Global Scientific JOURNALS

GSJ: Volume 7, Issue 4, April 2019, Online: ISSN 2320-9186
www.globalscientificjournal.com

CONDITION OF THE MANGROVE VEGETATION IN CILETUH GEOPARK, SUKABUMI REGENCY, WEST JAVA

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KeyWords
Community Structure, Geopark Ciletuh, Mangrove, Nutrient

ABSTRACT

The condition of mangrove is greatly influenced by nutrient by the availability of nutrients, physical factors - chemical waters and substrate texture. This research was conducted in April 2018. The purpose of this study was to identify the mangrove community structure and determine water quality and substrate in the Ciletuh Geopark area. This study used a survey method at three stations in the area of mangrove vegetation in the area of mangrove vegetation in the Village of Mandrajaya, Ciemas Subdistrict, Sukabumi Regency. Station determination based on distance from estuary. The results showed that there were seven types of mangroves. The results of this study indicate that the mangrove species in the study area were 7 (seven) mangrove species with the dominance of the species Lumnitzera racemosa, the diversity index including the low category (H '= 1.4 - 1.6 <2.0). The quality of the waters shows the parameters of temperature, DO, pH, and salinity which are still within the range that are in accordance with the standard quality of water for mangroves. The substrate at the research location has a dusty clay texture, clay and clay. Nutrients in the research location waters had phosphates ranging from 0.02 mg / L – 0.03 mg / L and nitrates ranging from 17.57 mg / L – 23.43 mg / L. Nutrient content in the waters and substrate respectively for phosphate in water 0.02 mg / L - 0.03 mg / L, phosphate on the substrate 0.24% - 0.33% while for nitrate is 17.57 mg / L - 23.43 mg / L in water 0.02% - 0.03% on the substrate. The nitrate content in the waters includes oligotrophic whereas phosphate content in the waters includes oligotrophic.

Keywords : *Community Structure, Geopark Ciletuh, Mangrove, Nutrient*

INTRODUCTION

Mangrove in Mandrajaya Village, Ciemas Subregency, Sukabumi Regency has been damage a lot because of massive illegal mangrove loging by the local society because the stem will be utilized for building houses and boats. But at this time the mangrove area has undergone rehabilitation. Mangrove forest is a coastal habitat ecosystem that must be maintained as a provider of natural resources. Assessment of mangrove forest ecosystems provides a lesson that this ecosystem is absolutely necessary and its survival must be guaranteed (Fitri et al., 2010).

Decreasing quality and quantity of mangrove forest has been made terrible effect, as increasing abrasion, decreasing coastal fisheries, intrution sea water getting further into the land, and increasing malaria (Onrizal et al., 2005). Ministry of environment released policy that manage quality standard regional waters of mangrove and support flora's and fauna's life. Nutrient has an important role for existence of various biota or vegetation because of the exixstence utilized by phytoplankton as sources of food. Nitrogen and phosphor in waters are divided into several forms, however only a few that can be utilized in waters which nitrite and nitrate, even though phosphor in the form of ortho phosphate (Jones-Lee & Lee, 2005 in Risamasu & Prayitno, 2011).

METHOD

The tools and materials used in this research is GPS (Global Positioning System), roll mater, cool box, camera, piston core, refraktometer, thermometer, pH meter, DO meter, and plastic wrap.

This research used survey method that the structure and community mangrove vegetation, then taking the data of quality waters, and sample substract and water. Determination of the research station will be taken as 3 stations based on the location near the station from the estuary (Figure 1). The study was conducted on April14, 2018 until April 14, 2018.

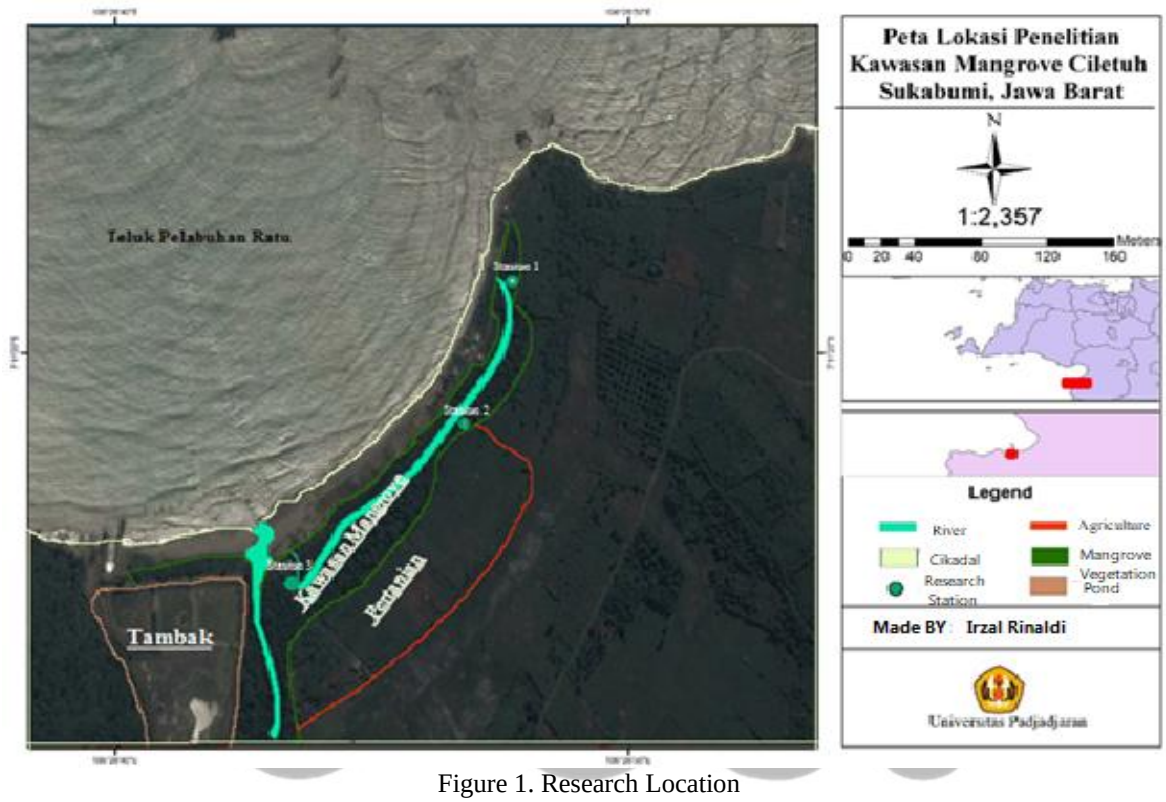

Figure 1. Research Location

Collecting Data of Mangrove

Collecting data of mangrove vegetation used quadrat transect method, which is stretched vertically (perpendicular) to the observation plot sized 10x10 m for mangroves tree level with diameters >10 and heights more than 1.5 m, plot sized 5x5 m for mangroves stake level with diameters <10 cm and heights less than 1.5 m, whereas plot 2x2 m for seedling level.

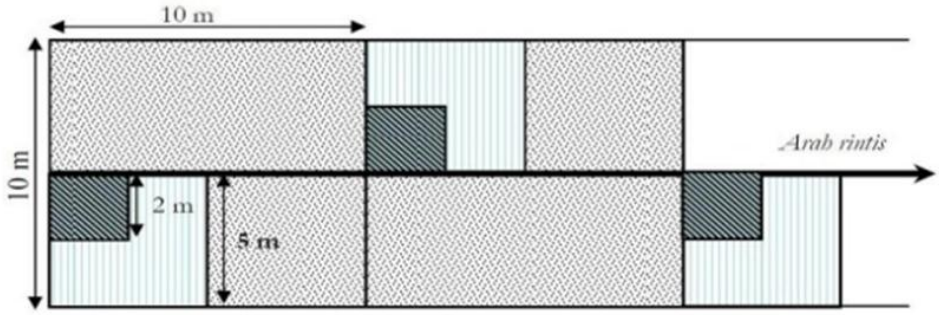

Figure 2. Quadrat Transect Method

Collecting Substrate Sample dan Water

The substrate sample taken in 5 point every plot according the number of plotsusing *piston core* ± 500gram each and put into plastic bag, labeled then take to the Plant Chemistry Laboratory and Soil Nutrition Faculty of Agriculture Padjajaran University for analyze the texture of substrat, pH meter, and the content of NO_3 and PO_4. Afterwards taking water sample amount of 600 mL in each station and pour into the bottle, labeled then take it to the Plant Chemistry Laboratory and Soil Nutrition Faculty of Agriculture Padjajaran University for analyzing the amount of NO_3 and PO_4.

Analysis of Data

Calculation of the quantitative value of vegetation parameters, especially determining of index is carried out with the following formula (Onrizal and Kusmana, 2005) :

Mangrove's Density

$$\text{Density (K)} = \frac{\text{number of individuals a type}}{\text{the whole plot area}}$$

$$\text{relative density(KR)} = \frac{\text{Density of a type}}{\text{Density all types}} \text{x } 100\%$$

Mangrove's Frequency

$$\text{Frequency of a type (F)} = \frac{\sum \text{The plot found in a type}}{\sum \text{all observation plots}}$$

$$\text{The relative frequency of a type (FR)} = \frac{\text{F of a type}}{\text{F all type}} \text{ x } 100\%$$

Mangrove's Domination

$$\text{Dominance of a type (D)} = \frac{\text{Broad base area of a type}}{\text{extensive observation plot}}$$

$$\text{The relative dominance of a type (DR)} = \frac{\text{D of a type}}{\text{D all types}} \text{ x } 100\%$$

Broad base area (LBD) a tree used in calculating type dominance is obtained by formula:

$$\text{(LBD)} = \frac{\pi \text{ R}^2}{\sum \text{all observation plots}}$$

Important value index (INP)

To tree level is:

$$\text{INP= KR + FR + DR}$$

To seedling and stake is:

$$\text{INP = KR + FR}$$

Types diversity index

Types diversity index (H') (Tuwo 2011)

$$\text{H = -}\Sigma\ pi \ln (pi)$$

Information : H'= Types diversity index
ni = number of individual types
pi = ni/N
N = Total individuals of all types

The value H' < 2.0 shows low types diversity, H' is worth 2.0--< 3.0 moderate type variations and the value H' ≥ 3.0 shows the high type variation (Komara 2008).

Result and Discussion

Structure and Composition of Mangrove Vegetation

Mangrove vegetation divided between the level of tree (Image 1), stake (Image 2), and seedling (Image 3). In the research location found 7 mangrove types in 7 research stations, such as *Avicennia marina*, *Avicennia officinalis*, *Bruguiera cylindrica*, *Excoearia agallocha*, *Hibiscus tiliaceus*, *Lumnitzera racemosa*, and *Rhizophora mucronata*.

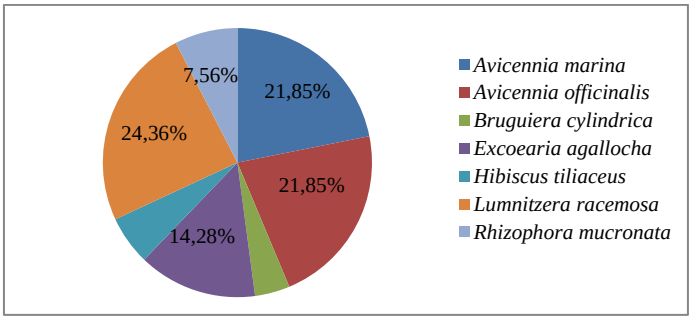

Figure 3. Composition of Mangrove Vegetation On The Tree Level

Composistion of mangrove vegetation on the tree level which has the highest value in the research location occur in *Lumnitzera recemosa* type with a percentage of 24.36 %, and the lowest was *Bruguiera cylindrical* type with a percentage of 4.20% (Image 19). The *Lumnitzera recemosa* type has the highest composition because the characteristic of research location match with the characteristic of the living area of *Lumnitzera recemosa* substrate which has large clay and dust content, can be adapt easily in the waters that have low salinity, and research area which surrounded by land so that type can easily spread to land instead of other types.

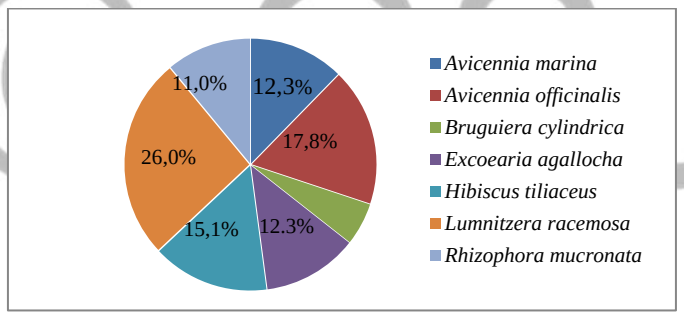

Figure 4. The Composition of Mangrove Vegetation On the Highest Stake Level

The composition of mangrove vegetation at the highest stake level at the research location with *Lumnitzera recemosa* type with a percentage of 26% and the lowest is *Bruguiera gymnorrhiza* type with a percentage of 1.4% (Image 20). *Lumnitzera recemosa* type has the highest composition due to compatibility of location characteristics and this type spreading grows 1, 2, and 3.

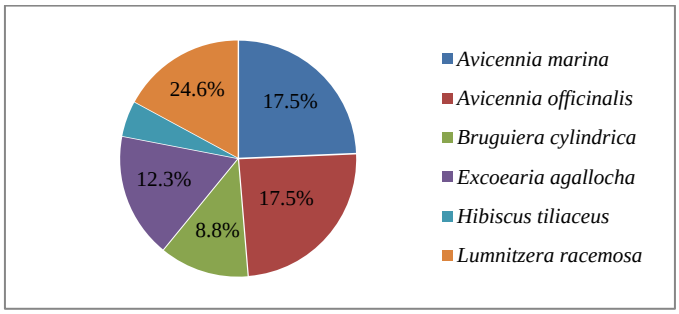

Figure 5. Composition of The Mangrove Vegetation On The Seedling Level

The composition of the mangrove vegetation on the seedling level that had the highest in the research location is *Lumnitzera recemosa* type with a percentage of 24.6% and the lowest value is *Lumnitzera recemosa* type with a percentage of 3.5% (Image 21). Lumnitzera recemosa type are spread on stations 1, 2, and 3. Station 3 is found in Lumnitzera recemosa type on the seedling level instead of other stations.

Density of Type

Table 1. Density Type

No	Type	Density of Stake Type (tegakan/ha)			Density of Seedling Type (tegakan/ha)			Density of Seedling Type (tegakan / ha)		
		Station 1	Station 2	Station 3	Station 1	Station 2	Station 3	Station 1	Station 2	Station 3
1	*Avicennia marina*	133	733	66	66	233	0	0	333	0
2	*Avicennia officinalis*	266	300	300	66	266	100	0	133	200
3	*Bruguiera cylindrica*	0	100	66	0	33	100	0	166	0
4	*Excoearia agallocha*	133	0	433	466	0	133	100	0	133
5	*Hibiscus tiliaceus*	133	0	100	300	0	66	33	0	33
6	*Lumnitzera racemosa*	233	233	500	200	133	300	100	66	300
7	*Rhizophora mucronata*	0	300	0	0	166	100	0	0	0
	Jumlah	898	1610	1465	798	831	799	233	698	666

Density of Tree Type

The dominance of *Lumnitzera racemosa* type at station 3 is due to the salinity condition at station 3 having $0^0/_{00}$ salinity, because these type is less sensitive to changes in salinity (Amir, 2015). Station 3 has clayey substrate texture with 32% sand, 36% dust, and 32% clay composition *Lumnitzera racemosa* type dominating on research location has a dusty substrate to dusty clay (Kusmana et al., 2003). Station 1 and 2 are dominated *Avicennia* spp type. Station 1 has condition soil acidity 6.93, salinity $4^0/_{00,}$ texture of dusty clay with composition of 27% sand, 59% dusty, and 14% clay, and more than 50% station 1 are flooded for 25 days/month. *Avecennia* spp type can live in locations that have clay substrate, dusty, and dusty clay. Station 2 has a texture of clay substrate with composistion of 47% sand, 40% dust, and 13% clay, soil pH 7.69, salinity of $4^0/_{00}$, and station 2 is a swamp area that has a frequency of flooding 25 days/month. *Avecennia* spp type can live in locations that have clay substrate, dusty, dusty clay.The location has a flooding frequency of 20 days for a month, has soil salinity 6--7, and water salinity 4–35 (Kusmana et al,. 2003).

Station 1 has the lowest tree level density because of 50% has a depth of 1.20 meters of waters so it was difficult for natural regeneration of mangroves. Station 2 has the highest density type even though the temperature and oxygen in the waters are below the quality standard because the location has been reforested by POKMASI. Tree level mangrove density can be categorized by Kepmen. LH. No. 201, 2004 with a very dense category >1,500 stands/ha, medium> 1000--<1500, and rarely <1000. Tree level density at station 1 (898 stands/ha) was categorized as rare, station 2 (1610 stands/ha) were categorized as very dense, and station 3 (1465 stands/ha) were categorized as medium.

Density of Stake Type

Density stake level station 1 dominated by *Excoaeria agallocha* type as much 466 stand/ha, and station 3 dominated by *Lumnitzera racemosa* type as much 300 stand/ha. Domination of *Excoaeria agallocha* on station 1 due to spreading on land surrounding that location, tidal does not causing the location, and it has high seedling level. Domination by *Avicennia officinalis* type supported by low water depth and location support the life of mangroves such as substrate with clay texture. Sation 3 have 0% salinity and dominated by *Lumnitzera racemosa* on ever level due to unsensitivity to salinity change.

Density of Seedling Type

Seedling level density on station 1 dominated by *Lumnitzsra racemosa* and *Excoaeria agallocha* (100 stand/ha), station 2 dominated by *Avicennia marina* (333 stand/ha), and station 3 dominated by *Lumnitzera raceomosa* (300 stand/ha). Station 1 location surrounded by land. Station 2 dominated by type that has highest mangrove brood, and most of the location surrounded by land. Low seedling level density on station 1 due to plastic waste and other things on that location flooded it causing seedling level is difficult to grow.

Important Value Index

No	Type	Tree Level			Stake Level			Seedling Level		
		Station 1	Station 2	Station 3	Station 1	Station 2	Station 3	Station 1	Station 2	Station 3
1	*Avicennia marina*	60,59	98,96	28,82	24,93	62,7	-	-	87,63	-
2	*Avicennia officinalis*	78,46	65,20	51,61	24,93	66,83	25,02	-	38,93	50,03
3	*Bruguiera cylindrica*	-	35,27	33,66	-	-	25,02	-	43,66	-
4	*Excoearia agallocha*	46,82	-	67,13	37,46	-	41,65	76,25	-	59,97
5	*Hibiscus tiliaceus*	43,13	-	45,3	70,92	-	20,76	47,49	-	24,95
6	*Lumnitzera racemosa*	70,9	53,88	73,5	41,72	33,17	62,55	71,75	29,34	65,05
7	*Rhizophora mucronata*	-	47,67	-	-	37,30	25,02	70,9	41,72	29,24

Table 2. Important Value Index of Tree Level

Important Value Index of Stake Level

Avicennia marina type on station 2 has highest INP value on tree level than the other type and other station for (98.96). This INP value *Avicennia marina* type on station 2 means that this type is more dominant and it stabilized the higher ecosystem. On station 1 and 2 dominated by *Avecennia* spp. Because on station 1 and 2 more than 50% was flooded, salinity 4%, texture of dusty clay and clay substrate, pH of substrate (6.9–7.69), the flooded frequent is 20 days/month, salinity ground 6–7 and flooded frequent 25 days/month. *Avecennia* spp type could live on the same location that has clay substrate, dust. Domination *Lumnitzera racemosa* type due to station 3 has substrate texture is rather smooth., low salinity (0%), and flooded frequent not to often happen. Domination *Lumnitzera racemosa* live in dusty substrate to dusty clay, and flooded frequent happens sometimes in a year (Kusmana et al., 2003).

Important Value Index of Stake Level

Stake level on station 1 dominated by *Hibiscus tiliaceus* because on that station has the same compability on substrate and it has land broad enough so *Hibiscus tiliaceus* spreading on station 1 good. Stake level on station 2 dominated by *Avicennia officinalis* type because is the result of planting carried out by conservation community groups, while on station 3 stake level mangrove dominated by *Lumnitzera racemosa* type because on that station has the same compability subtrate and station condition has flooded frequent only a few in a year.

Important Value Index of Seedling Level

Station 1 INP the biggest is found in the *Acanthus ilicifolius* type with a value 48.54 has mangrove brood a lot so the natural regeneration can occur with good. That type come under association that lives in that land and grows on mud substrate and sand on the edge of the mangrove forest (Ardli et al., 2011). While at station 3 INP highest on *Lumnitzera racemosa* type with value 65.05 due to too many mangrove brood so the regeneration nature can occur with good.

Diversity Index

Table 3. Diversity Index at Research Sites

Station	Diversity Index		
	Tree	Stake	Seedling
1	1.27618	1.45533	1.20662
2	1.39012	1.46571	1.42285
3	1.51579	1.65330	1.19219

Value of type diversity (H') shows a low value of type diversity at each level. this shows that there has been a loss of certain type of vegetation due to logging. the fall of trees due to wind disturbances and low regeneration at the study site (Ningsih dalam Arief 2012).

Water Quality

Table 4. Water Quality Research Location

No	Parameter	Station 1	Station 2	Station 3	Quality standards
1	temperature (^{o}C)	28.0	26.5	28.7	28 ^{o}C – 32 ^{o}C
2	Salinity (%)	4	4	0	$0^{0}/_{00}$ - $34^{0}/_{00}$
3	Dissolved Oxygen (DO)	2.5	1.8	6.4	> 5 mg/L
4	Acidity (pH)	5.28	5.20	5.01	7 - 8.5

Temperature

The lowest temperature value is found at station 2 because the light received by the waters is the shade (closure) by the leaves which are very tight above the waters and waters at the station has a depth 1.20 m. The temperature with the highest value is found at station 3 because the light received by the water is not too closed by the shade and at the station has 50 cm depth. All the temperature value at the location of the study classified can be according to the quality standards of Kepmen LH No. 51 tahun 2004.

Salinity

The low salinity at research location was due to the fact that in April Pelabuhan Ratu area was still the rainy season causing a large amount of freshwater to enter research location. This case also caused by mangrove ecosystem areas that are not directly exposed to the sea or be confined by land. So that seawater that enters the mangrove ecosystem only has high tides or storms (Bonita 2017). Station 3 has the value of salinity 00/00. The salinity in research location was compatiable with seawater quality standards for mangroves according to.

Degree of Acidity (pH)

The value shows below the quality standard that determined the Ministry of Environment Decree of 2004 No. 51. The low pH value is caused by data collection carried out in April which is still entering the rainy season. So that the research location is dominated by rainwater. The rainwater is naturally acidic (5.6) carbon dioxide (CO2) in the air can dissolve in rain water and produce acidic compounds (Wardhani etc. 2015).

Dissolved Oxygen (DO)

The solubility of DO in the waters of Ciletuh Bay mangrove ecosystem area shows variations in each station. After compared with station 1 and 3, station 2 has the smallest DO because the turbidity at location is most murky. The significant difference in DO values indicates the physical and chemical characteristics of each station is different.

Substrate

Tabel 5. Substrate

Station	Sand (%)	Silt (%)	Clay (%)	Criteria	pH
1	27	59	14	Lempung Berdebu	6,93
2	47	40	13	Lempung	7,69
3	32	36	32	Lempung Berliat	7,07

Acidity (pH) Substrate

The difference in the soil pH value of each station is not too significant and is included in a neutral. The pH value of the soil in research location is ideal for mangrove growth and the best place for plants to absorb soil nutrients. The suitable soil pH supports mangrove growth ranging from 6.0–8.5 (Wahyu and Widyastuti 1998). A neutral pH value will affect the level of nutrient absorption by plant roots. Because neutral pH most nutrients dissolve easily in soil solutions (Hardjowigeno. 2007).

Substrate Texture

The results of the measurement of substrate texture were analyzed with 3 fractions, namely the sand fraction. dust. and clay. The mangrove substrate is included in the clay criteria. Each station has different clay criteria depending on the amount of each fraction. Density in the mangrove ecosystem is influenced by the texture of susbtrat. If the composition of the substrate is more clay (clay) and dust (silt) then the stand becomes denser (Tomlinson 1986).

Aquatic Nutrients and Substrates

Tabel 6. Nutrient Waters dan Substrate

Station	NO_3 (mg/L)	PO_4 (mg/L)	NO_3 (%)	PO_4 (%)
1	17.57	0.02	0.0326	0.27
2	23.43	0.03	0.0234	0.24
3	20.50	0.03	0.0394	0.33

Station 2 is the closest location to settlements and agricultural areas. Household waste such as detergent, livestock, industry, and agriculture in the form of artificial fertilizers that affect the content of nitrate and phosphate.

Another potential source that can enrich nitrate in waters is rain and waste material from the land (Savoie et.al. 1998). Nitrate (NO3) and phosphate (PO4) are the main nutrients that determine the stability of vegetation growth (Nagelkerken e. al 2008). Based on the nitrate content it can be said that each station is classified as eutrophic waters. Phosphate contained in waters. it can be said that at each station including the mesotrophic.

Substrate texture affects the ability of the substrate to store nutrients. The soils that have a sand-dominated fraction have the ability to store low nutrients (Islamic 1996). The low nutrient in station 2 is due to the density of mangrove so that nutrients in the soil are more absorbed and the texture of the substrate at station 2. High sand fraction and percentage of clay fraction are smaller than other stations. The research substrate has a very high nitrate content. Three categories in assessing the high and low levels of nitrate in the soil. that is 0 <> 0.001% is a high category (Bahri 2006). The phosphate yield on the substrate can be said to contain more than the limit.

Conclusion

1. Based on the results of the research it was found that there were seven species, namely *Avicennia marina*. *Avicennia officinalis*. *Bruguiera cylindrica*. *Excoearia agallocha*. *Hibiscus tiliaceus*. *Lumnitzera racemosa*. and *Rhizophora mucronata* with the type of vegetation that dominates, namely *Lumnitzera racemosa*. The diversity of species of mangrove vegetation is relatively low and density value that are classified moderate.
2. The waters condition of the mangrove ecosystem in the research location is below the quality standard because it has a pH value of 5.01 - 5.28 and oxygen levels (DO) at stations 1 and 2 that do not meet the criteria for mangrove waters which have been determined by the Ministry of Environment Decree of 2004 classified as eutrophic waters while phosphate content in waters is classified as oligotrophic. Substrate of ecosystem in Ciletuh Geopark, Sukabumi Regency, West Java has a dusty clay texture. clay and clay. It has substrate pH value 6.93 - 7.69. The nutrient content of the substrate of the mangrove ecosystem in the Ciletuh Geopark Region contains nitrate and phosphate on the substrate classified as exceeding the threshold.

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