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Analysis of Vegetation and Structure of Mangrove Community in Ranga-Ranga Village, Banggai Regency, Indonesia

Moh. Fahri Haruna(*), Abd. Muin Kenta, Riska Masiri, Ibram Ibram, Yuliati R. Ladiku, Nurul Sakinah M. Asiama

Biology Education Study Program, Faculty of Teacher Training and Education, Universitas Muhammadiyah Luwuk
Jl. KH Ahmad Dahlan, Luwuk, Sulawesi Tengah, Indonesia, 94771

*Email Corresponding Author moh.fahriharuna@yahoo.com

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Abstract

The observed mangrove ecosystem is located in a pond area on the coast of Ranga-ranga Village, Banggai Regency. Therefore, this study aims to provide information on the status of the mangrove ecosystem, including the Important Value Index (INP), Density, Diversity Index, Uniformity, and Dominance. We employed two line transect method measuring 150 meters, plotted 20x20 m, 10x10 m, and 5x5 m, and collected data on environmental factors. The study results show that the mangroves species found are Rhizophora apiculata, R. mucronata, Bruguiera gymnorrhiza, B. sexangula, and Xylocarpus granatum. The highest tree-level INP values are R. apiculata (130,90 %), B. gymnorrhiza (80,24 %), R. mucronata (61,16 %), Bruguiera sexangula (14,39 %), and X. granatum (13,31%). At the sapling level, the highest INP values are B. gymnorrhiza (164.75%), R. apiculata (84.75%), R. mucronata (34.89%), and X. granatum (15.61%). At the seedling level, the highest INP values are B. gymnorrhiza (126.06%), R. apiculata (54.52%), and R. mucronata (19.41%). The tree-level community structure has a medium category diversity index, medium category uniformity, and low category dominance. The diversity index is medium at the sapling level, with high category uniformity and low category dominance. At the mangrove seedling level, the diversity index is low category, medium category uniformity, and medium category dominance. The mangrove in research area is in good condition, with dominant species R. apiculata and B. gymnorrhiza. The local government can consider the condition of the mangrove ecosystem in Ranga-ranga Village, Banggai Regency, for adaptive and sustainable management of mangrove areas

Keywords: *Banggai; Ranga-ranga Village; Mangrove Ecosystem; Vegetation*

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INTRODUCTION

The world records Indonesia as having the most mangrove species. However, significant deforestation has resulted in a loss of 182,091 ha and a remaining area of approximately 3.2 million ha (Campbell & Brown, 2015; Onrizal et al., 2016; Arifanti et al., 2021). In general, due to the prolonged economic crisis faced by society and industry, mangrove forests are experiencing high pressure (encroachment and changes in land use) (Tai et al., 2020;Turschwell et al., 2020). Given the rapid conversion of mangrove forests for various land uses in Indonesia in recent years, there is an urgent need to establish more mangrove conservation areas in this country (Kusmana & Sukristijiono, 2016).

This mangrove forest is a component of the coastal ecosystem with exciting and distinctive characteristics as well as the biological potential for rich flora and fauna (Friess et al., 2019). Mangrove forests function as a green belt (free zone) along the coast, protecting it from accretion and erosion activities caused by sea waves or tsunami storms, preventing coastal erosion, strong winds blowing inland, and can also stabilize the soil by capturing various material deposits. Land under river water towards the sea (Barbier, 2016; Saragi & Desrita, 2018; Carugati et al., 2018; Naharuddin, 2020). Ecologically, the role of the mangrove ecosystem is as a habitat, for spawning and foraging for various species of aquatic flora and fauna (Redjeki et al., 2017; Haruna et al., 2022). Mangrove *R. mucronata* has L-asparaginase from its endophyte isolates which shows high enzyme production and activity, so that in the future it can be produced under optimal conditions and used to treat leukemia cancer Nafisaturrahmah et al., 2023).

This mangrove forest is a component of the coastal ecosystem with intriguing and distinctive characteristics as well as the biological potential for rich flora and fauna (Friess et al., 2019). Mangrove forests serve as a green belt, or free zone, along the coast, shielding it from accretion and erosion activities brought on by sea waves or tsunami storms. They also prevent coastal erosion and strong winds from blowing inland, and they can stabilize the soil by capturing various materials. The land under river water flows towards the sea (Barbier, 2016; Saragi & Desrita, 2018; Carugati et al., 2018; Naharuddin, 2020). Ecologically, the mangrove ecosystem serves as a habitat, facilitating the spawning and foraging of various aquatic flora and fauna (Redjeki et al., 2017; Haruna et al., 2022). The endophyte isolates of Mangrove R. mucronata exhibit high levels of L-asparaginase production and activity, paving the way for its future production under optimal conditions for the treatment of leukemia cancer (Nafisaturrahmah et al., 2023).

According to Babo et al., (2020), Banggai Regency is one of the islands on Sulawesi, Indonesia, which has a biodiversity of mangrove plants. The mangroves in this area comprise 32 families, with 25 species of true mangroves and 25 species of associated mangroves dispersed throughout Banggai Regency. These include *Avicennia*, *Sonneratia*, *Rhizophora*, *Bruguiera*, *Xylocarpus*, and *Lumnitzera* (Katili et al., 2019; Utina et al., 2019; Kalsum et al., 2022). The East Luwuk area categorizes several species of mangroves as endangered, including *Scyphipora hydrophyllacea*, *Sonneratia ovate*, and *Schypiphora hydropalaceae* (Kalsum et al., 2022).

The forest area in Ranga-Ranga Village, East Luwuk District, Banggai Regency consists of mangrove forests, primary forests, and secondary forests. The coast of Ranga-ranga Village in Banggai Regency is home to several unidentified species of mangroves. Suspicion exists that the village lacks data on the names of the mangrove species. Apart from that, various kinds of activities in the surrounding community are seen as disturbing or even destroying the mangrove ecosystem (Romañach et al., 2018). The presence of people entering forest areas to access forest resources causes degradation and deforestation (Su et al., 2020; Sulistyorini et al., 2018; Hasnanda et al., 2018). Human or anthropogenic factors are the leading cause of the decline in mangrove areas (Elfayetti et al., 2024). Activities, low community knowledge, and a lack of concern for the mangrove environment are causing increasing damage to the mangrove ecosystem every year (Haruna et al., 2018; Pimple, 2020; Poedjirahajoe & Matatula, 2019; Rasquinha & Mishra, 2021). The rate of decline in mangrove ecosystems in the world has been very significant over the last 40 years and occurs throughout the year (Spalding & Leal, 2021; Elfayetti et al., 2024). Banggai Regency has suffered considerable damage, with its mangrove forest shrinking from 7,387 hectares to 5,652 hectares (Utina et al., 2019). In East Luwuk District, approximately 209 hectares of the 350 hectare total area of mangroves suffered damage (Katili et al., 2019).

The people of East Luwuk use mangrove forests to support their daily lives. Based on information from field observations, the majority of communities, including immigrants and indigenous communities, have shrimp and milkfish ponds that are still productive. The damage to mangroves that occurred in the East Luwuk area was caused mainly by the large-scale opening of ponds that did not take into account environmental sustainability (Kalsum et al., 2022). Various mining industry development activities, including nickel, energy, minerals, and mining, have slightly disturbed the sustainability of the mangrove ecosystem in Banggai district (Nur et al., 2019). Activities to convert mangrove land into agriculture, fisheries, oil and gas mining, and city development are the causes of the reduction of mangrove ecosystems (Murdiyarso et al., 2015; Elfayetti et al., 2024; Romadoni et al., 2023; Partama et al., 2024).

Because of this, this study aims to provide information on the status of the mangrove ecosystem, including the Important Value Index (INP), Density, Diversity Index, Uniformity, and Dominance. I tis expected to provide helpful information about the mangroves in Ranga-ranga Village, some of which have temporarily changed their purpose to become Pond Land. This research can also serve as a scientific foundation for managing mangrove areas by the regional government of Banggai Regency.

METHOD

This research was conducted between February 2024 and April 2024 in the Ranga-ranga Village area, Banggai Regency, Central Sulawesi. Data collection was carried out at 2 stations/points.

Observation of research locations and determination of sampling points

Based on the survey, the forest area in Ranga-Ranga Village, East Luwuk District, Banggai Regency reaches 625 ha or 75.85% of the total administrative area. At the observation stage, researchers carried out direct observations at the research location, namely on the coast of Ranga-ranga Village, Banggai Regency, to obtain information and ensure that the station's location was suitable for taking research

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samples. Then the researcher conducted interviews with the Village Government to obtain data regarding location conditions around the Village.

Determining Research Location Points

In this stage, what is done is so that researchers can estimate a suitable location for conducting research. Location points are determined using purposive sampling, which is a sampling technique that uses certain considerations (Fachrul, 2007). Researchers determine the location by considering the condition of vegetation thickness and the condition of the research location which is directly observed. Researchers took 2 locations for collecting mangrove data, namely station 1 with coordinates 123°6'4.62"E, 0°50'3.42"N and station 2 with coordinates 123°6'17.16"E, 0°50'6.6"N (Figure 1).

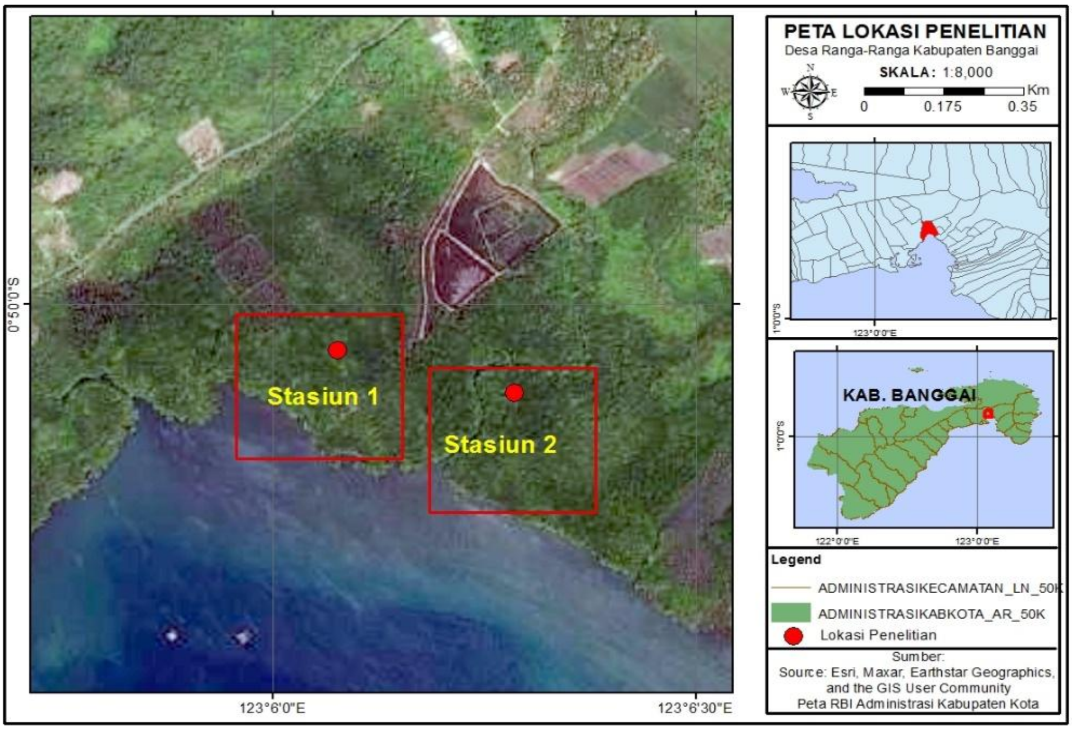

Figure 1. Map of research locations

Data retrieval

Collecting mangrove data begins by taking samples of mangrove plants using a line transit plot, which must be taken into account when taking samples based on morphology, namely the position of leaves, stems, roots and flowers, the species of mangrove found are documented in the form of photographs.

Data Collection Techniques

The method or technique for obtaining data is carried out using transit lines (Kusmana, 1997), which stretch towards the sea, with a line length of 150 meters at each point of the research location. On each line, 4 plots were created, in which there were 3 plot sizes, namely 20 x 20 meters for observation at tree level, 10m x 10 m for sapling level and 5m x 5m for mangrove seedling level. The distance between plot 1 and other plots is 10 meters. The target sample for researchers is true mangrove species.

The species of mangrove plants in the observation plot were determined directly in the field, after which the individual tree, sapling, and seedlings level were counted. For unknown species of mangroves, stems, leaves, flowers and seeds were taken to determine the species. Species identification was carried out using the book (Noor et al, 2012), which is the key to the determination/guide to the introduction of Indonesian mangroves.

Measurement of Environmental Factors

Water quality measurements are carried out every month including the following parameters:

a). Soil pH using a soil tester.
b). Salinity using a refractor meter
c). Dissolved oxygen content, water pH and water temperature using a *Water Quality Checker.*
d). Environmental temperature and humidity using a hygrometer.
e). Substrate

Data analysis

Data analysis, namely diversity index, dominance, uniformity and species density (K),

Diversity index

The diversity index is calculated using the *Shannon-Wienner* index (Fachrul, 2007).

$$H' = -\sum = Pi \ \text{In} \ Pi \quad \text{...} \quad (1)$$

Information :
H = Diversity index. Shannon-Wienner;
Pi = Relative abundance of species i (ni/N);
Ni = Number of individuals of a species;
N = Total number of individuals of all species.

The results obtained can then be categorized into 3 categories, namely:

- If Ĥ < 1 then the diversity index is categorized as Low.
- If Ĥ 1 < Ĥ < 3 then the diversity index is categorized as Medium.
- If the result Ĥ > 3 then the diversity index is categorized as High.

Dominance Index

According to Odum (1998) dominance values can be used to determine which species are most frequently found and to describe them, the dominance index refers the formula on (Fachrul, 2007).

$$C = \frac{1}{N^2} \sum n_i^2 \quad \text{..} \quad (2)$$

Information :
C = Simpson dominance index;
Ni = amount of individuals of species i;
N = total of individuals of all species.

Categories (Fachrul, 2007), namely:

$0 < C \leq 0,5$: Low dominance
$0,5 < C \leq 0,75$: Medium dominance
$0,75 < C \leq 1,0$: High dominance

Uniformity Index

Uniformity is the uniqueness of each species that forms a community. Uniformity index formula (Ludwig & Reynolds, 1988).

$$E = \frac{H'}{H'max} \quad ; \ H' max = Ln\ S \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots \quad (3)$$

Information :
E = uniformity index
H' = diversity index
H'max = maximum diversity index
S = amount of species

Categories (Ludwig & Reynolds, 1988), namely:
$0 < E \leq 0,5$: Low uniformity
$0,5 < E \leq 0,75$: Medium uniformity
$0,75 < E \leq 1,0$: High uniformity

Mangrove Species Density (K)

Mangrove density analysis was calculated for each species (Ludwig & Reynolds, 1988).

$$K = \frac{ni}{A} \times 10.000 \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots \quad (4)$$

Information :
K = Species density (Ind/m^2)
ni = Total number of individuals of species i
A = Total area of sample observation area (m^2)

Vegetation analysis

Vegetation analysis uses the Important Value Index (INP) calculation to calculate the sum of relative density, relative frequency, and relative cover area. The formula follows (Fachrul, 2007).

$$\text{Density (K)} = \frac{\text{Number of Individuals (species plant)}}{\text{Sample Plot Area}} \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots \quad (5)$$

$$\text{Frequency (F)} = \frac{\text{The number of plots found for a species}}{\text{Number of all sample plots}} \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots \quad (6)$$

$$\text{Dominance (D)} = \frac{\text{The basic area of a species}}{\text{The area of the entire sample plot}} \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots \quad (7)$$

$$\text{Relative density (KR)} = \frac{\text{Density of a species}}{\text{Total density of all species}} \times 100\ \% \quad \ldots\ldots\ldots\ldots\ldots \quad (8)$$

$$\text{Frequency relatif (FR)} = \frac{\text{Frequency of a species}}{\text{Frequency all species}} \times 100\ \% \quad (9)$$

$$\text{Dominance relatif (DR)} = \frac{\text{Dominance of a species}}{\text{Dominance all species}} \times 100\ \% \quad (10)$$

$$\text{Important Value Index (INP)} = KR + FR + CR \quad (11)$$

The Importance Value Index for this species ranges from 0% - 300%. This value is helpful for getting information or an overview of how big the influence or role of each mangrove species is in structuring the mangrove community environment.

RESULT AND DISCUSSION

The results of identifying the mangroves species found at all research location stations were *Rhizophora apiculata, R. mucronata, Bruguiera gymnorrhiza B. sexangula and Xylocarpus granatum.* The results of calculating the number of individuals of each species found at the tree level plot size showed that *Rhizophora apiculata* was the species most commonly found at both stations, namely 208 individuals. The mangrove species with the lowest number of individuals is the *Bruguiera sexangula* species with 12 individuals and *Xylocarpus granatum* with 1 individual. In the data presentation in Figure 2, it can also be seen that at station 1 there are 5 species, while at station 2 there are only 4 species of mangroves. The species *Bruguiera sexangula* was not found at station 2.

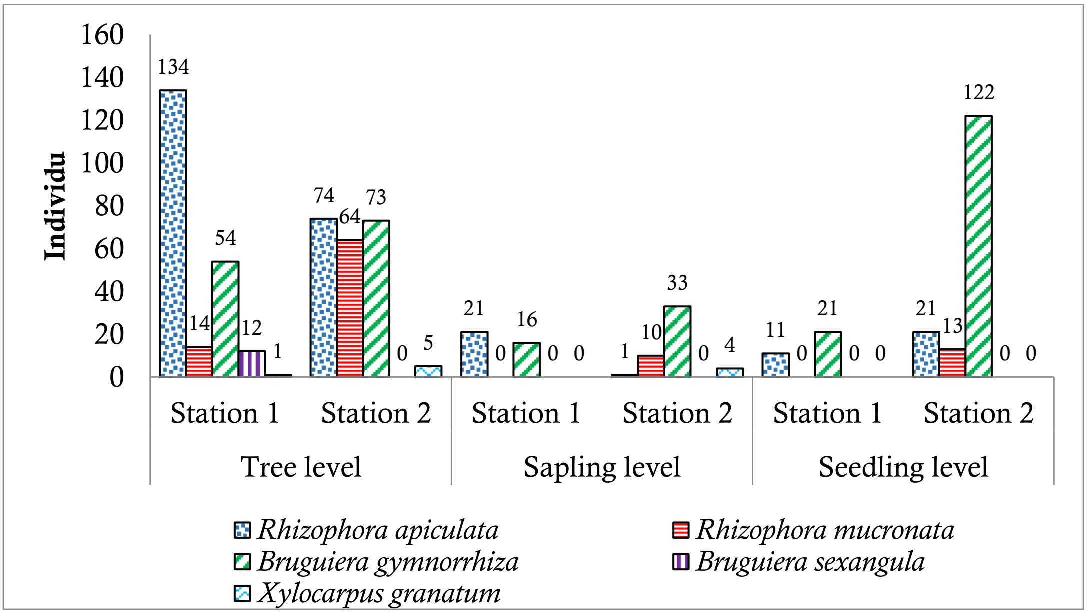

Figure 2. Differences in The Amount of Mangrove Species

At the sapling level mangrove species at station 1 there were only 3 species of mangroves, while at station 2 there were 4 species of mangroves. The most common species of mangrove found at this level is *Bruguiera gymnorrhiza* with 49 individuals, while the smallest number of individuals is the *Xylocarpus granatum* species with 4 individuals. The *Bruguiera sexangula* species was not found at both research station locations. These two species of mangroves was not found due to the lack of individual tree levels. Kusmana & Chaniago (2017) stated that the low number of species at the seedling and sapling level was due to the low number of species at the tree level. Lamury et al, (2023) added a lack of species at the seedling or sapling level can occur due to disturbances/threats.

At the seedling level, only 2 species of mangroves were found at station 1, namely the *Rhizophora apiculata* and *Bruguiera gymnorrhiza* species. Meanwhile, at station 2, 3 species were found. The highest number of individuals of the *Bruguiera gymnorrhiza* species was found at the seedling level, namely 143 individuals, and the *Rhizophora mucronata* species had the lowest number of individuals, namely 13 individuals. The species *Bruguiera sexangula* and *Xylocarpus granatum* were not found at the seedling stage. The results of vegetation calculations and mangrove community structure at the tree, sapling and seedling level at the two research stations are presented in table 1.

Table 1. Results of Mangrove Tree Level

No	Species	Basal Area (m^2/ha)	K (Ind/m^2)	INP (%)	H'	E	C
1	*Rhizophora apiculata*	39902.75	0.0650	130.90			
2	*Rhizophora mucronata*	18335.33	0.0244	61.16			
3	*Bruguiera gymnorrhiza*	15391.40	0.0397	80.24	1.18	0.73	0.35
4	*Bruguiera sexangula*	3009.33	0.0038	14.39			
5	*Xylocarpus granatum*	290.32	0.0019	13.31			

Based on Table 1 above, it can be seen that the *Rhizophora apiculata* species has the highest value, namely with a basal area of 39,902.75 m2/ha, density of 0.0650 Ind/m2 and INP of 130.90%, so this species is the most dominant in the research location area. Meanwhile, the mangrove species with the lowest value is m2/ha *Xylocarpus granatum*, with a basal area value of 290.32 m2/ha, density 0.0019 Ind/m2 and INP only 13.31%. As a result, the species *Xylocarpus granatum* is the rarest to find because it is suited to the muddy soil substrate conditions at the research location, which is not a place for it to grow optimally. Ardiansyah et al., (2022) stated that the *Xylocarpus granatum* species is only found in areas with delicate sand substrates and muddy substrates. Hendrawan et al., (2015) *Xylocarpus granatum* is a species of mangrove plant that is often found in coastal areas.

Table 1 also shows the diversity index value (H'), namely 1.18, based on the indicator value it can be said that the level of species diversity of mangrove trees is in the **medium** category ($1 < \hat{H} < 3$). The uniformity of species obtained was an E value of 0.73 in the **medium** category ($0.5 < E \leq 0.75$). The Dominance (C) value is 0.35, with a **low** dominance category ($0 < C \leq 0.5$).

Table 2. Data analysis results at mangrove sapling level

No	Species	Basal Area (m^2/ha)	K (Ind/m^2)	INP (%)	H'	E	C
1	*Rhizophora apiculata*	317.65	0.0275	84.75	1.06	0.77	0.42
2	*Rhizophora mucronata*	68.74	0.0125	34.89			
3	*Bruguiera gymnorrhiza*	472.72	0.0613	164.75			
4	*Xylocarpus granatum*	28.53	0.0050	15.61			

Based on Table 2 above, which is a sapling level data analysis table, it can be seen that the species with the highest values in sequence are the species *Bruguiera gymnorrhiza, Rhizophora apiculata, R. mucronata,* and *Xylocarpus granatum. B. gymnorrhiza* has the highest value, namely with a basal area of 472.72 m2/ha, density of 0.0613 Ind/m2 and INP of 164.75%, so this species is the most dominant at the sapling level in the research location area. Meanwhile, the mangrove species with the lowest value is X. granatum, with a basal area value of 28.53 m2/ha, density of 0.0050 Ind/m2 and INP of only 15.611%. So the species X. granatum is the rarest to find.

Table 2 also shows the diversity index value (H'), namely 1.06, based on the indicator value it can be said that the level of species diversity of mangrove trees is in the **medium** category ($1 < \hat{H} < 3$). Uniformity of species obtained an E value of 0.77 with a **high** category of $0.75 < E \leq 1.0$. The Dominance (C) value is 0.42, with a **low** dominance category ($0 < C \leq 0.5$).

Table 3. Results of Mangrove Seedling Level

No	Spesies	K (Ind/m^2)	INP (%)	H'	E	C
1	*Rhizophora apiculata*	0.1600	54.52	0.69	0.63	0.61
2	*Rhizophora mucronata*	0.0650	19.41			
3	*Bruguiera gymnorrhiza*	0.7150	126.06			

Table 3. analysis of seedling level data only found 3 species of mangroves, namely *Rhizophora apiculata, R. mucronata and Bruguiera gymnorrhiza*. The *Bruguiera gymnorrhiza* species has the highest density value, namely 0.7150 Ind/m2 and INP 126.06%. So, at the seedling level, *Bruguiera gymnorrhiza* is the dominant species. Then *Rhizophora apiculata* with a density value of 0.1600 Ind/m2 and an INP of 54.52%. *Rhizophora mucronata* is the species that has the lowest density value, namely 0.0650 Ind/m2 and INP 19.41%. The diversity index (H') at the seedling level is 0.69, in the low category ($\hat{H} < 1$), the species uniformity obtained is an E value of 0.63 in the medium category ($0.5 < E \leq 0.75$). The Dominance (C) value is 0.61, with a moderate dominance category ($0.5 < C \leq 0.75$).

Mangrove growth is influenced by environmental conditions such as substrate, salinity, water and environmental temperature, humidity, soil pH and pH. Data on the results of measuring environmental factors at the research location based on stations can be seen in table 4.

Table 4. Environmental Factors Data

Stasiun	Salinity	Soil pH	pH water	Water temperature	Environmental temperature	Humidity	Substrate type
I	25 ppt	7	7	27 ^{0}C	26 ^{0}C	70 %	Muddy ground
II	27 ppt	6-7	7	27 ^{0}C	26 ^{0}C	70 %	Muddy ground

Measurement of temperature environmental factors was carried out when collecting mangrove data. The intensity of sunlight entering the water, the volume of standing water in the mangrove habitat, and weather conditions all contribute to the high and low temperatures found at the location. Waters with a pH of 5.5, 6.5, and > 8.5 are less productive; waters with a pH of 6.5-7.5 are considered productive (Dewiyanti et al., 2021). The waters at the research location are productive waters for the growth and development of mangroves with a pH value of 7.

Vegetation Analysis

Based on the identification results, five species of true mangroves were found in the observation plots on the Coastal Coast of Ranga-ranga Village, Banggai Regency, namely the species *Rhizophora apiculata, Rhizophora mucronata, Bruguiera gymnorrhiza, Bruguiera sexangula,* and *Xylocarpus granatum*. These five species belong to the families of Rhizophoraceae and Meliacea, these two families are the main mangrove plants that are most often found in Indonesia. The dominant flora found in mangrove forests is the Rhizophoraceae family. Rhizophoraceae genera include Rhizophora and Bruguiera (Irawan et al., 2021; Noor et al., 2012). Mangrove species found in one location can be monospecies (single) (Martin et al., 2019; Hanggara et al., 2021) or mixed species parallel to the coastline (Santos et al., 1997). Mangrove vegetation usually shows zonation patterns that emerge based on population dynamics, ecophysiology, and geomorphology (Yuvaraj et al., 2017).

Referring to the Important Value Index (INP) indicator, at tree level the mangrove species Rhizophora apiculata has the highest value in the location, so this species is the main species that makes up the mangrove vegetation in Ranga-ranga Village, Banggai Regency. The *R. apiculata* species is a species of mangrove that has a high density in the mangrove ecosystem. This species can be found at all observation stations (Figure 1), both at the sapling and seedling levels. Species density can provide clues about the abundance of species in a community (McAlpine et al., 2021). The dense growth of mangroves in this location is thought to be caused by environmental factors that are good enough for the growth and development of the species of mangroves found, and suitable habitat substrates. Differences in the number of mangrove species between one coastal area and another are influenced explicitly by tidal water inundation, tolerance to salt, physicochemical properties of the soil (Raganas & Magcale, 2020), and other environmental factors, such as the natural

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condition of the land and its openness to the wave environment (Raganas & Magcale, 2020; Feng et al., 2020). Mangroves will grow optimally on coastlines that are protected from sea waves with relatively calm coastal currents (Oetama et al., 2023). The extent of cover and dominance of the *Rhizophora apiculata* species is supported by the environmental conditions of the research location, both environmental factors and the substrate in which it lives. *Rhizophora apiculata* grows in deep, muddy, soft soil, which is flooded by normal tides (Setyawan et al., 2014; Sri et al., 2023).

This species is still a large constituent of vegetation at the sapling level, namely INP 84.75%. However, at the seedling level, this type only has an INP value of 54.52%. So it can be said that there are quite a few seedlings of the *Rhizophora apiculata* species in composing the vegetation of the mangrove ecosystem at the research location. This is caused by predators that eat this species of seed. According to Setyawan et al., (2014); Sri et al., (2023), the presence of crabs eats or peels off the skin of seedlings and hypocotyl, which can inhibit the growth of mangrove seedlings.

At the sapling and seedling levels, the *Bruguiera gymnorrhiza* species had the highest INP values and dominated the research location. This species dominates because it has an INP of 80.24 at tree level, covering the mangrove ecosystem in the second highest location after the *Rhizophora apiculata* species. Sri et al., (2023), this species of mangrove is the dominant species and has high development, with flowers and fruit available throughout the year.

Based on the INP value, the two species *Rhizophora apiculata* and *Bruguiera gymnorrhiza* are the largest species that make up the mangrove vegetation in Ranga-ranga Village, Banggai Regency. Apart from that, the species *Rhizophora mucronata, Bruguiera sexangula and Xylocarpus granatum* were also found. Four of the five species found belong to the Rhizophoraceae family. the five species found in the observation plot, 4 species belong to the Rhizophoraceae family, namely *Rhizophora apiculata, Rhizophora mucronata, Bruguiera gymnorrhiza and Bruguiera sexangula*. So it can be said that the *Rhizophoraceae* family dominates the mangrove area of Ranga-ranga Village, Banggai Regency. Setyawan et al., (2014), *Rhizophora* is mainly supported by its ability to reproduce with the help of wind, although it can also reproduce with the help of insects because its flowers have a smell, color and nectar that can attract insects. The Rhizopora genus is the genera most commonly found in all mangrove locations in Indonesia (Nugraha et al., 2024). Mangrove vegetation in Indonesia generally consists of 5 flora groups, namely Rhizophora, Sonneratia, Bruguiera, Avicennia and Nypa (Kusmana, 2014). The Importance Value Index of mangrove species in the research location can provide parameter information that describes their role and function in structuring the mangrove community. The emergence of a type of mangrove in this area shows its ability to adapt to its habitat and has a high tolerance for its environmental conditions.

Community Structure

Diversity Index

The mangrove diversity index value from the results of data processing at the tree level was found to be (H') 1.18 in the medium category, the sapling level (H') 1.06 in the medium category, while the seedling level (H') was 0.69, in the low category.

This shows that the species of mangroves found on the coast of Ranga-ranga Village, Banggai Regency, at the tree and sapling level are still in good condition. However, the seedling level of species diversity is quite worrying and there are species that dominate at the seedling level. This is caused by the large number of residents' activities where they cut down mangroves around the mangrove forest area, resulting in a low level of diversity. According to Didik et al., (2021), the value of species diversity in a region depends on the diversity and number of community members. The diversity value of a community depends on the number of species and the number of individuals. In this case, the diversity index will generally be high in communities consisting of many species, and no species dominates.

Uniformity Index

The uniformity value from the tree level mangrove community structure analysis was obtained (E) at 0.73 in the medium category, the sapling level E was 0.77 in the high category, and the seedling level E was 0.63 in the medium category. From these data, the mangrove ecosystem at the tree and seedling level is in an ecosystem with less stable conditions. In this research, it can be seen that several species found were not evenly distributed in all observation plots. According to Drajati et al., (2024), a moderate uniformity value still indicates that the conditions at the station are quite balanced and the distribution at each research location is even or there is no dominant species. Meanwhile, at the sapling level, the ecosystem is in a stable condition, and this shows that the sustainability of the mangrove species in the research location has the opportunity to survive because it is evenly distributed (Sitio et al., 2023). This reflects that the species of mangroves found tend to be uniform (Inayah & Kaswanto, 2023).

Dominance Index

The mangrove dominance index value at tree level from the results of data processing obtained the result (C), namely 0.35, with a low dominance category, the sapling level with a value (C) 0.42, while the seedling level value (C) was 0.61, with medium dominance category. The data from the dominance calculations stated that at the tree and sapling level there was no dominant species of mangrove plant, while at the seedling level there were several species that dominated, namely *Bruguiera gymnorrhiza, Rhizophora apiculata and Rhizophora mucronata*. This is because there is no species that is more dominant than other species, the environment is stable, and the biota at that location does not experience ecological pressure.

CONCLUSION

This research shows that the *Rhizophora apiculata* species has the highest INP value at the tree level and the *Bruguiera gymnorrhiza* species has the highest INP value at the sapling level and seedling level. These results indicate that *Rhizophora apiculata* has a dominant role in the mangrove ecosystem in the research area because this species can grow well on muddy soil substrates found at all observation stations. The tree level community structure has a **medium** diversity index, moderate uniformity and **low** dominance. At the sapling level, the diversity index is in the **medium** category, high uniformity and **low** dominance. The diversity index is categorized as low, uniformity is medium, and dominance is medium at the mangrove seedling level. The condition of mangroves in the research area can currently be said to be good, with the dominant species *Rhizophora apiculata* and *Bruguiera gymnorrhiza*. As an essential step to improve the environment and enrich mangrove species, the rehabilitation program requires the involvement of all communities and related stakeholders.

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