8,69	21,27
5	*Rhizophora apiculata*	194,62	53,92	0,58	60,00	0,861	54,28	168,20

Based on the results of data analysis on the importance of mangrove vegetation at pole level, the type that has the highest INP is *Rhizophora apiculata* at 168.20% and the type that has the lowest INP is *Avicennia lanata* at 20.49%.

The results of the analysis of the important value index at the stake level, the complete data is presented in Table 5 as follows

Table 5. Recapitulation of the Results of the Analysis of the Importance Value Index at the Stake Level

No	NameType	Density	KR (%)	Frecuency	FR (%)	INP
1	*Bruguiera sexangula*	132,70	12,77	0,06	14,29	27,05
2	*Ceriops tagal*	331,74	31,91	0,08	21,43	53,30
3	*Rhizophora apiculata*	486,55	46,81	0,22	57,14	103,95

4	*Rhizophora mucronata*	88,46	8,51	0,03	7,14	15,70

Based on the results of data analysis on the importance of mangrove vegetation at sapling level, the type that has the highest INP is *Rhizophora apiculata* at 103.95% and the type that has the lowest INP is *Rhizophora mucronata* at 15.70%.

The results of the analysis of the important value index at the seedling level, the complete data is presented in Table 6 as follows

Table 6. Recapitulation of Seedling Level Important Value Index Analysis Results

No	NameType	Density	KR (%)	Frecuency	FR (%)	INP
1	*Bruguiera sexangula*	353,86	5,63	0,03	4,76	10,40
2	*Ceriops tagal*	1326,96	21,13	0,08	14,29	35,41
3	*Rhizophora apiculata*	4423,21	70,42	0,44	76,19	146,61
4	*Rhizophora mucronata*	176,93	2,82	0,03	4,76	7,58

Based on the results of data analysis on the importance of mangrove vegetation at seedling level, the type that has the highest INP is *Rhizophora apiculata* at 146.61% and the type that has the lowest INP is *Rhizophora mucronata* at 7.58%.

Based on the recapitulation of the results of the important value index (INP) analysis, it shows that the *Rhizophora apiculata* type has the highest INP among other types, namely 230.40% for tree level, 168.20% for pole level, 103.95% for sapling level and 146.61 % for seeding rate. Meanwhile, the lowest INP at the tree level is the *Phemphis acidula* type at 2.25%, for the pole level it is the Avicennia lanata type at 20.49%, and the *Rhizophora mucronata* type at 15.70% for the sapling level and for the seedling level at 7.58 %. The results of the analysis of important values for the *Rhizophora apiculata* type are in the high category, while for the *Phemphis acidula, Avicennia lanata* and *Rhizophora mucronata* types they are in the low category. The INP value also describes the level of influence of a type of vegetation on ecosystem stability. According to Fahrul (2007) in Warpur (2018) the categorization of INP values is as follows: INP > 42.66 is categorized as high, INP 21.96 - 42.66 is categorized as medium, and INP < 21.96 is categorized as low. The importance value shows the importance of a plant type in influencing or not the plant in the community and ecosystem (Peters, 2004 in Hotden, et al., 2014).

Based on the results of research conducted by Warpur (2018) in Kunef Village, a species shows high importance, so the role of this species is very large compared to other species in the mangrove ecosystem. Thus, it can be said that *Rhizophora apiculata* has a fairly large role, especially in terms of the contribution of organic material to the mangrove ecosystem in Kunef Village. This statement is also supported by Prasetyo (2007) in Usman, et al. (2013) explained that a mangrove area that has a high importance value indicates that the mangroves in the area are in good condition and have not experienced any changes, conversely, if this condition decreases or turns into land due to sedimentation and is damaged due to human activity, rehabilitation needs to be carried out to balance the ecosystem awake.

D. Species Diversity Index

The species diversity index is used to determine the state of succession or community stability (Rochmady, 2015 in Khairunnisa et al., 2020). The complete data diversity index analysis results are presented in Table 7 as follows.

Table 7. Recapitulation of Species Diversity Index Analysis based on Growth Level

No	Nama Jenis	Species Diversity Index (H')			
		Tree	Pole	Sapling	Seedling
1	*Avicennia lanata*	0,075	0,148	0,000	0,000
2	*Bruguiera sexangula*	0,130	0,291	0,263	0,162
3	*Ceriops zippeliana*	0,070	0,000	0,000	0,000
4	*Ceriops tagal*	0,088	0,313	0,364	0,328
5	*Phemphis acidula*	0,032	0,184	0,000	0,000
6	*Rhizophora apiculata*	0,114	0,333	0,355	0,247
7	*Rhizophora mucronata*	0,038	0,000	0,210	0,101
8	*Scyphiphora hydrophyllacea*	0,038	0,000	0,000	0,000
Total		**0,585**	**1,269**	**1,192**	**0,838**

Based on the results of data analysis on the value of mangrove forest vegetation diversity for the tree and seedling level, it is classified as low because it has a value of $H' < 1$, namely for the tree level it is 0.585 and for the seedling level it is 0.838. Meanwhile, the pile and stake level is classified as medium because it has a value of $1 < H' < 3$, namely for the pile level it is 1.269 and for the pile level it is 1.192. According to Bengen (2000) in Kresnasari et al. (2021) that the magnitude of the species diversity index is that if the value of $H' > 3$ then species diversity is categorized as high or abundant, if the value $1 < H' < 3$ then species diversity is categorized as medium and if the value of $H' < 1$ then species diversity is categorized as low or little.

Based on the results of research conducted by Khairunnisa et al. (2020) in Dusun Besar Village, Pulau Maya District, North Kayong Regency, the diversity value is relatively low, this shows that the mangrove ecosystem has insufficient productivity and the ecosystem condition is not balanced enough, the water condition is unstable, and the pressure is high. ecological, and there is a dominant community. This statement is also supported by Suwardi et al., (2013) in Khairunnisa (2020) who stated that the species diversity of a community will be high if the community is composed of many species and no species dominates, and a community has a low species diversity value. if the community is composed of a few types and there is a dominant type.

E. Species Evenness Index

The species evenness index shows the level of evenness of individuals of each species in a location. The complete data type evenness index analysis results are presented in Table 8 as follows

Table 8. Recapitulation of Type Evenness Index Analysis based on Growth Level

No	Nama Jenis	Type Evenness Index (E)			
		Tree	Pole	Sapling	Seedling
1	*Avicennia lanata*	0,030	0,092	0,000	0,000
2	*Bruguiera sexangula*	0,040	0,105	0,147	0,117
3	*Ceriops zippeliana*	0,029	0,000	0,000	0,000
4	*Ceriops tagal*	0,033	0,106	0,135	0,121
5	*Phemphis acidula*	0,023	0,094	0,000	0,000
6	*Rhizophora apiculata*	0,018	0,083	0,115	0,063
7	*Rhizophora mucronata*	0,024	0,000	0,151	0,145
8	*Scyphiphora hydrophyllacea*	0,024	0,000	0,000	0,000
Total		**0,221**	**0,480**	**0,548**	**0,446**

Based on the results of data analysis on the evenness value of mangrove forest vegetation types at each growth level, the species evenness index for tree level is 0.221, pole level is 0.480, sapling level is 0.548 and for seedling level is 0.446. From the data analysis, it can be seen that the evenness value of mangrove species at the tree level is low, while the evenness value of mangrove species at the pole, sapling and seedling level is medium. Stated by Magurran (1988) in Ghufrona et al. (2015) the magnitude of the species evenness index is that if the E value is > 0.6 then the species evenness is categorized as high, if the value is 0.3 < E < 0.6 then the species evenness is categorized as medium and if the E value < 0.3 then the species evenness is categorized as low.

Furthermore, the results of research conducted by Namakule et al. (2020) in Sehati Village, Central Maluku Regency, the species evenness is relatively low due to the presence of a dominant species, the dominant species causes low evenness. This statement is supported by Suwardi et al., (2013) in Namakule et al. (2020) that evenness is inversely proportional to dominance. If the evenness of species in a community is low (the number of species is not the same), then dominance is high (there is a dominant species). Conversely, if the evenness of species in a community is high then dominance is low (there is no dominant species).

F. Dominance Index

The dominance index is a parameter used in a community to express the level of central dominance of a species. The complete data type dominance index analysis results are presented in Table 9 as follows

Table 9. Recapitulation of Type Dominance Index Analysis based on Growth Level

No	Nama Jenis	Type Dominance Index (C)			
		Tree	Pole	Sapling	Seedling
1	*Avicennia lanata*	0,00035	0,00240	0,00000	0,00000
2	*Bruguiera sexangula*	0,00166	0,02461	0,01630	0,00317
3	*Ceriops zippeliana*	0,00030	0,00000	0,00000	0,00000
4	*Ceriops tagal*	0,00055	0,03470	0,10186	0,04463
5	*Phemphis acidula*	0,00004	0,00471	0,00000	0,00000
6	*Rhizophora apiculata*	0,77077	0,29075	0,21910	0,49593
7	*Rhizophora mucronata*	0,00006	0,00000	0,00724	0,00079
8	*Scyphiphora hydrophyllacea*	0,00006	0,00000	0,00000	0,00000
Total		**0,77379**	**0,35717**	**0,34450**	**0,54452**

Based on the results of the analysis of species dominance values, it is known that the most dominant species found was *Rhizophora apiculata* with a dominance value for tree level of 0.77077, pole level of 0.29075, sapling level of 0.21910 and for seedling level of 0.49593. From the sum of each growth level, the dominance value at tree level was 0.77379, pole level was 0.35717, sapling level was 0.34450 and seedling level was 0.54452. So at the tree level there is a dominant species, while at the pole level, sapling level and seedling level there is no dominant species. This situation is described by The Odum (1993) in Nuraina et al., (2018) states that the value of the species dominance index is that if the value is $0 < C < 0.5$ then there is no dominant type and if the value is $0.5 < C < 1$ then there is a dominant type.

Based on the results of research conducted by Namakule et al. (2020) in Sehati Village, Central Maluku Regency, the dominance of mangrove species is relatively high because there are dominant species. These types are *Rhizophora apiculata* and *Rhizophora mucronata*. Both types of mangroves have good adaptation and mastery in their environment. This is in accordance with the opinion of Alimudin (2010) that the dominant type is the type that is able to adapt well and control space, nutrients, water and light in its environment compared to other types.

G. Mangrove Vegetation Structure

Vegetation structure consists of individuals that form stands in a space. Stand structure can be viewed from two directions, namely: horizontal and vertical stand structure. Horizontal stand structure describes the distribution or spread of individual species within their habitat. Meanwhile, vertical stand structure is expressed as the distribution of the number of trees in various canopy layers.

1. Horizontal Structure

The horizontal structure of a forest can be known from the relationship between diameter class and individual density in a forest location. Individual density based on diameter class at tree level, complete data is presented in Table 10 as follows

Table 10. Recapitulation of Individual Density Analysis by Diameter Class at Tree Level

No	NameType	Class of Diameter (cm)					Total
		10-19,9	20-29,9	30-39,9	40-49,9	50 up	
1	*Avicennia lanata*	1,96	0,56	0,84	0,00	0,00	3,35
2	*Bruguiera sexangula*	4,47	1,40	1,12	0,00	0,28	7,26
3	*Ceriops tagal*	4,19	0,00	0,00	0,00	0,00	4,19
4	*Ceriops zippeliana*	2,23	0,28	0,56	0,00	0,00	3,07
5	*Phemphis acidula*	1,12	0,00	0,00	0,00	0,00	1,12
6	*Rhizophora apiculata*	62,85	67,60	22,35	3,63	0,28	156,70
7	*Rhizophora mucronata*	0,00	0,28	0,84	0,28	0,00	1,40
8	*Scyphiphora hydrophyllacea*	0,00	0,28	0,84	0,28	0,00	1,40
Total		**76,82**	**70,40**	**26,55**	**4,19**	**0,56**	**178,49**

Based on Table 10 above, the density of individuals for each diameter class is not evenly distributed, the results of the analysis show that the *Rhizophora apiculata* type has the highest individual density in the 10-19.9 cm diameter class of 76.82 individuals, in the 20-29.9 cm diameter class. cm was 70.40 individuals, in the 30-39.9 cm diameter class it was 26.55 individuals, in the 40-49.9 cm diameter class it was 4.19 individuals. For the 50 up diameter class there are only 2 types, namely *Bruguiera sexangula* and *Rhizophora apiculata* with 0.28 individuals. The individual density of each diameter class at tree level can also be seen in Figure 3 as follows

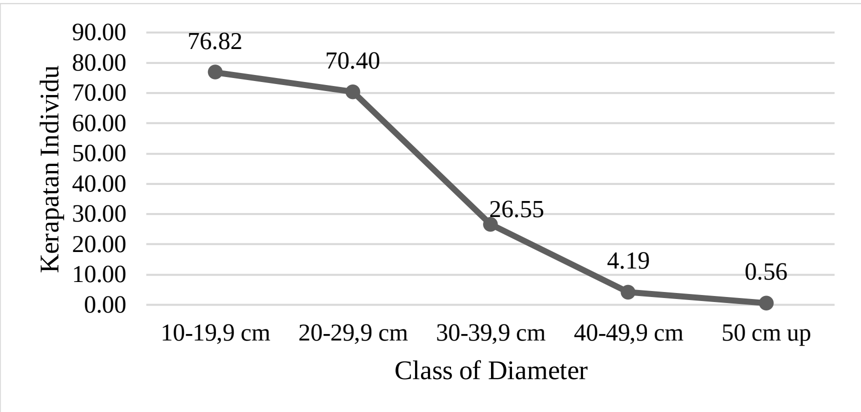

Figure 3 above shows that the horizontal structure of individual density in the 10-19.9 cm diameter class is 76.82 individuals, in the 20-29.9 cm diameter class it is 70.40 individuals, in the 30-39.9 cm diameter class cm, which is 26.55 individuals, in the 40-49.9 cm diameter class, which is 4.19 individuals and in the 50 up diameter class, which is 0.56 individuals.

Based on the results of research conducted by Ghufrona et al. (2015) on Sebuku Island, South Kalimantan showed that the distribution of the number of trees per hectare based on diameter class at almost all observation locations in the Sebuku Island mangrove forest tended to form an L-form. This shows that the tree population at each observation location in the Sebuku Island mangrove forest tends to develop towards an uneven-age balanced forest, that is, the larger the tree diameter, the fewer the number of individuals.

As in general mangrove forests in Indonesia, the composition of mangrove species in Singa Geweh Subdistrict is dominated by the Rhizophoraceae family. This is thought to be because the environmental conditions at the research location support the spread and growth of this family so that the adaptation process runs well. This is supported by Heriyanto & Subiandono, (2012) in Marsudi et al., (2018) that apart from suitable habitat, one of the reasons that the Rhizophora sp type has an even distribution is because this type is generally viviparous, namely the condition in which the seeds able to germinate while the fruit is still attached to the parent tree.

2. Vertical Structure (Heading Stratification)

Vertical structure (header stratification) is closely related to controla place to grow that is guided by the amount of energy from sunlight, the availability of ground water, growth that is guided by the amount of energy from light.

The vegetation structure can be divided into five consecutive stratum, namely stratum A, B, C, D and E. According to Indriyanto (2012) in Naharuddin (2017), not all types of forest ecosystems have five stratum, therefore, of course there are forests -forests that have strata A, B, D and E or C, D, and E and so on.

Crown stratification is determined by observing the condition of the tree canopy and classified by category according to Indriyanto (2017) in Putri et al. (2019), namely:

(1) Stratum A, namely the top layer of the forest canopy formed by trees that are more than 30 meters high.
(2) Stratum B, namely the second canopy layer formed by trees 20-30 meters high.
(3) Stratum C, namely the third canopy layer formed by trees 4-20 meters high.
(4) Stratum D, namely the fourth canopy layer formed by bush and shrub plant species with a height of 1-4 meters.
(5) Stratum E, namely the lowest canopy layer formed by ground cover plant species with a height of 0-1 meter.

The canopy cover is arranged based on the height of the tree, forming layers known as crown stratification. The canopy stratum at tree level at the research location can be seen in Table 11 as follows.

Table 11. Recapitulation of Header Stratum Analysis at Tree Level

No	NameType	Stratum A (> 30m)	Stratum B (20-30 m)	Stratum C (4-20m)	Stratum D (1-4 m)	Stratum E (0-1m)
1	*Avicennia lanata*	0	1	11	0	0
2	*Bruguiera sexangula*	0	4	22	0	0
3	*Ceriops tagal*	0	0	15	0	0
4	*Ceriops zippeliana*	0	0	11	0	0
5	*Phemphis acidula*	0	0	4	0	0
6	*Rhizophora*	0	27	534	0	0

No	NameType	Stratum A (> 30m)	Stratum B (20-30 m)	Stratum C (4-20m)	Stratum D (1-4 m)	Stratum E (0-1m)
	apiculata					
7	*Rhizophora mucronata*	0	1	4	0	0
8	*Scyphiphora hydrophyllacea*	0	1	4	0	0
Total		**0**	**34**	**605**	**0**	**0**

Based on Table 11 above, it shows that at the tree level for Stratum A, D and E there are no tree species, Strata B has 34 individuals from 5 species, which is dominated by *Rhizophora apiculata* with 27 individuals. Strata C numbered 605 individuals from 8 species, dominated by *Rhizophora apiculata* with 534 individuals. The number of trees that form canopy stratification at the research location can be seen in Figure 4 as follows

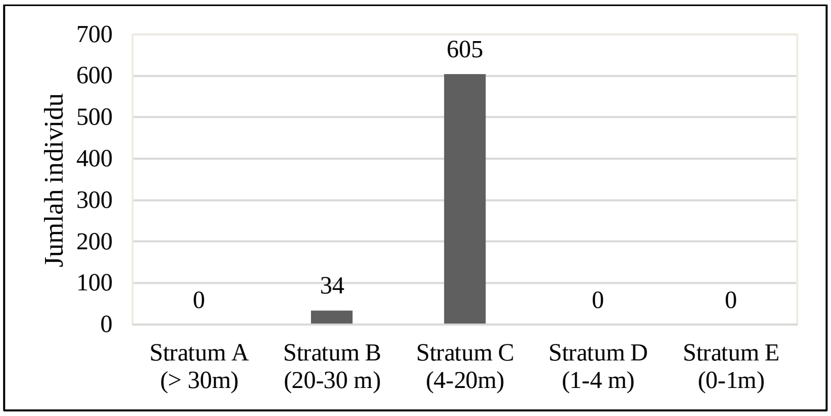

Figure 4. Header Stratum Graph at Tree Level

Based on the results of research conducted by Seran (2018) at Paradiso Beach, East Nusa Tenggara, it shows that there is 3 stratum forest stratification, namely C, D and E. What dominates the area the most is vegetation in stratum C with a height of between 4 - 20 cm, while the amount of vegetation in strata D and E is very low. The vegetation in the Paradiso Beach mangrove forest has a maximum height of 10 m.

CONCLUSIONS AND RECOMMENDATIONS

A. Conclusion

Based on the results of vegetation analysis research that has been carried out in Singa Geweh Village, it can be concluded as follows:

1. The mangrove vegetation found comes from 4 families, namely Avicenniaceae, Lythraceae, Rubiaceae and Rhizophoraceae, which consists of 8 types, namely *Avicennia lanata, Phemphis acidula, Scyphiphora hydrophyllacea, Bruguiera sexangula, Ceriops tagal, Ceriops zippeliana, Rhizophora apiculata,* and *Rhizophora mucronata* with the total number of individuals was 859.
2. The highest Importance Value Index for the mangrove species is *Rhizophora apiculata* at 230.40% for tree level, 168.20% for pole level, 103.95% for sapling level and 146.61% for seedling level.
3. The mangrove vegetation diversity index for the tree and seedling level is relatively low because it has a value for the tree level of 0.585 and for the seedling level of 0.838. Meanwhile, the pile and

pile level is classified as medium because it has a value for the pile level of 1.269 and for the pile level of 1.192.

4. The mangrove vegetation evenness index for the tree level is classified as low because it has a value of 0.221, while for the pole, sapling and seedling level it is classified as medium because it has a value for the pole level of 0.480, the sapling level of 0.548 and the seedling level of 0.446.
5. The most dominant type found was *Rhizophora apiculata* with a value for tree level of 0.77077, pole level of 0.29075, sapling level of 0.21910 and for seedling level of 0.49593.
6. The horizontal stand structure of mangrove vegetation at tree level forms an L Form or inverted J pattern curve indicating that the tree population at the research location in the mangrove forest of Singa Geweh Subdistrict tends to develop towards uneven-age balanced forest (forest of all ages which is balanced), namely the larger the size. the diameter of the tree, the fewer the number of individuals. The vertical stand structure of mangrove vegetation at tree level consists of 2 canopy layers, namely stratum B and C.

B. Suggestions

1. It is necessary to carry out further research on mangrove forest vegetation in Singa Geweh Village, so that the management and utilization of mangrove forests can be better and more efficient.
2. There needs to be community and government participation in preserving mangrove forests in Singa Geweh Village.

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