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Submission date: 03-Jan-2021 09:59PM (UTC+0700)

Submission ID: 1482648188

File name: Widodo_2020_IOP_Conf._Ser.-_Earth_Environ._Sci._550_012010.pdf (564.42K)

Word count: 2352

Character count: 11821

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To cite this article: P Widodo *et al* 2020 *IOP Conf. Ser.: Earth Environ. Sci.* **550** 012010

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Distribution and Characteristics of Nypa Palm (*Nypa fruticans* Wurmb.) in Southern Part of Cilacap Regency

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Abstract. Nypa palm (*Nypa fruticans* Wurmb.) is a kind of palm growing very well in the brackish water forest or along the river near its mouth. In some countries, it is considered to be invasive plant, so that its development should be controlled. The aim of this study is to find out the morphological distribution of the nypa along Cilacap and Kebumen coastal areas of Central Java. The method used in this study is survey. The sample was taken with purposive sampling technique by taking samples from nypa population randomly. The environmental factors measured included water salinity, water pH, soil pH, and soil type. The nypa characteristics measured included leaf morphology and size, and plant individual density. The results of this study based on the distance from the coastline showed that: 1) The nypa is mainly distributed along the river with Grey regosol and Alluvial Hydromorph soils; 2) erect leafed nypa are present close to the water while the curved leafed nypa were presence in the inner part of the areas; 3) Based on the rachis color, the young, medium, and old nypa leaves tend to have green, greenish yellow, and orange rachis respectively. 4) Based on survivability, the nypa seeds tend survive in water further inland.

1. Introduction

Nypa fruticans (nypa palm) is a kind of estuarine plant distributed from Africa, South Asia, Indonesia, to the west Pacific. It grows up to 10 m tall depending on the habitat fertility. It produces many propagules which are dispersed with ocean currents. In the Niger Delta it invades deforested and exposed mudflats and forms dense monospecific stands which outcompete native mangrove species. The absence of stilt roots, lack of leaf litter and dense structure reduce estuarine habitat and may negatively affect native biodiversity.

Nypa communities usually form green belts along the river edges. Nypa palm is adapted to muddy soils along rivers and estuaries of River Donan, Serayu, Adiraja, Sodong Lagoon, Ijo, Suwuk Beach etc. It forms extensive stands along brackish to tidal freshwater rivers and creeks. It is very tolerant to freshwater environments as well as brackish conditions, demonstrating its wide ecological areas. It is also found inland as far as the tide can deposit the floating seeds. It is the only palm species that is well adapted to mangrove forest [1][2]. There has been a damage on nypa communities in some areas for example those in River Tipar and Sentolo (Figure 1).

The habitat of nypa is characterized by high turbidity and low salinity [3]. Among other parameters, tidal level has strongest correlation to nypa population density. The nypa has become invasive and started multiplying in the last 30 years [4]. The palms have acclimatized to the coastal environment by developing superior root system, which they use to tap available nutrients.

There was a report stating that areas that are invaded by nypa palm are more at risk of erosion, leading to destabilisation of foreshores and increased water turbidity. The lack of pneumatophores in the nypa may also affect sedimentation processes. Nypa palm serves as the first line of defense against the impacts of tsunami, hurricanes, and cyclones that reduce the damages in the coastal zones [2]. Unlike native mangroves, where nypa palm normally does not produce leaf litter [5], however in some areas in southern part of central Java they produced litter because of the use of the leaves. The leaf litter is important as primary production in estuarine food webs, invasion by nypa may affect microbes and fauna that utilise it.

Nypa palm is classified as nationally vulnerable in Singapore [3]. There was a report that the most common threat it faces is habitat destruction, but nypa populations in Sungei Buloh Wetland Reserve, Pulau Ubin and Pulau Tekong are protected [4]. In Java, especially along River Tipar, nypa communities were destroyed for the purpose of tourism such as for canoe competition.

Nypa palm are very useful for people in the surrounding areas. The long, feathery leaves of the nypa palm are used by local populations as roof material for houses. The leaves are also used in many types of basketry. In some areas the leaves are also used as fish attraction by waving. The young leaves are used to wrap tobacco for smoking. Large stems are used to train swimmers in Burma as it has buoyancy. In 2000 the Nigerian Conservation Foundation (NCF) began project to assist local communities with the manufacture of jewellery from nypa palm. Nypa can also be used to produce alcohol, sugar and vinegar [6].



Figure 1. Damages in landscape from nypa forest to nothing at River Tipar Adipala Cilacap.

³ Nypa palms produce large quantities of a sugar-rich sap that can be used for ethanol production. Nypa palm has been reported to have ethanol yields ranging from 6,480 to 20,000 liters/ha, which makes it several times more productive than the sugarcane. In Kedah Malaysia, the nypa sap were reported to be used as materials for candy. The average number of fruit was 196,120 per hectare. In a hectare of land could yield 1.89 ton unripe fruit and 3.27 tons of nypa powder. The powder was composed of high fiber with low fat and calories. So this food has potential for dietary program [7].

2. Methods

The material used are nypa palm (*Nypa fruticans* Wurmb.) growing on Tritis mangrove and the edge of River Bengawan, Sentolo, Tipar, and Ijo Cilacap Regency.

The method used in this study was survey with purposive sampling technique which is taking samples from a population randomly by looking at the characteristics of the nypa population. The method of vegetation analysis was quadratic method 10 m x 10 m to find out the density of the plant in the areas sampled. Three quadrats were distributed along each river sampled with the interval of approximately 200 m depending on their accessibility. The characteristics of nypa palm which were recorded included: leaf height, leaf shape, leaf direction, petiole color, rachis color, diameter of compound fruits. The environmental factors measured included water salinity, water pH, soil pH, soil type, distance from the sea.

3. Results

Nypa fruticans is dispersed by water where their fruits are floated and dispersed to the sea and land in many areas, but they may not grow well until reaching the suitable muddy land. For example the edge of river Serayu is not suitable for the nypa, it does not have nypa palm, in fact the soil type is Grey Aluvial dan Greyish Brown Aluvial which consists of sediments of clay and sand. This area is at elevation of approximately 5-10 m alt. The beach areas of southern part of Cilacap consists of Grey Regosol soil which is dominated by dicotyl mangrove, while the inland parts of the river is dominated by the nypa. The nypa are mostly found as back mangrove not facing the sea. However, there has been a change that in Segara Anakan Cilacap, many front mangrove have been occupied by the nypa. This may be caused by the decrease of water salinity.

In the past, there were a lot of nypa communities along the river in the western part of Cilacap, however, the river were widened and most nypas were eradicated. There may be still some nypa communities in Patimuan, Kawunganten, and Bantarsari. The need for lands for settlements is increasing in accordance with the population growth. Some nypa communities may have been converted to gardens or settlements especially those located inland.

The morphological characteristics of the nypa varies depending on some environmental factors. Nypa leaves on young plants are curved, because the tissue parts of the petiole and rachis are still meristematic and contain low wood. While the old leaves tend to be up right straight. This can be seen on those growing especially in open areas. On the other hand, nypa leaves growing under the shade tend to be curved. The petiole and rachis of the nypa palm show some color variations such as: brownish purple, green, yellowish

Table 1. Distribution of nypa palm (*Nypa fruticans*) in southern coasts of Cilacap

No	Location	Distance from sea (m)	Soil type	Soil pH	Water salinity	Nypa density (ind/acr)	Nypa frond	Average Leaf height (m)	Rachis color
1	Tritih	4,000	Alluvial hydromorph with clay sediment water	6.5	-	Low (1-5)	Small curved	1-3	Green
2	River Beji	4,500	Alluvial hydromorph with clay sediment water	6.5	-	Low (1-5)	Small curved	1-3	Green
3	River Plered	4,700	Alluvial hydromorph with clay sediment water	6.5	-	Low (1-5)	Small curved	1-3	Green
4	River Sitopong	1,500	Alluvial hydromorph with clay sediment water	6.5	-	Low (1-5)	Large erect	5-10	Green
5	River Bangawan	500	Grey regosol		-	Low (1-5)	Small curved	1-3	Green
6	River Sentolo	3,000	Alluvial Hydromorph	6.0	3.0	High (50-120)	Large erect	5-10	Dark green
7	River Tipar	2,000	Alluvial Hydromorph	5.5	3.0	High (50-120)	Large erect	5-10	Dark green
8	Sodong Beach	200	Alluvial Hydromorph	4.5	3.75	Low (1-5)	Large erect	1-3	Green
9	River Ijo	300	Complex of Litosol, Mediteran and Renzina with mixture of limestone and napal		-	High (50-120)	Large erect	5-10	Green, purple, yellow, orange



Figure 2. The distribution of the nypa palm according to soil type of coastal part of Cilacap [8]

4. Discussion

The nypa palms are scattered irregularly in mangrove areas in Segara Anakan Cilacap. This may be caused by water current during high and low tide. When the water is high, the fruits of nypa are floated to the land and find the suitable conditions to grow. On the other hand, during low tide, the nypa fruits which are floated to the sea do not find suitable condition and cannot grow. As a result, the nypa will only grow well in the muddy areas further in land.

In some river beds in Cilacap such as River Bengawan, Sentolo, Tipar, and Ijo, the nypa can grow very well because the land condition is very suitable.

5. Conclusion

1. The nypa are mostly found as back mangrove not facing the sea, however there has been a tendency that this palm has invaded the front mangrove in Segara Anakan Cilacap.
2. Nypa as green belt of rivers (River Bengawan, River Sentolo, River Tipar, River Ijo, River Kalibenda).
3. Nypa habitats in southern part of Java are river with mud and not on sandy soils.
4. Young and under low light intensity, the nypa tends to have curved leaves, while those in open areas they tend to have up straight leaves.

Acknowledgment

The authors would like to thank local communities around the Rivers Bengawan, Sentolo, Tipar, and River Ijo for help and information.

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