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Tree Species Diversity As the Base of Conservation On Panjang Island Jepara, Central Java

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Abstract

Panjang island is a small island in Indonesia which is administered in the territory of the district Jepara, Central Java, Indonesia. Small island properties are susceptible to changes and environmental pressures so it is important to be maintained and protected. Community tree is a component of the ecosystem that plays an important role in protecting the environment. The purpose of this study is to assess the composition and diversity of tree species as a basis for conservation of small islands. The research method is purposive sampling. Research site is was choosed four points located in the southern, eastern, northern and western Panjang island. Each point of the transect line drawn perpendicular to the coastline and put the research site from the beach toward the land. Vegetation data were analyzed by calculating the Importance Value Index, Degree of Constancy, Diversity Index and Evenness Index. There are 33 species of trees belonging to 19 families. Diversity of tree species (H') : 1,58-2,22. In Panjang island there were 2 important tree: *Phemphis acidula* (Setigi) which has the status of Least Concern IUCN and *Excoecaria agallocha* (wood blind) that are endemic in Java, so that these two species need to be protected population. Tree species that plays an important role in conservation on Panjang island are: *Leucaena leucocephala*, *Bombax ceiba*, *Thespesia populnea*, and *Acacia mangium*.

Keyword: Small island, protected population, species diversity index, endemic species, purposive sampling.

1. Introduction

Panjang island is a small island in Indonesia with an area of 19.73 Ha, which is administered in the territory of the district Jepara, Central Java. Natural resources of Panjang island are white sand beaches and its clear waters with its various organisms that would be an attraction to be used as a tourist attraction. Moreover, in the central part of the island there is a protected forest that have been defined by the regional government as a place of birds breeding and conservation [1]. Panjang island as a small island has properties that are vulnerable to changes the environment, therefore it is very necessary to be maintained and protected [2]. Forest management interventions can lead to maintain or increase the diversity [3].

Panjang island region has experienced a very high abrasion, it appears some new buildings are still exposed abrasion collapsed. Climate change and sea-level rise in small island will cause unfavorable shifts in biotic composition and adversely affect among some species [4]. Community trees on Panjang island development and regeneration of the tree less well [5]. Forest regeneration status can be determined by calculating the density of the individual levels of the tree, sapling and seedling. The level of the tree is a plant that has a trunk diameter ≥ 10 cm, saplings is a plant with a trunk diameter <10 cm and height ≥ 1.5 m, at the seedling stage is a plant from seedling to regeneration with a height <1.5 m [6]. Community development and regeneration of trees are said to be good if the density of individual seedlings $>$ saplings $>$ tree level [7, 8]. Regenerating status stands of trees will affect the sustainability and stability of forest ecosystems in the future. Ecosystem stability is the ability of a ecosystem to keep himself remained stable despite the disruption of its components.

Tree diversity is a fundamental component of ecosystem diversity, contributing to both habitat structure and ecosystem function [9]. Structure, composition and function of the tree are the three essential elements in the forest ecosystem. Changes in these elements is a response of the climate, topography, soil and disturbance [10]. The ecosystem stability can be measured through the diversity species of its component. Species diversity is one of the most important features of biotic communities [11]. High species diversity in the community show the complexity in the ecosystem related to a very high species interactions occur [12]. Community which has a high diversity is composed by many species [8].

In the area of small islands are found unique and endemic plant species. It is estimated that 33% of know threatened plants are island endemic, and 23% of bird species found on islands also are threatened [4]. Sempu small island located in Malang found 54.54% of plant species that categorized of unique qualifications and 32.32% into the category of very unique, which means that most of these plants have a high level of extinction and thus needs to be maintained Indonesia endemitas sustainability [13]. A high flora endemism on small islands have been reported by [14], in Vanua Levu Fiji Islands that discover 34% of endemic species of native plant. Meanwhile [15] reported that in the Lau Group Islands, Fiji 14% of all endemic plant.

Community tree is a component of the ecosystem that plays an important role in protecting the environment. Research has been done in the small island area that

has many rivers as a source of fresh water. Panjang Island is an has no river area with limited sources of fresh water and has a very low rainfall. The objective of this research is to determine the composition and diversity of tree species as a basis for ecosystem management area of Panjang island.

2. Material and methods

2.1. Study area

The study was conducted in the forest area of Panjang island Jepara, Central Java in December 2014. Panjang Island is geographically located at position $06^{\circ} 34'33,6''$ to $06^{\circ} 34'40,8''$ SL and $110^{\circ} 37'37,2''$ to $110^{\circ} 37'51,59''$ EL. The site located on facing slope with an inclination of 0-2% and the altitudinal range is between 0-5 m a.s.l.

2.2. Experiment design

The research used purposive sampling, by making paths around the island and put a research site in the south, west, north and east. At each site transect lines were made perpendicular to the shoreline. Futhermore determined the tree plot 20 x 20 m along the transect line started from littoral region, supralitoral and the central part of the island and point total of 11 samples taken. Eleven soil samples were taken for analysis of soil organic matter, pH, concentration of N, P, K, soil salinity, soil texture, soil moisture and soil temperature.

2.3. Analysis vegetation of tree species diversity

Vegetation analysis is calculated using species importance value index, species diversity index, Evenness Index [16].

1. Important value index (IVI) = rel.density + rel. frequency + rel. dominance

2. Degree of Conctancy = $\frac{\text{how many times a species found}}{\text{number of site}}$

3. Species diversity index Shannon-Wiener: $H' = - \sum \frac{n_i}{N} \log \frac{n_i}{N}$

H' = Shannon-Wiener diversity index

n_i = Number of individuals of a species

N = Total number of all individual

4. Evenness Index : $e = H' / \ln S$

e = Evenness Index

H' = Shannon-Wiener diversity index

S = Number of species

3. Result and Discussion

In Panjang island were found 33 species trees included 19 families. This result is less than that found in the tropical forests of India Ghasst are 106 species trees [17], and in Ethiopia Ziway Island there are 141 species of included in 55 familia [18]. This was due to the unfavorable climatic factors for the growth of trees and the only certain tree species that can grow in that environment.

Panjang island region is area that experienced long dry season at relatively high temperatures reached 41.3°C [5]. Panjang island there are 6 months with low rainfall (< 100 mm per month) in June, July, August, September, October and November. Very low rainfall occurred in August, September and October to reach 10 mm (Fig 1). The climatic conditions led to the availability of water in the soil. The availability of water resources critical in small island, water already is short supply because island are drought-prone rely heavily on rainwater from small catchments or limited freshwater lenses [4]. In consequence in Panjang island only a few species of plants that can adapt and establish their lives.

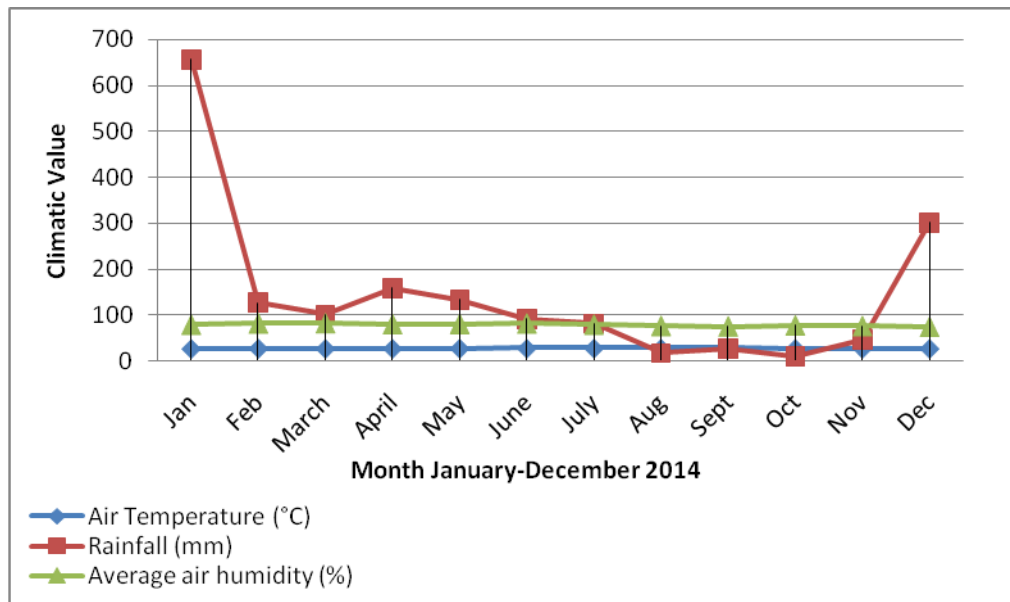


Fig. 1. Climatic factor on the the region Jepara 2014 (Meteorological Agency, Climatology and the Geophysics Central Java 2014).

Tree species have a higher importance value index are *Ceiba petandra*, *Thespesia populnea*, *Leucaena leucocephala*, *Maccranga sp.*, *Tamarindus indica*, *Bombax ceiba*, *Xylocarpus granatum*, *Musa paradisiaca* and *Acacia mangium* (Figure 2). An importance value index was used an indicator species dominant [19], plants species that have a high Importance Value Index is the dominant species in the region [8].

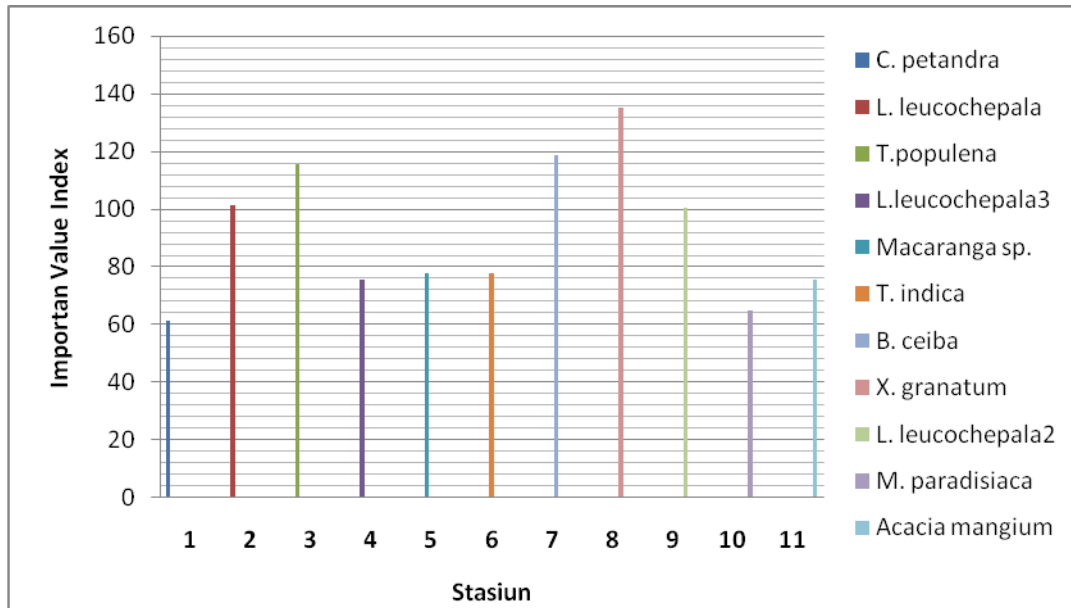


Fig. 2. Species that have highest important value index on Panjang island

The degree of constancy value is the value that describes the distribution area of a species. Figure 3 shows 10 species have a high degree of constancy value (> 45%) are *L.leucocephala*, *Bombax ceiba*, *Acacia mangium*, *Hibiscus tiliaceus*, *Terminalia catappa* and *Thespesia populnea*. Plant species that have a degree of constancy higher value indicates extent of the distribution area and species has a high adaptability to environmental factors. Vegetation experience cyclical fluctuations from season to season until many years. Vegetation that is formed is a reflection of the overall environmental factors which took place in a very long time [10]. Tree species which play an important role in conservation is species that has important value index high and wide distribution are *L.leucocephala*, *Bombax ceiba*, *Acacia mangium* and *Thespesia populnea*.

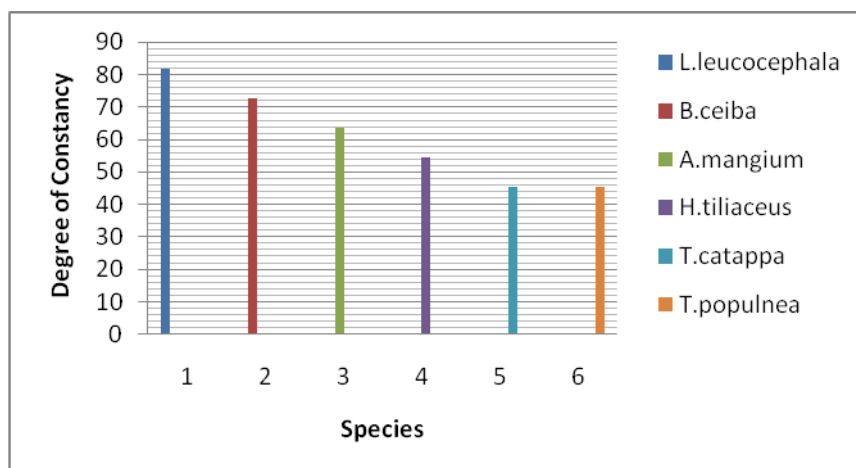


Fig. 3. Degree of constancy plant species (>45%) on Panjang island Jepara

Diversity species index (H') ranged from 1.58 to 2.22 with evenness species index ranged from 0.69 to 0.97 (Fig. 4). Based on the value of the diversity index, it can be said that the community diversity of trees in Panjang island region was moderate. While the evenness index in the category of high value. Species diversity index on the island of Ziway Ethiopia is higher than in Pulau Panjang. Species diversity index on the island of Ziway Ethiopia is 2.60 and evenness index is 0.62 [18]. The index value of diversity is not only determined by the species richness, but also determined by evenness or distribution of individual species [12].

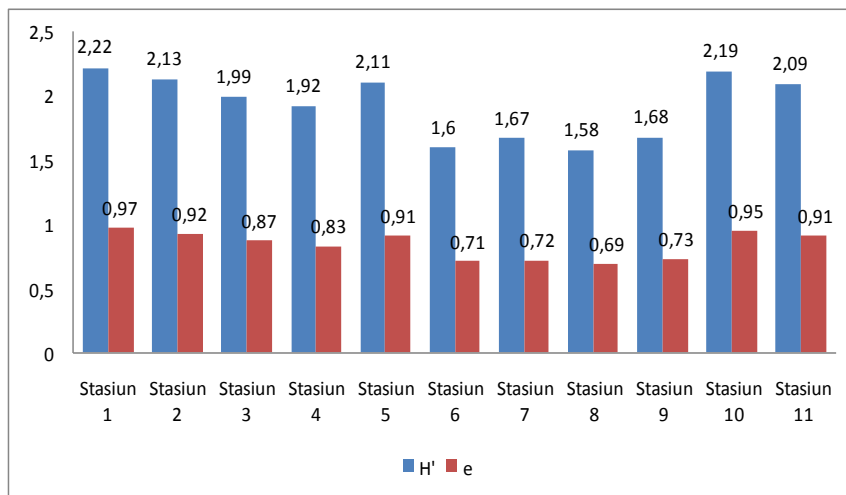


Fig. 4. Diversity and evenness index species of community tree in Panjang island Jepara.

In the area of Panjang island found *Excoecaria agallocha* tree species (timber blind) in small amounts. This species is endemic in Java. This species has much decreased so that needs to be protected [20]. In the area of Panjang island also is found *Pemphis acidula*. This tree is found growing in coastal areas and many were planted around the grave as an ornamental plant that accidentally by the local community. *Pemphis acidula* wood was believed have mystical and as favorite bonsai lovers, makes this tree so much hunted and cause the population continues to decline and likely to become endangered if nothing is did not start to conserve. According to the IUCN Red List of Threatened Species [21], these plant species are included in the category of Least Concern, which means categorized the threatened, with extinction risk status is low and needs to be conserved. The IUCN Red List of Threatened Species is a list of names of animals and plants are endangered and rare that require conservation efforts.

4. Conclusion

There are 33 species of trees which belong to in the 19 families. Diversity of tree species (H') : 1,58-2,22). There is *Phemphis acidula* (Setigi) which has the status of Least Concern IUCN and *Excoecaria agallocha* (wood blind) that are endemic in Java, so that these two species need to be protected population. Plant species that an important role in conservation on Panjang island are : *Leucaena leucocephala*, *Bombax ceiba*, *Thespesia populnea* and *Acacia mangium*.

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