



Status and Rehabilitation Pattern of Mangrove Ecosystem in the Eastern of Segara Anakan Cilacap

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HIGHLIGHT

- The rehabilitation pattern of E-SAL is *Rhizophora apiculata*, *Rhizophora mucronata*, *Aegiceras corniculatum*, *Sonneratia alba*, *Avicennia marina*, and *Bruguiera gymnorrhiza*

Keyword

The mangrove ecosystem, Mangrove species, Eastern of Segara Anakan Lagoon, The status and rehabilitation pattern

ABSTRACT

The Segara Anakan Lagoon (SAL) has a potentially reduced mangrove ecosystem. In this year, the mangrove area in SAL is predicted only remaining 1788 ha. The degradation of mangrove ecosystem often occurs in SAL, especially in Eastern of Segara Anakan Lagoon Cilacap (E-SAL). To reduce mangrove degradation need activities to review their status and recovery activities. This research aims to analysis the activities to support the effort of mangrove rehabilitation. The results of this research showed that (1) The potential of mangrove ecosystem in E-SAL was seedling between 15.000 – 34.999 trees ha⁻¹, sapling between 5.199-9.065 trees ha⁻¹ and trees between 533 – 1366 trees ha⁻¹, (2) The status of mangrove ecosystem in E-SAL was damaged – very damaged. (3) the model spesices selection of rehabilitation pattern to reduce mangrove degradation were *Rhizophora apiculata*, *Rhizophora mucronata*, *Aegiceras corniculatum*, *Sonneratia alba*, *Avicennia marina*, and *Bruguiera gymnorrhiza*

1. Introduction

The Eastern Segara Anakan Lagoon (E-SAL) is part of Segara Anakan Lagoon Cilacap which has characterize as spesific eustary and mangrove ecosystem (Hilmi *et al.*, 2017a., Hilmi *et al.*, 2017c) and as eustary form rivers namely Donan, Sapuregel and Kembang Kuning rivers which has deep water between 5 m -10 m (Hilmi *et al.*, 2015). The Eastern Segara Anakan Lagoon also is influenced by seawater and freshwater which give possibility of mangrove vegetation to grow up in Segara Anakan Lagoon as a

ecosystem (Nursid, 2002; Hilmi *et al.*, 2019a). Mangrove ecosystem in E-SAL has spesific vegetation can be classified base on the tolerance level of wter salinity and the inundation of seawater in mngrove ecosystem and coastal ecosystem (Kolinug *et al.*, 2014). The potential of mangrove ecosystem in E-SAL is composed by the mangrove vegetations to develop mangrove zones base on tha adaptation pattern, association, sea water inundation, sea tide, and potential of biodiversity to reach the stability of

community structure of mangrove ecosystem (Hilmi *et al.*, 2015).

However, The mangrove and eustary ecosystem in E-SAL is wide utilized as fishing areas, industry areas, industry and domestic waste, and area of public transportation (Hidayati *et al.*, 2014; Hilmi *et al.*, 2019b). The utilization of mangrove ecosystem in E-SAL caused the water and soil pollution including heavy metal pollution (Hilmi *et al.*, 2017a); coastal disasters (Hilmi, 2018), the increasing of carbon source (Hilmi *et al.*, 2019a), seawater intrusion (Hilmi *et al.*, 2017b), sedimentation (Sari *et al.*, 2016) and degradation of economic value of mangrove and eustary ecosystem (Sari *et al.*, 2017). The utilization of mangrove and eustary ecosystem also caused the degradation of mangrove ecosystem (Sari, 2016) is showed by loss and decreasing of mangrove area, the degradation and loss of mangrove density and biodiversity (Sunsufi, 2017), the degradation of aquatic organism habitat, the lossing of social income, and degradation of environment services of mangrove ecosystem.

The degradation of mangrove ecosystem must have effort to rehabilitate mangrove ecosystem with recovery, rehabilitation and replanting activity (Barbier, 2018), develop mangrove landscaping (Hilmi, 2018) base on the pattern of mangrove adaptation and community perception to restore and rehabilitate mangrove ecosystem.. The rehabilitation activity of mangrove ecosystem and mangrove replanting are showed to regrowth, restore and rehabilitate mangrove ecosystem to reach mangrove climax (Kusmana, 2005). This paper aims to analyze the status of mangrove ecosystem in E-SAL and species selection to develop the rehabilitation effort of mangrove ecosystem in E-SAL.

2. Research methods

2.1. The Site Research

This research was conducted in Eastern Segara Anakan Lagoon Cilacap by research team between FPIK Unsoed and BMKG Cilacap on 2019.

2.2. Research Procedures

The research procedure was conducted with two stages that were :

1. Mangrove sampling

The sampling of mangrove was done by line transect method and transect line plot. The data's were collected by sampling plot 2 m x 2m (seedling), 5 m x 5 m (sapling) and 10m x 10m (mangrove trees with diameter > 10 cm) (Dharmawan dan Pramudji, 2014; Hilmi *et al.*, 2015).

The mangrove sampling was done to collect species density, number of species, and total density of mangrove ecosystem in E-SAL. The sampling of mangrove vegetation was done for 5 stations in Donan river, Kembang Kuning river and Sapuregel river as mangrove area in E-SAL.

2. Mangrove training and Socialization

The mangrove training and socialization were conducted to give knowledge for social community especially the mangrove value, the mangrove services, the mangrove function, rehabilitation technique, and the planting method of mangrove trees based on the trees useful in E-SAL.

3. Focus Group Discussion

Focus group discussion was done to get the data's and information's of the community interest to select mangrove trees to support the rehabilitation, recovery and planting method.

2.3. Data Analysis

The data analysis used descriptive method with tabulation data. The data analysis supported to select mangrove species of mangrove rehabilitation pattern..

3. Result and Discussion

3.1. The Mangrove density

The mangrove density in E-SAL Cilacap could be shown on Table 1. The Table 1 showed that the mangrove density divided into 3 classes that were seedling density had 15.000 – 34.999 trees ha⁻¹, sapling density had 5.199 – 9.065 trees ha⁻¹

and trees density had 533 – 1.366 trees ha-1. According of Direktorat Jenderal Reboisasi Lahan (1997) shows that the mangrove seedling in E-SAL has density > 5000 trees ha-1 (high density), 2000 – 5000 trees ha-1 (moderate density), and < 2000 trees ha-1 (low moderate). Base on the Table 1 showed

Tabel 1. Seedling, Sapling and Tees Density in Eastern Segara Anakan Lagoon

Growth stage	Species	Stations (trees ha ⁻¹)				
		I	II	III	IV	V
Seedling	<i>Avicennia alba</i>	5833	-	-	-	-
	<i>Bruguiera gymnorrhiza</i>	10833	-	26670	14167	15000
	<i>Ceriops tagal</i>	-	5000	-	6666	-
	<i>Rhizophora apiculata</i>	18333	13333	-	-	-
	Jumlah	34999	18333	26670	20833	15000
Kelas	Baik	Baik	Baik	Baik	Baik	
Sapling	<i>Avicennia alba</i>	1733	933	-	-	-
	<i>Bruguiera gymnorrhiza</i>	2133	-	2933	-	-
	<i>Ceriops tagal</i>	267	1733	1333	2533	-
	<i>Rhizophora apiculata</i>	2133	2800	933	4000	4800
	<i>Sonneratia alba</i>	1733	-	-	-	1200
	<i>Sonneratia casolaris</i>	1066	-	-	-	-
	Jumlah	9065	5466	5199	6533	6000
Kelas	Baik	Baik	Baik	Baik	Baik	
Trees	<i>Avicennia alba</i>	233	367	-	-	-
	<i>Bruguiera gymnorrhiza</i>	667	-	333	-	-
	<i>Ceriops tagal</i>	33	333	100	266	-
	<i>Rhizophora apiculata</i>	200	467	100	566	766
	<i>Sonneratia alba</i>	166	-	-	-	200
	<i>Sonneratia casolaris</i>	67	-	-	-	-
	Total	1366	1167	533	832	966
Ecosystem Status	Degraded	Degraded	Very degraded	Very degraded	Very degraded	

that the density of seedling had category good density. Base on sapling category, Kusmana (1997) notes that if mangrove has sapling density > 2.500 trees ha-1 then the mangrove ecosystem has good regeneration categorize. Mangrove in E-SAL has good generation to grow as mangrove ecosystem. But, base on Direktorat Jenderal Reboisasi Lahan (1997) shows that the mangrove trees density in E-SAL has category was degraded

3.2. Species selection to support rehabilitation and recovery of mangrove ecosystem

The rehabilitation activity of mangrove ecosystem in Segara Anakan Lagoon, both of E-SAL or Tritih were done by some criteria's, that were the suitability of mangrove species were planted in mangrove habitat based on water salinity and social interest and mangrove zone. The mangrove zone is built to select and analysis suitability of mangrove species of mangrove rehabilitation in E-SAL (Johnstone, 1983., Hilmi, 2018).

The mangrove species were selected to support mangrove rehabilitation in E-SAL can be shown on Table 2 were *Rhizophora apiculata*, *Rhizophora mucronata*, *Aegiceras corniculatum*, *Sonneratia alba*, *Avicennia marina*, and *Bruguiera gymnorrhiza*. The mangrove selection is done by some aspects and criteria's that were the mangrove zone and the responsibility of mangrove species for water salinity, sea tide, seawater inundation and soil texture. This factors give high contribution for mangrove zone to support distribution of mangrove trees and animal, for example crabs distribution, fish distribution, plankton distribution and others (Kusmana, 2005; Aksornkoae, 1993, Hamilton and Snedeker, 1984, Hilmi et al., 2015). The other factor to support mangrove rehabilitation was the social interest for mangrove selection to support social and community life base on environment services of mangrove ecosystem

Tabel 2. Mangrove selection of mangrove rehabilitation model in E-SAL.

Mangrove area	Stations	Species selection
Pelawangan Timur	1	<ul style="list-style-type: none"> • <i>Rhizophora apiculata</i> • <i>Rhizophora mucronata</i> • <i>Ceriops tagal</i>
	2	<ul style="list-style-type: none"> • <i>Aegiceras corniculatum</i> • <i>Rhizophora apiculata</i>
	3	<ul style="list-style-type: none"> • <i>Aegiceras corniculatum</i> • <i>Rhizophora apiculata</i> • <i>Rhizophora mucronata</i>
Tritih	1	<ul style="list-style-type: none"> • <i>Rhizophora mucronata</i> • <i>Rhizophora apiculata</i> • <i>Avicennia marina</i> • <i>Bruguiera gymnorrhiza</i>
	2	<ul style="list-style-type: none"> • <i>Rhizophora apiculata</i> • <i>Bruguiera gymnorrhiza</i>
	3	<ul style="list-style-type: none"> • <i>Rhizophora apiculata</i> • <i>Rhizophora mucronata</i> • <i>Sonneratia alba</i>

4. Conclusion

Mangrove ecosystem in Esatern Segara Ankan Lagoon was degraded which be seen by trees density of mangrove vegetation. This condition is a factor to rehabilitate and recover mangrove ecosystem in E-SAL. But, base on the potential of mangrove seedling and sapling show the secondary succession process of mangrove ecosystem to reach mangrove climax in E-SAL. The mangrove species to support mangrove rehabilitation and recovery were *Rhizophora apiculata*, *Rhizophora mucronata*, *Aegiceras corniculatum*, *Sonneratia alba*, *Avicennia marina* and *Bruguiera gymnorrhiza*

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