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MANGROVES SUCCESSION IN THE RESTORATION AREAS OF SEMBILANG NATIONAL PARK SOUTH SUMATRA

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Abstract (English):
Mangrove conditions in the region under pressure and degradation from year to year. The main cause of mangrove destruction in the Sembilang National Park (SNP) is cultivation or manufacture of fish ponds, especially in the Peninsula Banyuasin South Sumatra. The activities of these ponds have resulted in the degradation of mangrove, especially in greenbelt. The destruction of mangrove areas causes a decrease in the quality and extent of mangrove areas which result in the degradation of a variety of important functions. Damage to mangroves occur both at the regional, national and even up to the global level. The purpose of this study is to know the process of natural mangrove revegetation on former ponds. The composition of the type of vegetation that grows in the area of the former ponds in South Sumatra region SNP restoration consists of four species: Avicennia marina (Forssk.) Vierh., Avicennia alba Blume, Rhizophora mucronata Lam., and Portulaca villosa. The most dominant species of mangrove revegetation of former pond in SNP is A. marina.

Keywords: former pond, mangrove, restoration, SNP, succession

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1. INTRODUCTION

Mangrove forests are among the most productive ecosystems in the world [1] Mangrove ecosystem is the largest habitat in the Sembilang National Park (SNP), Banyuasin Peninsula, Banyuasin District, South Sumatra, Indonesia. Pond activity (Figure 1) has been the main cause of mangroves degradation since 1995 [2];[3];[4];[5]. The Farmers, in principle, realize that they are engaging in a prohibited location. Nevertheless, their presence that existed before SNP was inaugurated [3]. An understanding of the mangrove forest structure is ecologically important, this information useful for the management and sustainable conservation [6].

Mangrove forests are extremely important coastal resources, which are vital to our socio-economic development. Mangrove forests as ecosystems are particularly vulnerable to environmental influences [7]. Mangroves are one of the most threatened ecosystems all over the world today due to direct and indirect degradation [8]. Mangroves is ecologically important habitats that link the marine and terrestrial environments and provide habitat for both marine and terrestrial organisms, including several threatened species [9];[10]. Coastal development and mangrove deforestation have significantly reduce global mangrove area and created a need for restoration. In order to restore degraded mangrove systems, a complete understanding of the processes that lead to natural changes in mangrove area is necessary [11].

Mangrove vegetation structure varies depending on the location of the mangrove ecosystem, management, and disturbance. Evaluation of changes in mangrove ecosystems are very important [4], and thus mangrove restoration

encourages the return of such species, in some cases to levels equivalent to those in natural stands. Most of the studies on mangrove forest structure and regeneration have focused on natural stands [12]. Indonesia is largest mangrove area (31,890 km2) of 6 large mangrove extent countries in Southeast Asia [21]. The aim of this study is to know trend of mangrove succession former ponds in SNP.

Figure 1. Primary mangrove forest (A) and fish pond active (B) in SNP South Sumatra.

2. METODE PENELITIAN

Study area

This study was conducted from April to June 2015 in the area restoration of SNP, Banyuasin Peninsula, South Sumatra (Figure 2). Information of former ponds got from local people (Taher 2015, pers. com. (personal communication). Mangrove condition from each former pond can be seen in Figure 3.

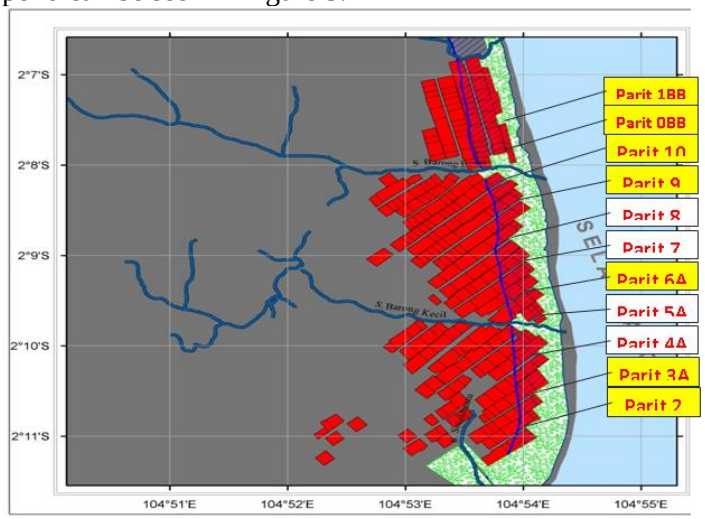

Figure 2. Illustration of the site study in SNP South Sumatra; Parit 8 (02º10'310"S, 04º 54' 906"E), Parit 5 (02 º09' 997"S, 04 º53' 977"E), Parit 4 (02 º09'920"S, 04 º54' 094"E), Parit 4 (02 º 10' 320"S, 04 º53' 903"E), Parit 7 (02 º08' 729"S, 04 º54' 938"E).

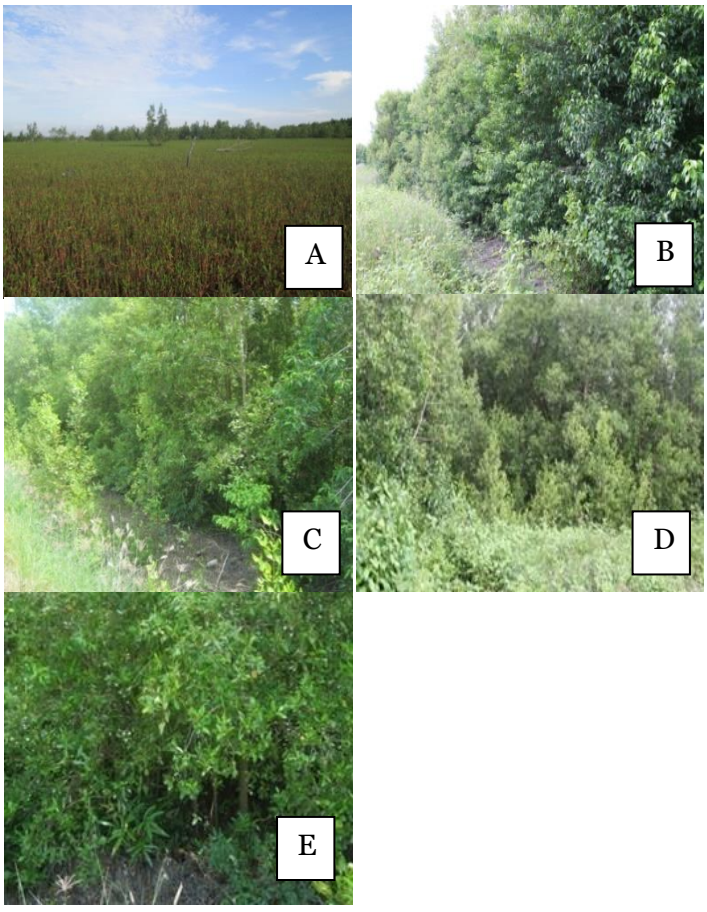

Figure 3. Mangrove condition in the former ponds of this study area on April 2015: A. Former pond 4 years, B. Former pond 7 years, C. Former pond 8 years, D. Former pond 10 years, E. Former pond 15 years.

Procedures

Vegetation analysis using line transect method. Each location of the observations made transect lines perpendicular to the river and each transect line made plots with a size of 10 m x 10 m with a distance of 10 m between the plots, in which is made a plot with a size of 5 m x 5 m and 2 m x 2 m. From the largest to the smallest to be a place for the collection of data for the trees, saplings and seedlings. The data collected is a mangrove species, diameter at breast height (DBH) (1.3 m) and tree saplings. Ecological data collected include temperature, pH and soil texture.

Data analysis

Field data regarding the mangrove species, number of tree stands and DBH of tree stands were analyzed to determine: Density, Basal Area, Dominance, Relative Density, Relative Frequency, relative dominance, and the Importance Value. Important value index is the sum of the value of the Relative Density, Relative Frequency and relative dominance [13]; [14]. Importance Value is a parameter that indicates the role of a species in a community with a maximum value of 300.

3. RESULTS AND DISCUSSION

Based on research that has been conducted, composition of the type of vegetation that grows in the area of the former ponds in SNP consists *Avicennia marina, Avicennia alba, Rhizophora mucronata*, and *Portulaca villosa* (Table 1). The soil texture in the former ponds and ecological data can be seen in Table 2.

Table 1. Mangrove vegetation strata trees, saplings and seedlings on site observations based on Importance Value in the former ponds

Former ponds (year)	Species	Importance Value		
		Tree	Sapling	Seedling
4	*A. marina*	-	65.14	-
	A. marina	-	234.85	2
	A. alba	-	-	2.08
7	*A. marina*	82.04	54.3	54
	A. marina	36.13	120.39	16
	R. mucronata	-	-	2
	A. marina	181.78	125.35	54
8	*A. marina*	94.40	105.48	66.41
	A. marina	28.94	132.85	92.98
	A. marina	176.64	61.7	108.92
10	*A. marina*	69.31	112.15	25
	A. alba	-	-	1.66
	A. marina	80.68	86.72	33.3
	A. marina	-	101.12	91.7
15	*A. marina*	74.81	92	62.28
	A. marina	108.18	68.56	75.4
	A. marina	116.9	139.51	62.28

Note: (-) = not found

Some of farms are unproductive state and become displaced. Naturally, over time, will be overgrown by plants again. Commonly Derris or Sesuvium growth in ponds that have been unproductive for 4 years. This type is a kind of undergrowth that can grow and develop rapidly in the mangrove area that is already open. *A. marina* found on all of former ponds have been abandoned, ranging from seedling level to tree (Table 1).

The first necessary step in the revegetation of the pond will be the opening on the tidal gate to allow for natural in-filling of sediment. This would also allow the recruitment of propagules however during the first months of revegetation, seedlings may not grow as they may either drown or get buried by inflowing of sediment [15]. Assisted planting may be considered by replanting the propagules in the areas of the pond where elevation is relative higher [16]. In this study we found *R. mucronata* in former pond 7 years as enrichment species of restoration project.

Table 2. The soil texture in the former ponds and ecological data

No.	Former ponds (year)	Soil texture (%)			Temperature (^{0}C)	pH
		sand	dust	clay		
1.	4	6.50	39.58	53.92	27.5	6
2.	7	20.30	64.20	15.50	30	6.5
3.	8	9.96	28.05	61.99	29	6.8
4.	10	5.36	49.05	45.59	26.5	6.5
5.	15	7.07	55.04	37.89	27	6.5

Mangrove in greenbelt area of Banyuasin Peninsula consisted of 9 species of true mangrove (*A. marina* (Forssk.), *A. alba*, *A. officinalis*, *Rhizophora apiculata*, *R. mucronata*, *Bruguiera gymnorrhiza*, *B. sexangula*, *S. alba*, and *Excoecaria agallocha*. *A. marina* was the dominant species that had Importance Value was 72.88-300.00 for tree level and 0.00-300.00 for sapling level. The conditions of soil and water quality is quite good and can support the needs of mangrove plants [3]. *A. marina* and *A. alba* were able to grow well on coarse sandy substrate [17]. Observation of ecological parameters at each former pond (Table 2) is quite good and can support the needs of mangrove plants, pH is at neutral conditions, thus supporting

the chemical processes that occur in the soil. Acco-rding to [18], conversion of mangroves into fishponds land is a major cause of mangrove degradation in Solok Buntu. *A. marina* is a mangrove species that grow naturally and dominant in the former ponds. The condition of the former pond is still capable of supporting the growth of mangrove vegetation either naturally or even planting and restoration efforts to the next degraded areas. Phenology of *A. marina* and *A, alba* from anthesis to maturation are 7-8 months*; R. mucronata* is 14-15 months [19]. According to Sarno et al. [20], *R. apiculata* need 46 months after propagule planting for the first flowering.

Growth and development of mangrove naturally differ between species with another. Each has a different phenology. Avicennia relative faster time to grow and develop. *A. marina* found in all of former ponds and most dominant species of mangrove in this study.

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