



Mangrove Ecosystem Health Condition Evaluation in Citeureup Village, Pandeglang Regency, Banten Province

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Abstract: Mangrove in Citeureup Village, Panimbang District, Pandeglang Regency is a mangrove area that is located at the western coastal of Java Island. Panimbang District is one of areas in Pandeglang District where abrasion occurs. Almost half of the shoreline having damaged that is caused by abrasion. In 2010, the damaged mangrove area in Panimbang District was 37.07 ha wide. Meanwhile, for the mangrove area in Citeureup Village, still no data available that specifically defines the condition of that area. Hence, the study about analytical approach of mangrove vegetation for knowing the mangrove health in that area is needed to be done. The sample retrieval was located in Citeureup Village, Panimbang District, Pandeglang Regency. The method of mangrove health evaluation integrating vegetation analysis and canopy cover quantification, the location determination was determined by purposive sampling. The result of this study showed that the mangrove ecosystem condition in Citeureup Village, Pandeglang Regency, Banten Province was in a good condition since it has the average value of >1,500 ind/ha in every station. The mangrove composition was dominated by the species of *A. marina* and *A. alba*. *A. marina* species was dominating all of the research area. The structure of mangrove vegetation had the mangrove density with tree category was around 2,350-5,167 ind/ha, this condition showed that it was in a good category. The percentage of canopy cover was categorized as moderate to dense with 51.95-93.18%. The percentage value of canopy cover is affected by the mangrove density and the dominating species.

Keywords: Mangrove ecosystem; density; percent coverage; health condition.

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1. INTRODUCTION

Mangrove is an ecosystem that is scattered around the tropical and subtropical sea. Mangrove vegetation only grows on the beach that is protected from the waves, these beaches located along the island sides that is protected from the wind, or a series of islands

or on islands with land time behind coral reefs behind sheltered offshore [1].

Mangrove is unique since it can adapt with high salinity (halophyte) and has several functions, including physical, economical, and ecological. Physical functions of mangrove such as protecting the shoreline or lessen the abrasion that caused by the sea waves and increase the land accretion caused

by sedimentation. Furthermore, mangrove also has its function as nutrient recycler, the fisheries productivity keeper, seawater intrusion rate reducer, biodiversity preserver, and other coastal ecosystems supporter [2].

Mangrove area in Pandeglang is *Kawasan Ekonomi Khusus (KEK)* Tanjung Lesung. One of the mangrove area in Pandeglang named *Lembur Mangrove Patikang*. This village includes mangrove forest and swamp with 4 ha wide and having 30 head of families. In addition to producing mangrove seeds in Pandeglang Regency, the Patikang people are also fishermen and selling mangrove processed drinks and foods [3].

As time goes by, *Lembur Mangrove Patikang* can be damaged if it doesn't get special attention. The damage in mangrove ecosystem can cause the decreasing quality and quantity of the coastal ecosystem potential resource. The mangrove damage can also interfere the biota life in that ecosystem. The water quality will decrease because of the role of mangrove ecosystem in treating organic waste [4].

The existence of monitoring data in the future as the comparison data can be used for important evaluation for the success of this study. Besides, the monitoring data is expected to be a learning medium for the *Lembur Mangrove Patikang*'s locals as well as tourists and being the inspiration for another stakeholders.

The determination of the mangrove health condition in mangrove ecosystem preservation is crucial based on density and canopy cover as basis for determining the first step and mangrove preservation method as well as providing good facilities and infrastructure [5]. In the effort to preserve mangrove ecosystem, required the role of various parties who support each other in preventing damage to the mangrove

ecosystem. Through good collaboration between the governments, educational institutions, industry, local communities, as well as non-governmental organizations or institutions will be an important element in supporting efforts to preserve mangrove ecosystems, especially in *Lembur Mangrove Patikang*.

Based on the explanation above, it is necessary to do the study about the mangrove ecosystem condition evaluation in Citeureup Village, Panimbang District, Pandeglang Regency using vegetation and canopy cover analytical approach, the obtained data is expected to be used as consideration for the stakeholder in managing mangrove ecosystem sustainably.

2. MATERIALS AND METHODS

This research was conducted in Citeureup Village, Pandeglang Regency, Banten Province in May 2020. The material used in this research was mangrove vegetation. The location determination was determined by purposive sampling. The sampling station spreaded over 6 stations with each of them was coded with Citeureup (CT) followed by their numbers.

The method used in evaluating mangrove health condition was referred to *Buku Panduan Struktur Komunitas Mangrove* 2nd edition [5]. The mangrove health evaluation included vegetation analysis data retrieval such as frequency, dominance, density and Important Value Index (IVI), the percentage of canopy cover, along with external factor that affected the mangrove condition in the research area. Vegetation data retrieval included the measurement of the tree and sapling trunk circumference along with the calculation of seedling stand. The height of the tree was also measured to know how high of the mangrove canopy cover from the trees that were in the

plot. For the canopy cover percentage used hemispherical photography method [5]. Meanwhile for the external factor data, the team calculated the felling and marine debris in the plot. The marine debris in the plot were categorized by 3 types, namely big (> 40cm² dimension), medium (10-40 cm² dimension), and small (<10cm² dimension). Besides doing the data retrieval in the plot, association mangrove and coastal vegetation species identification was also conducted around the research plot by field observation. Mangrove species identification referred to [6]. Meanwhile for association mangrove and coastal vegetation species identification referred to [7].

3. RESULTS AND DISCUSSION

Based on the field observation, mangrove was categorized by 3 types, namely true mangrove, minor mangrove, association

mangrove and coastal vegetation. It was found true mangroves with 8 species, 3 species of minor mangroves along with 4 species of association mangrove and coastal vegetation. The mangrove found is listed on the Table 1. The species found in the plot such as *Avicennia marina*, *Avicennia alba*, *Excoecaria agallocha*. The mangrove species was different compared to the species found at Mojo Village, Pemalang Regency, Central Java. There were 3 true mangrove species namely *Avicennia marina*, *Avicennia alba* dan *Rhizophora mucronata* [6]. Based on the observation results, there were two mangrove species found in the plot (i.e. *A. marina* and *A. alba*). *A. marina* dominated six observation stations, this was because the muddy sand substrate is also the land suitability factor for the growth of *A. marina*.

Table 1. Mangrove composition in Citeureup Village, Pandeglang Regency, Banten Province.

Vegetation Component	Mangrove Species
True Mangrove Component	<ol style="list-style-type: none"> 1. <i>Avicennia alba</i> 2. <i>Avicennia marina</i> 3. <i>Bruguiera gymnorrhiza</i> 4. <i>Ceriops decandra</i> 5. <i>Nypa fruticans</i> 6. <i>Rhizophora mucronata</i> 7. <i>Rhizophora apiculata</i> 8. <i>Sonneratia caseolaris</i>
Minor Mangrove Component	<ol style="list-style-type: none"> 1. <i>Calotropis gigantea</i> 2. <i>Acanthus ilicifolius</i> 3. <i>Excoecaria agallocha</i>
Association Mangrove and Coastal Vegetation	<ol style="list-style-type: none"> 1. <i>Ipomea pes-caprae</i> 2. <i>Terminalia catappa</i> 3. <i>Hibiscus tiliaceus</i> 4. <i>Derris trifoliata</i>

The graph (A) that displays the tree and sapling density shows the mangrove regeneration rate at the observation stations of mangrove health condition and graph (B)

shows seedling density in Citeureup Village, Pandeglang District, Banten Province Whilst the graph (C), IVI on the tree category is the value from how high the function of a species

for an ecosystem. IVI is an index that is arranged from Relative Frequency (RF), Relative Density (RD), and Relative

Dominance (RD) so that every component will affect the high or low of the IVI of a species in the plot (Figure 2).

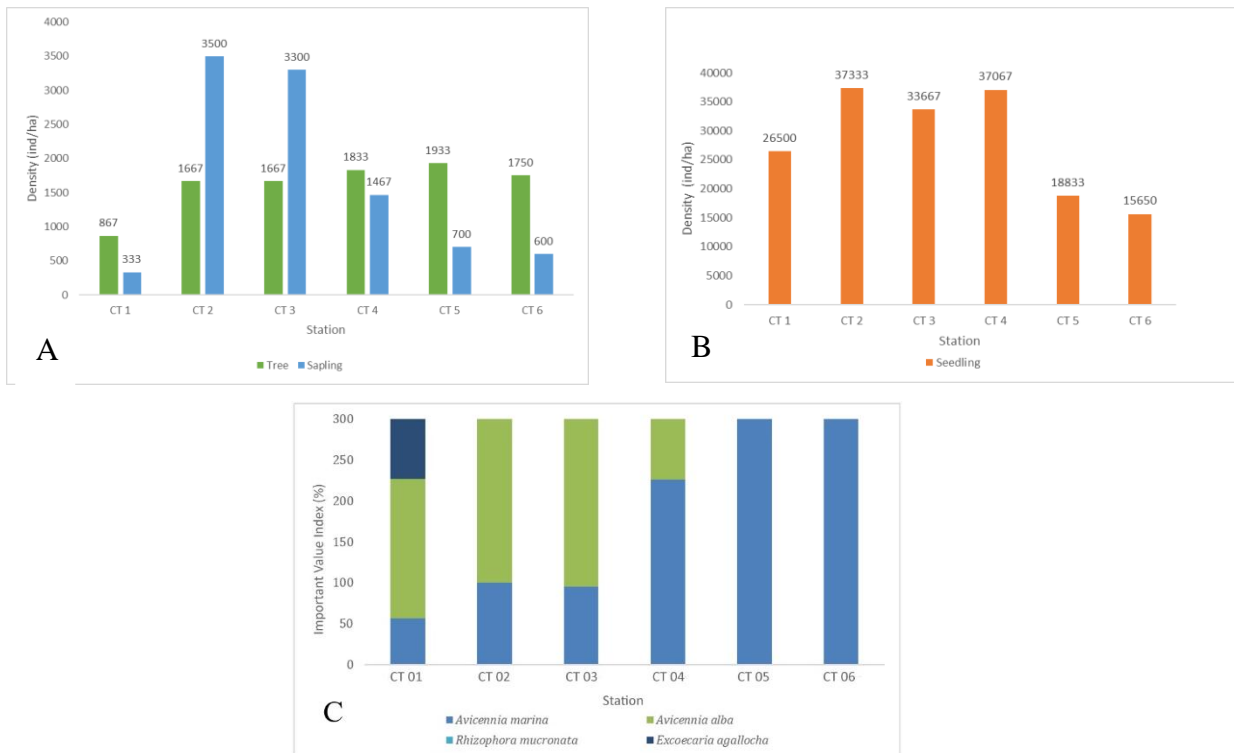


Figure 2: The graph of tree density, sapling (A), and seedling density (B) along with Importance Value Index (IVI) (C) in Citeureup Village, Pandeglang Regency, Banten Province.

Mangrove ecosystem in Citeureup Village, Pandeglang Regency, Banten Province is naturally regenerating through its falling propagule into the substrate then becomes a new stand. Mangrove that categorizes as seedling found in every station. This showed that mangrove at the coastal of Citeureup Village has the good ability to regenerate and potential to enhance the density with the growth of a new stand. This ability to regenerate shows the way mangrove plant to adapt with its habitat and environment.

A. marina was found in every observation station. This showed that *A. marina* has a wider species distribution than other species. The existence of a mangrove species depends on the environment condition, likeas substrate condition and salinity that is possible for the optimal mangrove growth [8]. Substrates such as silt-clay, sand, and clay-dust are classified as very suitable, suitable, and less suitable for mangroves, respectively, with asalinity range between 20,01 – 30 ppt [9].

Table 2. The distribution of Tree Frequency (F), Density (D), Basal Area (BA), Important Value Index (IVI) in Citeureup Village, Pandeglang Regency, Banten Province.

Citeureup Village		CT 01			Pandeglang Regency		
Species	Frequency	Relative Frequency (%)	Density (Ind/ha)	Relative Density (%)	Basal Area (cm ³)	Relative Dominance (%)	Importance Value Index (%)
<i>Avicennia alba</i>	0.67	50	1,066.67	88.89	-	88.89	170.12
<i>Avicennia marina</i>	0.33	25	66.67	5.56	-	5.56	56.30
<i>Excoecaria agallocha</i>	0.33	25	66.67	5.56	-	5.56	73.59
TOTAL	1.33	100	1,200	100	1,281.64	100	300
Citeureup Village		CT 02			Pandeglang Regency		
Species	Frequency	Relative Frequency (%)	Density (Ind/ha)	Relative Density (%)	Basal Area (cm ³)	Relative Dominance (%)	Importance Value Index (%)
<i>Avicennia alba</i>	1	50	3,400	65.81	-	84.07	199.88
<i>Avicennia marina</i>	1	50	1,766.67	34.19	-	15.93	100.12
TOTAL	2	100	5,166.67	100	2,065.5	100	300
Desa Citeureup		CT 03			Pandeglang Regency		
Species	Frequency	Relative Frequency (%)	Density (Ind/ha)	Relative Density (%)	Basal Area (cm ³)	Relative Dominance (%)	Importance Value Index (%)
<i>Avicennia alba</i>	3	50	3,400	68.46	-	86.60	205.06
<i>Avicennia marina</i>	3	50	1,566.7	31.54	-	13.40	94.94
TOTAL	6	100	4966,7	100	3,951.74	100	300
Citeureup Village		CT 04			Pandeglang Regency		
Species	Frequency	Relative Frequency (%)	Density (Ind/ha)	Relative Density (%)	Basal Area (cm ³)	Relative Dominance (%)	Importance Value Index (%)
<i>Avicennia marina</i>	1	50	3,000	90.91	-	85.04	225.95
<i>Avicennia alba</i>	1	50	300	9.09	-	14.96	74.05
TOTAL	2	100	3,300	100	1,561.34	100	300
Citeureup Village		CT 05			Pandeglang Regency		

Species	Frequency	Relative Frequency (%)	Density (Ind/ha)	Relative Density (%)	Basal Area (cm ³)	Relative Dominance (%)	Importance Value Index (%)
<i>Avicennia marina</i>	1	100	2,633.33	100	-	100	300
TOTAL	1	100	2,633.33	100	3,471.48	100	300

Citeureup Village		CT 06			Pandeglang Regency		
Species	Frequency	Relative Frequency (%)	Density (Ind/ha)	Relative Density (%)	Basal Area (cm ³)	Relative Dominance (%)	Importance Value Index (%)
<i>Avicennia marina</i>	1	100	2,350	-	-	100	300
TOTAL	1	100	2,350	6,600.28	-	100	300

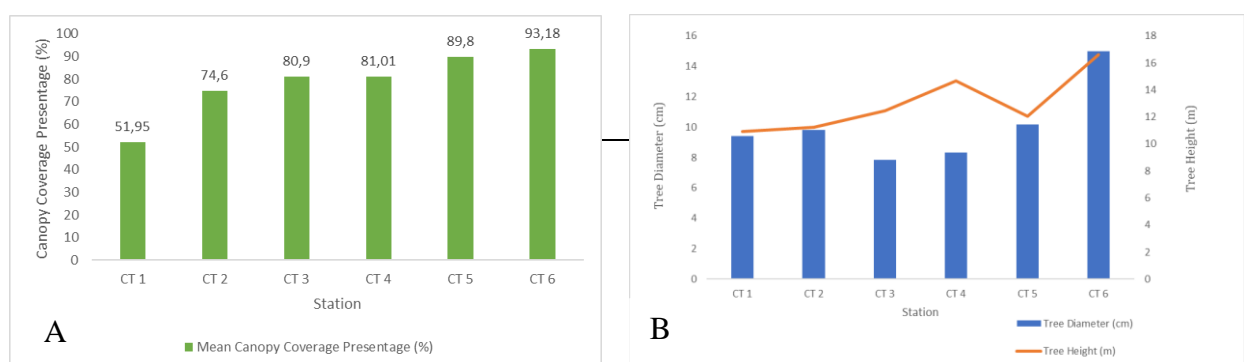
Mangrove density in Citeureup Village, Pandeglang Regency, Banten Province was between 1,200-5,167 ind/ha. This result was higher than the mangrove density in Betahwalang Village, Demak Regency, Central Java which the mangrove density is between 1,066-3,066 ind/ha [10] Meanwhile for the canopy cover percentage in Citeureup Village, Pandeglang Regency, Banten Province is showed on Table 3. Based on Ministerial Decree of Ministry of Environment and Forestry of The Republic of

Indonesia No. 201 year 2004, the percentage of canopy cover is divided into 3 categories, namely Thin (0-50%), Moderate (>50-75%), dan Dense (>75%). The observation stations that canopy cover were in moderate category are CT 01, and CT 02. This can be quite important, because with the good percentage of the canopy cover condition and a good ecosystem condition, it is expected that the mangrove in Citeureup Village, Pandeglang Regency, Banten Province can always be sustainable.

Table 3. Canopy cover percentage in Citeureup Village, Pandeglang Regency, Banten Province.

Station	Canopy Cover (%)	Status
CT 01	51.95 ± 6.44%	Moderate
CT 02	74.16 ± 0.65%	Moderate
CT 03	80.9 ± 0.85%	Dense
CT 04	81.01 ± 0.73%	Dense
CT 05	89.80 ± 0.71%	Dense
CT 06	93.18 ± 0.50%	Dense

Figure 3. The distribution of canopy cover percentage (A) and the mangrove tree diameter and height (B) in Citeureup Village, Pandeglang Regency, Banten Province.



The diameter and average height of the mangrove trees were also showed a quite good result, average height of the tree was above 10m, so it was able to form a dense canopy cover that demonstrates the mangrove condition is a well-grown mature mangrove. Based on the field observation and data processing, the health of mangrove in Citeureup Village, Pandeglang Regency, Banten Province was in a good condition. These results showed that the canopy cover percentage in Citeureup Village, Pandeglang Regency, Banten Province is as same as in Kemujan Island, Karimunjawa National Park that is also dominated with dense category [11].

The result of canopy cover percentage in Citeureup Village, Pandeglang Regency,

Banten Province was higher than the research that is conducted in North Lombok with the average value of 50.38%-64.70%, this showed that the mangrove condition on that reasearch is poor [12]. Mangrove vegetation condition that was dominated by *A. marina* has lower canopy cover percentage and mangrove density. The different value of mangrove canopy cover percentage was caused by the difference of mangrove species dominance. The size of *Rhizophora* sp. leaf has the bigger size than *Avicennia* sp.'s, and the canopy cover that is formed by *Rhizophora* sp. species is a short multilevel branching so that the area of the canopy cover becomes narrow and tends to form abnormal branches [13].

Table 4. The number of marine debris from every category and felling in every station in Citeureup Village, Pandeglang Regency, Banten Province.

Station	Marine debris/100 m ²			Felling/Ha
	Small	Medium	Big	
CT 01	101	33	244	167
CT 02	17	5	1	767
CT 03	10	-	-	600
CT 04	36	5	10	1,800
CT 05	22	9	45	1,167
CT 06	20	10	20	300

The marine debris from each category was found in every observation station. This showed that the marine debris has been spreaded into the mangrove forest in Citeureup Village. Marine debris is a factor that can be a threat for mangrove regeneration, since the marine debris can interfere with seedling growth and cover the forest floor where the propagules fall and grow [14]. It was found felling from every station. The logging activity with the highest

frequency of felling was in CT 04 station, it is presumed that the area is close to the river and road access so the logging activity is easier to do.

Mangrove ecosystem in Citeureup Village, Pandeglang Regency, Banten Province is managed by mangrove farmer group and community watchdog group. The surveillance for damaged mangrove ecosystem is a vital aspect. Mangrove damage is caused by land clearing or

utilization of mangrove wood, and inorganic trash pollution. Based on the field observation, it was known that plastic trash like food and drink packaging, styrofoam, even household furniture were mostly found in every station. One of the factors of the

4. CONCLUSION

The mangrove health condition in Citeureup Village, Pandeglang Regency, Banten Province was good with the average density value of $>1,500$ ind/ha in all stations. Based on the research result, mangrove composition in Citeureup Village, Pandeglang Regency, Banten Province was dominated by 2 mangrove species namely *A. marina* and *A. alba*. *A. marina* was dominated all stations. Mangrove vegetation structure had the density of 2,350-5,187 ind/ha for tree category. The mangrove density in this research was categorized as good (dense). Mangrove canopy cover percentage in all stations in Citeureup

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mangrove damage in Citeureup Village, Pandeglang Regency, Banten Province is the plastic trash and water pollution that is caused by the boat activity in that area, piles of trash on the forest floor can certainly disturb the mangrove seedling place [15].

Village, Pandeglang Regency, Banten Province was categorized as moderate to dense with the value of 51.95-93.18%. The percent height of canopy cover is affected by mangrove density and the dominating mangrove species, a limitation of this research is its short duration and geographic focus on only Citeureup Village, which may not capture long-term or regional variations. Future studies could benefit from long-term monitoring, broader geographic coverage, and the inclusion of additional ecological and socioeconomic factors to provide a more comprehensive understanding of mangrove ecosystem dynamics.

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