



Calculation of the Vegetation Index as a Basis for Biodiversity Park Management at PT Sarihusada Generasi Mahardhika - Prambanan Factory

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Abstract. The existence of the initiation of the construction of a biodiversity park is a form of the company's concern for the balance of the ecosystem, one of which is related to maintaining biodiversity. This research has the benefit of obtaining baseline data or basic data as a basis for measuring the success or impact of the biodiversity park and biodiversity protection program that will be implemented by the company. Vegetation data was collected using the census method by recording all the trees found in the biodiversity park. Exploration results in the inner area that is integrated with the factory area show that the internal area has been arranged and planted with many shade plants and ornamental plants. The result of internal area identification shows that there are 40 species of flora spread in 681 vegetation. The types of species that exist have been arranged neatly and in groups and formed in one interpretation path that has been formed as an integrated path with factory visits. As for the outdoor area, some areas have been planted with perennials and some areas are still covered with grass. The topography is also not in the form of an expanse because some points are still adjacent to the residents' agricultural land. The results of the identification of the outer area show that there are 23 species of flora scattered in 251 vegetation. Prambanan biodiversity has 50 types of flora spread over 902 individuals. From the results of the calculation of the Diversity Index, it is obtained that $H' = 2.70$ (medium level), the Species Evenness index of $E' = 0.69$ (fairly evenly distributed), and the Margalef wealth index shows the value of $R = 7.20$ (high wealth). The iconic flora are plants that function as carbon sinks in the factory area, namely the king palm (*Roystonea regia*) and glodokan (*Longifrom monoon*). Monitoring and evaluation need to be carried out regularly to determine the growth and development of the impacts of the planted vegetation. One of the monitoring steps is to use a digital application platform.

Keywords: biodiversity park · diversity index · margalef index · vegetation index

1 Introduction

As a user of natural resources, environmental management is one of the company's benchmarks in running a green economy on the basis of Sustainable Development Goals (SDGs). In this case, the company carries out several goals in the SDGs, one of which is the 15th goal, namely managing forests sustainably, resisting land change into deserts, stopping and rehabilitating land damage and stopping the extinction of biological diversity. The existence of the initiation of the construction of Taman KEHATI Prambanan is a form of the company's concern for ecosystem balance, one of which is related to maintaining biodiversity.

As a country with the second largest biodiversity in the world, Indonesia is known to have a very rich wealth of nature, flora and fauna. Indonesia has a high level of biodiversity, namely 17% birds, 16% reptiles and amphibians, 12% mammals, and 10% plants. The issue of biodiversity has become a global environmental issue after the issue of environmental warming, because the importance of biodiversity has a special value in it, especially in terms of ecological, economic, social and cultural benefits [1].

Indonesia as a mega-biodiversity country is also one of the countries with the largest rate of extinction of species. The causes include forest destruction, poaching and trafficking of endangered animals on the black market. Ignorance and indifference lead to weak control of society which aggravates the condition. Ironically at this time most people no longer care about the fundamental benefits of Biodiversity for their lives, for the sake of the past, present and future of culture and economy. As a country that holds the status of mega-biodiversity, Indonesia is also known for its biodiversity hot spots where Indonesia is also one of the countries that has rare types of flora and fauna and is threatened by its existence due to forest quality degradation, deforestation, and other land use change. Thus, the urgency of biodiversity conservation actions is very important. The existence of biodiversity has an important role for the balance of natural resources. In the majority, diversity management is closely related to conservation where the concept of conservation has a role to preserve, preserve and utilize on a limited basis.

Taman KEHATI, one of the biodiversity conservation and protection activities that have been built by PT.Sarihusada Generasi Mahardhika – Prambanan Factory is biodiversity monitoring in the formation of a comprehensive and sustainable initial hue of Taman KEHATI as a form of implementation of monitoring of the results of the management that has been implemented.

Research calculation biodiversity index of flora in Taman KEHATI PT. Sarihusada Generasi Mahardhika – Prambanan Factory is expected to be useful in saving various native/local plant species that have a very high level of threat to their sustainability or threats that result in their extinction and species that have supporting value in the sustainability of life in the ecosystem. The study of flora biodiversity takes the form of an inventory of flora from the perspective of diversity value and equality value in an area where the species is found. This study is also aimed at determining the positive impact of the existence and management of KEHATI Park on improving the quality of biodiversity. This research has the benefit of obtaining baseline data or baseline data as a basis for measuring the success or impact of biodiversity parks and biodiversity protection programs to be implemented by companies.

The process of inventorying and studying biodiversity has been widely carried out in various places and various methods. Several studies related to biodiversity studies have been able to become a foundation in sustainable environmental management.

Indra dan Allo [2] in their research on biodiversity in Aopa Watumohai National Park found that high community pressure on natural resources can lead to biodiversity degradation. This has implications for the low value of the vegetation species diversity index, the absence of mammal species, and the limited number of birds encountered.

Biodiversity monitoring can be carried out on all types of vegetation, as well as specific to a genus. Irma and Herlina [3] observed the biodiversity of spike plants (Pteridophyta) in Gading Sari Village, Tapung, Kampar, Riau. In his observations, Shannon Wiener's equations were used to calculate the diversity index.

Biodiversity conservation can also be carried out in the company's area, as the results of research by Prastyo et al. [4] which conducts biodiversity observations carried out by PT Polytama Propindo by utilizing land in the site plant area for conservation. Conservation efforts carried out from 2015 to 2019 had an impact on increasing the value of the flora and fauna biodiversity index significantly.

Research on biodiversity can also be carried out on the area of educational institutions. Rahayuningsih and Abdullah [5] conducted research on the distribution and biodiversity of herpetofauna at Semarang State University. The data collection method uses the Visual Encounter Survey (VES) and data processing uses the Margalef index for the type richness index, the Shannon index for the diversity index, and the Simpsons index for the evenness index.

An overview of vegetation biodiversity can also be carried out on agroforest systems. This was done by Hartoyo et al. [6] in Sungai Sekonyer Village, West Kotawaringin, Central Kalimantan. The results of the study obtained that the level of diversity and richness of species is relatively low and uneven. This is due to the way of management, land suitability, economic and market value that tends to be uniform and seasonally dependent.

Rahmasari and Yulastri [7] use biodiversity inventory as capital in the management of tourist areas in Mount Puntang, Bandung Regency. It was explained that the use of biological areas and resources needs to be carried out in a sustainable manner in order to package the potential for tourism activities and production activities.

2 Methods

Management of Taman KEHATI Prambanan PT. Sarihusada Generasi Mahardhika - Prambanan Factory is a program that was implemented for the first time in 2022 which means that basic data is needed as baseline data and the basis for the formation of the Grand Design of Taman Kehati Prambanan which is the basis for the management to be carried out. The basic data will then become a benchmark for the success of the management carried out, one of the measurable indicators is the increase in the value of the diversity index and the evenness of species in Taman KEHATI Prambanan every year.

Measurement of the flora biodiversity index will be carried out from July to September 2022 at the Prambanan Biodiversity Park, PT Sarihusada Generasi Mahardhika – Prambanan Factory, Kemudo Village, Prambanan District, Klaten Regency, Central Java Province. With the landscape of the area as in Fig. 1.

Vegetation data collection is carried out by the census method by recording all trees found in the park. The census method in question is a method used to retrieve vegetation data as a whole (100%) without anyone left so that the data produced is the actual data contained in the year of observation. The advantage of the census method is that it is able to find out the overall of real data in the field which then the data can be used for evaluation of management programs, while the disadvantage of this method is that it requires a lot of energy, a lot of time and not a small cost.

Flora data were analyzed using:

1. Shannon-Wiener breed diversity index [8]

$$H' = - \sum_{i=1}^{i=n} \left(\frac{n_i}{N} \times \ln \frac{n_i}{N} \right) \tag{1}$$

Information:

H' = Shannon-Wiener species diversity index

ni = Total number of types by tree tier

N = Total number of all types of flora

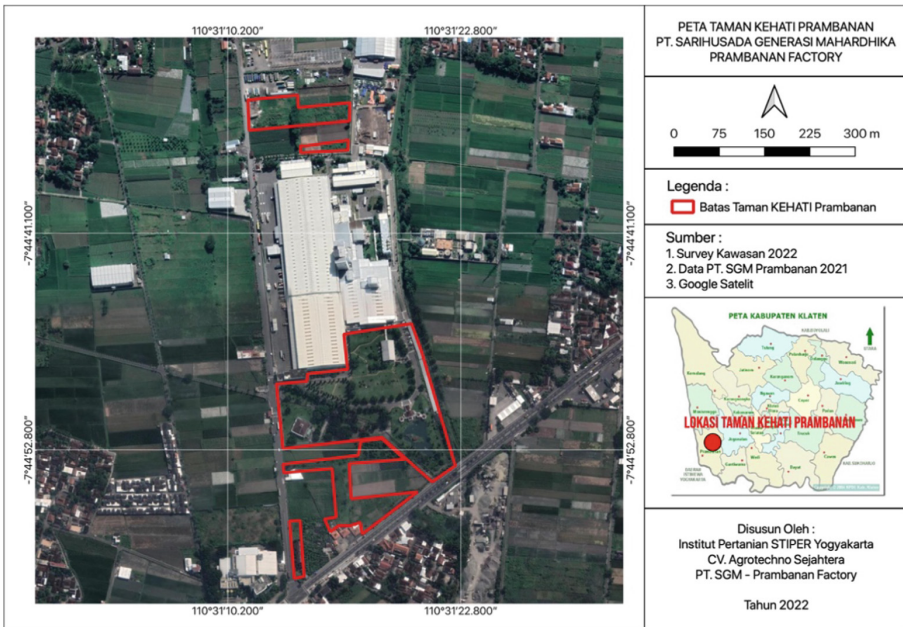


Fig. 1. Prambanan Biodiversity Park Location Map

H' values are categorized as follows:

- $H' < 2$: low diversity
- $2 > H' < 3$: moderate diversity
- $H' > 3$: high diversity

The higher the value of diversity indicates that the ecosystem is getting better. Each species plays an important role in its ecological processes. Conversely, the smaller this value indicates the ecosystem is particularly vulnerable to outside interference.

2. Equality Index to determine the spread of species in communities [9]

$$e = \frac{H'}{\ln S} \quad (2)$$

Information

e' = Type evenness index

H' = Shannon Index

S = Number of types found

According to Pielou [10], the amount of e' value in type equality, if the value of e' is at $0.0 \leq 0.50$ then the community is under pressure, if the value of e' is at $0.50 \leq 0.75$ then the community is in an unstable condition and if the value of E' is at $0.75 < 1.00$ then the community is in a stable condition. If the e' value is higher, it indicates the types in the community are increasingly spreading.

3. Type wealth index to find out type wealth is the number of types in a certain area of acreage. The calculation method is called margalef wealth index [11] with the following formula:

$$R = \frac{S - 1}{\ln(N)} \quad (3)$$

Information:

R = type wealth index (Margalef index)

S = total number of observed types

N = total number of observed individuals

The amount of R value < 3.5 indicates low type wealth, R value between $3.5 - 5.0$ indicates medium type wealth, and $R > 5.0$ is classified as high type wealth.

3 Results and Discussion

Prambanan Biodiversity Park is administratively located in Prambanan District, Klaten Regency, which is located on the southwest side of the Klaten Regency. Based on regional administrative data, Kemudo Village is bordered by Brajan Village to the north, Sanggrahan to the south, Geneng to the east and Bugisan to the west. Where in general the area is in a lowland with an altitude of < 500 m above sea level, precisely 149.44 masl [12].

Kemudo Village has the largest area of land both paddy and non-rice fields compared to other villages in Prambanan District with an area of 269 ha and its paddy fields reaching 156 ha with the main commodities cultivated are rice and corn. The soil classification in Prambanan District is included in the grayish-brown regosol soil type made from ash and intermediate volcanic sand, where this type also exists in surrounding districts such as Manisrenggo and Gantiwarno.

The results of the exploration in the inner area which became one with the factory area showed that the inner area had been organized and embedded with many shade plants and ornamental plants. The results of the identification of the inner area showed that there were 40 species of flora scattered in 681 vegetation. The existing species have been neatly arranged and clustered and formed in one interpretation path that has been formed as a path integrated with the factory visit (Fig. 2).

As for the outer area, some areas have been planted with perennials and some areas are still covered with grass. The topographical shape is also not in the form of an expanse because some points are still adjoining the residents' farmland. The results of the identification of the outer area showed that there were 23 species of flora scattered in 251 vegetation (Fig. 3).

Vegetation observations were carried out using the census method by collecting data on all trees encountered during observations with an area of 6 ha. The total censused and inventoried vegetation amounts to 902 vegetation and after being inventoried, it is divided into 50 different species. From the calculation of the Vegetation Type Diversity Index contained in Biodiversity Park using analysis (Shannon-Wiener) obtained by $H' = 2.70$, this shows that in Prambanan Biodiversity Park - PT. Sarihusada Generasi Mahardhika – Prambanan Factory has a moderate level of vegetation diversity and can be improved by planting new types of vegetation that can benefit the company and the



Fig. 2. Landscape of Prambanan Biodiversity Park Inner Area



Fig. 3. Landscape of Prambanan Biodiversity Park Outer Area

surrounding community. To increase it, it is necessary to carry out planned planting with various types of trees in accordance with the criteria set by Permen LH No. 3 of 2012 as well as the Biodiversity Park Plan and program set by PT. Kehati. Sarihusada Generasi Mahardhika – Prambanan Factory.

The types of flora to be planted are prioritized local native types, are under threat of extinction, or that are icons of the region. Exotic and invasive flora should be avoided as much as possible or removed from the park so as not to interfere with the growth of existing native tree species.

The value of the species diversity index is determined by the number of species and the distribution of individuals in each type, so in order to increase the value of the biodiversity index, it is necessary to regulate the composition of the types of flora to be planted and the number is expected to be evenly distributed in each type.

Based on the calculation of the Type Equality Index, an evenness value of $E' = 0.69$ was obtained, this shows that the distribution of types is high or quite even but there are still some pressures from the dominant plants in Prambanan Biodiversity Park.

The results of the calculation of the Margalef wealth index show the value of $R = 7.20$ which means that the richness of vegetation types in an area in Prambanan Biodiversity Park is relatively high (Fig. 4).

Monitoring and evaluation need to be carried out regularly to determine the growth and development of the impact of planted vegetation. One of the monitoring steps is to use a digital platform. Jejak.in is one of the programs/platforms in collaboration with DANONE Indonesia. Jejak.in is a tree monitoring system using technology-based software. Jejak.in work on mapping-based program that is used on desktop or mobile. Jejak.in needed for tree management with actual data and analysis that will provide convenience in the process of collecting data that is measurable, reportable, and verified.

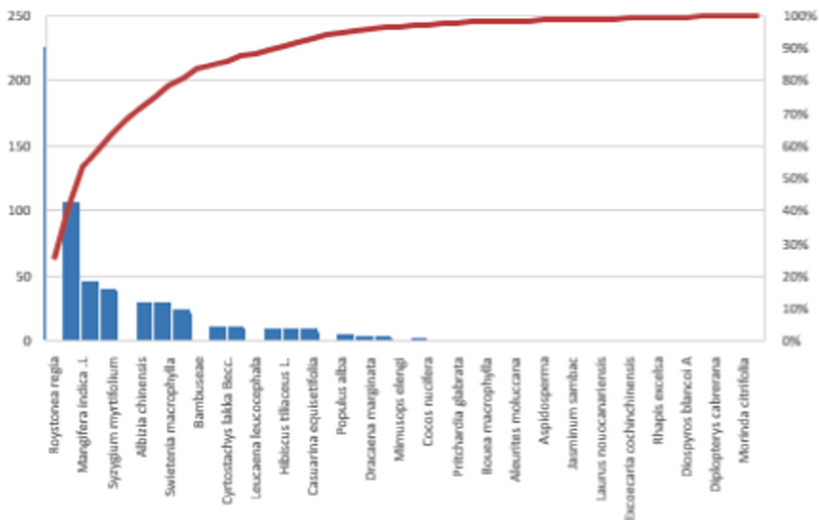


Fig. 4. Pareto Diagram of Vegetation in Prambanan Biodiversity Park

On the other hand, Prambanan Biodiversity Park is an educational place from various school groups to learn about natural resource conservation. The potential for great potential in the development of Prambanan Biodiversity Park is considered necessary to be further assembled from various related parties in order to get support in various circles.

4 Conclusion

The biodiversity park which is the initial dedication of PT Sarihusada Generasi Mahardhika – Prambanan Factory with an area of ± 6.4 ha is a land owned by the company that will be used as a biodiversity park. The results of preliminary hue studies show that Taman Kehati Prambanan has 50 types of flora spread across 902 individuals. From the calculation results of the Diversity Index obtained by $H' = 2.70$ (medium level), the Type Equality index of $E' = 0.69$ (fairly evenly distributed), and the Margalef wealth index shows the value of $R = 7.20$ (high wealth).

A collaboration plan is needed with various stakeholders such as Kemudo Village, NGOs, universities, Klaten Regency Government, etc. To be able to participate in adding biodiversity and land use in Prambanan Biodiversity Park. This collaboration is expected to provide benefits to stakeholders and provide good reciprocity for the company. The existence of KEHATI Park at large also needs to be considered for its impact, especially the impact on artificial ecosystems as a support for the lives of the surrounding animals and the impact of the wider community. Here it can be categorized as two impacts, namely ecologically and socially.

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