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VEGETATION ANALYSIS OF THE SECONDARY FOREST AREA IN CANGKRINGAN RESORT, MOUNT MERAPI NATIONAL PARK

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Abstract. *Mount Merapi National Park (MMNP) is a natural conservation area with the main function of preserving the diversity of plants, animals and their ecosystems. In 2010, Mount Merapi suffered a large eruption which caused damage to the forest ecosystem inside. One of the locations that suffered severe damage was at Cangkringan Resort. After the eruption, the affected vegetation began to grow again. The purpose of this study is to monitor and determine the diversity of secondary forest plants in the MMNP area. The method used was a method of path and use a point-intercept transect as the sampling unit. The results showed that after the eruption, the Acacia decurens dominated at each level starting from sapling, poles and trees. Based on the results of the study showed that the eruption of Mount Merapi that occurred in 2010 resulted in a change in vegetation structure in the area with the Shannon-Weiner diversity index which is still low, amounting to 1.86 for seedling, 1.32 for the sapling and 0.22 for poles. At the tree level 100% is still dominated by Acacia decurens.*

Keywords: *diversity, Mount Merapi, national park, secondary forest, vegetation*

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INTRODUCTION

Forests as a community are dynamic and have never been stable, many factors have caused forest conditions to change. In addition to land clearing factors, natural disasters also result in changes in forest vegetation. Ministry of Environment and Forestry Republic of Indonesia (2018), states that forest areas in Indonesia are based on their functions, categorized into production forests, protected forests and conservation forests. Conservation forest is a natural conservation area with special characteristics that has the main function of preserving the diversity of plants and animals and the ecosystem in it.

One type of nature conservation area is the Cangkringan Resort, Mount Merapi National Park. The area has a role in managing native ecosystems through a zoning system. Mount Merapi is one of the areas that has been designated as a National Park since 2004. Mount Merapi National Park (MMNP) is one place with a unique ecosystem, because it is located on the most active and dangerous volcano in the world. In 2010 Mount Merapi experienced the biggest and most explosive eruption in the last 100 years (Surono et al., 2012).

The impact caused by the eruption is the destruction of ecosystems as well as the

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JURNAL BIODJATI

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loss of the potential of forests as providers of oxygen, carbon sinks and habitat for various unique flora and fauna that exist on Mount Merapi (Marhaento & Kurnia, 2015). Another consequence of eruption is that the soil in the area is fertile. The land found around Mount Merapi is land originating from volcanic ash produced by eruption which provides nutrients for plants (Nuryani et al., 2011).

Ecosystem damage causes changes related to the structure of the ecosystem and the species in it, so it needs monitoring of changes that occur. Therefore, an analysis of the structure of land cover is needed to determine the characteristics of vegetation, and to see the level of diversity that exists in the MMNP ecosystem. The results of this study are expected to provide benefits for determining management strategies.

MATERIALS AND METHODS

Survey Area

This research was conducted in secondary forest in the Mount Merapi National Park area. North of Kalitengah Lor Village is located at latitude 110° 27' 11" - 110° 27' 12.8" East Longitude and 07° 34' 30.6" - 07° 34' 33.4" South Latitude (Figure 1). The research was conducted from January to February 2019. A number of tools used in this study were GPS, ropes, altimeter (hagameter) tree height gauge, diameter tape or 100 cm meter tape, benchmark, camera. While the materials used were Merapi vegetation, landscape data and identification reference books.

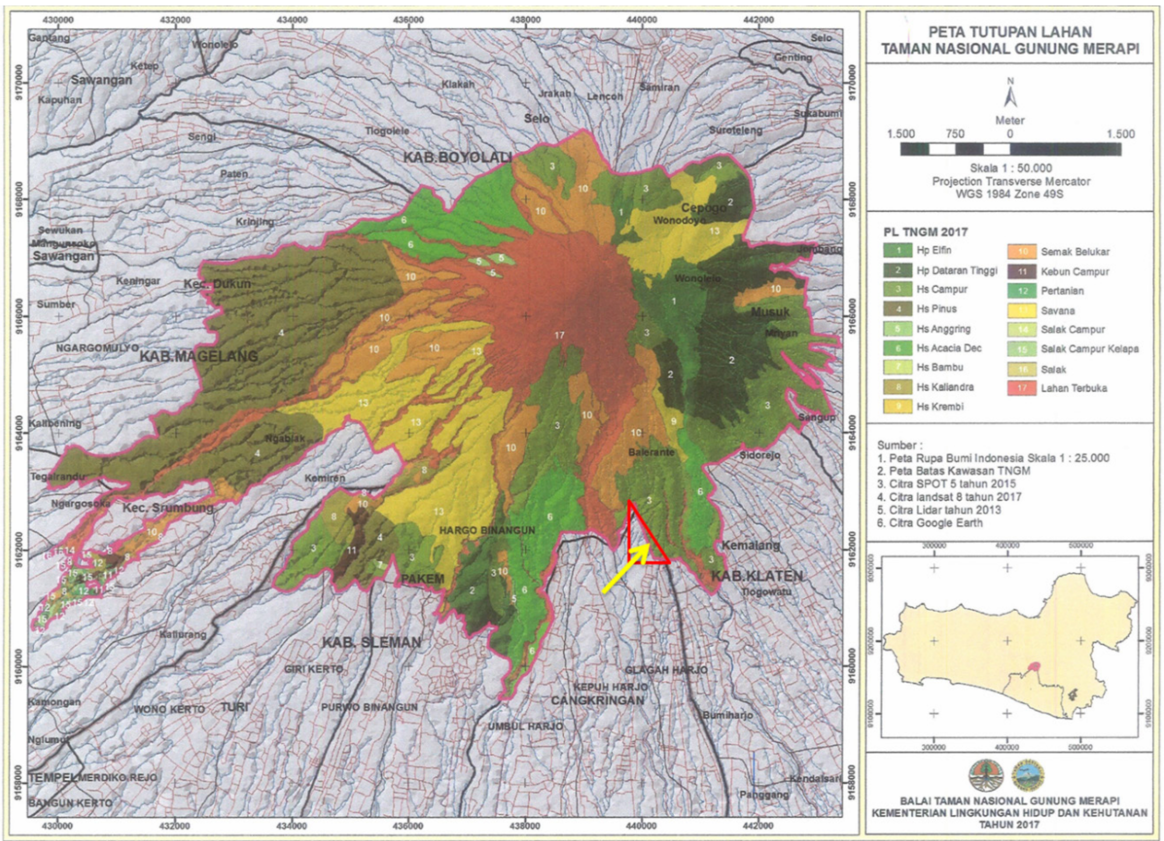

Figure 1. Study Area Mount Merapi National Park

Sampling Design and Data Collection

The method used is a method of combination between path and line methods (Indriyanto, 2012). In this method, a 100 meter line or transect line is created. Then, each plot is placed along the lines of the transect with a size of 2 x 2 m used to analyze seedling level vegetation (newly grown regeneration to those with 1.5 m height); plots of size 5 x 5 m are used to analyze seedling, sapling (vegetation having a diameter <10 cm and height> 1.5 m); 10 x 10 m plots are used to analyze poles level vegetation (diameter 10-20 cm); and 20 x 20 m plots are used to analyze tree level vegetation (diameter> 20 cm).

Identification of types and quantities in each plot was carried out and measurements of height and diameter at breast height (for total height and branch free) were measured for the tree, poles and sapling level. Whereas the seedling level is only identified by type and amount. Then the data is recorded on the prepared tally sheet. Identification is done by comparing it to the identification book that refers to the book identifying the flora of the Java mountains. For unknown species in natural forests, identification is carried out through herbarium collections (Steenis et al., 2006).

Data Analysis

The collected vegetation data is then analyzed. According to Gopal & Bhardwaj (1979) in (Indriyanto, 2012), for the sake of description of a plant community a minimum of three types of quantitative parameters are needed, among others: density, frequency and dominance. Relative frequency, relative density, and relative dominance were calculated in order to measure indices of important value. Species diversity was measured with Shannon-Wiener diversity indices.

RESULTS AND DISCUSSION

Cangkringan Resort is one of the areas that suffered severe damage during the eruption of Mount Merapi in 2010. According to Indirasari (2012), this happened because the land is located on the banks of the Gendol River which is a hot lava flow during eruption.

After the eruption, the condition of the vegetation that was directly affected in the Cangkringan Resort area was overgrown with various types of vegetation. According to (Suryana et al., 2018), one type of native forest vegetation such as *Schima walichii* is a sign of end-level secondary forest. the discovery of *Schima walichii* in MMNP shows that currently the MMNP Commission is in the process of going to old secondary forest.

Composition of Types of Vegetation After Eruption

Based on the results of research on plant vegetation on 2 different pathways in the MMNP Cangkringan Resort area at an altitude of 1200 meters above, 21 species were identified. Plant species found consisted of 3 types of poles, 5 types of sapling and 12 types for seedling levels. At the tree level only one tree was found, namely 29 *Acacia decurens*.

A. deccurens is a species that has high adaptability and is fast growing in post-eruption areas. According to (Suryawan, 2015), *A. deccurens* is considered as one of the invasive alien species in the Mount Merapi National Park area. This type can grow as a pioneer, fast, and dominant in the area affected by the eruption of Mount Merapi.

Vegetation Structure

The number of species of *A. deccurens* is very high at all growth rates (trees, poles and

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sapling). These plants can grow in the MMNP area, McDonald (2002) was inside (Suryanto et al., 2010) explain *A. deccurens* is a species that can grow triggered by high heat. So that after the Merapi eruption in 2010, many of *A. deccurens* in the MMNP at tree, poles, sapling levels (Table 1).

This *A. deccurens* plant appears due to heat passing through the MMNP area, this natural species grows at various points through the spread of seeds during eruption. According to (Gibson et al., 2011), cause because invasive species like *A. deccurens* can respond to interference more quickly from non-invasive.

The parameter that can describe the role of a species in the community is the Indices of Important Value (IIV) (Sundarapandian & Swamy, 2000). It can be seen that in addition to *Acacia* (*A. deccurens*), there are other species at the pole level, namely Puspa (*Schima walichii*) and Mahogany (*Khaya anthotheca*) (Table 1). Puspa is a species that dominates after *Acacia*, because it has a higher IIV than Mahogany. This illustrates that the native species found in damaged/degraded locations are pioneer types and are able to colonize open areas naturally. According to (Gunawan et al., 2013), native species such as Puspa (*S. walichii*) can adapt to conditions after the eruption. Nevertheless, the *Schima walichii* species can still be defeated by exotic species such as *Acacia decurrens* which are able to grow quickly and invasively in areas damaged by eruption with densities reaching 91.67% above the puspa (4.17%).

Data on plant species at the level of sapling and lower plants were presented (Table 2). Based on species found at the sapling level. *Acacia* still dominates with the highest IIV. Pancang is a sapling that is usually located near an adult tree, the difference is that the stem diameter is less than 10 cm and the height is more than 1.5 meters.

Tree diameter measurements are still carried out to determine the sapling level category. Different with trees and poles, the parameters observed for the sapling and seedling level are only carried out on the number of individuals and the number of species. It is because at the sapling level, what needs to be known is the density and frequency.

The results showed that besides the acacia species, the sapling species (*Agathis dammara*) at the sapling level also had the second highest Indices of Important Value after acacia. Damar is an important type of local plant, although its growth is slow. These plants provide benefits to resist erosion and protect water sources (store them) through strong roots (Gunawan et al., 2013).

Agathis Dammara has a relatively high frequency compared to other types such as Meranti, Pulai and Jamblang, which are only 8.33%. The same frequency values in the three species resulted in competition to compete as a more dominant species. Although having the same frequency value Meranti (*S. selanica*) is more dominant than Pulai and Jamblang.

Based on data, *Shorea selanica* (Meranti) has a higher density than Pulai and Jamblang at the poles level. According to Balai Penelitian Kehutanan Banjarbaru (2011), this species is the dominant species found in lowland forests on well drained soils. *S. selanica* is a type of meranti which is quite promising for planting programs, such as commercial planting, rehabilitation of degraded forests and reforestation of conservation land.

It can be seen that for the seedling there are 12 species from 8 families that have been identified. The poaceae and asteraceae families have the highest number of species found in each of 3 types (Table 2). The Poaceae family is represented by the types of *Imperata cylindrica, Brachiaria* and *Pennisetum purpureum.* The existence of low-level plants (seedling) is needed to maintain soil and water conservation (Surtikanti et al., 2016).

Imperata cylindrica (Alang-Alang) species has a lower density than the other two species which are still in one family (Table 2). According to (Heyne, 1987), if the reeds have been burned for years, the distance of the plants eventually becomes rare. This is an illustration that when hot lava eruptions burn vegetation in the area, including reeds.

The opportunity for other grasses to grow becomes larger because the distance of each reed is rare. Types of grasses that are still one family grow with greater density, namely *Brachiaria* and *Pennisetum purpureum*. This type can be used as animal feed. Residents of the area that live are directly adjacent to MMNP, most of them are cattle breeders and usually use *P. purpureum* (kolonjono grass) as cattle feed. Although *P. purpureum* often be used, this species can grow quickly, it is seen from relative dominance highly (27.29%).

Ageratum conyzoides is a family group of Asteraceae which has the lowest Indices of Important Value compared to other species in the same family. *A. conyzoides* is a type of nuisance plant that does no harm. *Synedrella nodiflora* has characteristics similar to *A. conyzoides*, which are the most common weeds on Java. Based on the Indices of Important Value, the type of *Eupatorium riparium* is the most dominant type with IIV 29.17.

E. Riparium is a small and deep rooted shrub. This plant originated in Mexico, but has long been included in Java and now grows wild in places with altitudes of 1000 to 2400 m (Heyne, 1987). *E. Riparium* can grow thick and fast on soils that are not so fertile that it can interfere when in a cultivated garden. Even so, the *Eupatorium riparium* on mountain slopes is useful for reducing erosion or landslides.

Diversity Index

Diversity index is a description of the level of species diversity within a community that can be used to express the relationship of species abundance in the community. According to (Indriyanto, 2012), species diversity can also be used to express community structure and measure community stability.

Based on the results of Shannon's analysis of quantitative diversity indices (Figure 2) it can be seen that saplings, poles and trees in the MMNP Resort Cangkringan area were still low after the 2010 eruption when compared to research conducted by (Susantyo, 2011) before the eruption of Mount Merapi.

Vegetation of the lower plants and saplings is a type of vegetation that has moderate diversity with a value of Shannon diversity index of 1.99 and 1.32. Diversity criteria according to (Barbour et al., 1987), vegetation has a high level of diversity if the Diversity Index (H '> 3). While categorized as moderate if the value of H '= 1-3, and said to be low if the value of H '<1.

Overall the value of the diversity index in the MMNP Resort Cangkringan area is still low after the 2010 eruption. The species diversity for the tree level is still very low. Because it is still dominated by one species, *Acacia decurrens*. According to (Indriyanto, 2012), a community is said to have low species diversity if the community is composed by a few species.

Secondary forest in the Mount Merapi National Park area is a region that has high diversity value, but after the eruption in 2010 it was one of the factors that resulted in low diversity in the region. At present the vegetation structure is still in the development stage, making its diversity value still in the low to moderate stages.

Jurnal Biodjati 4(1):50-57, May 2019

JURNAL BIODJATI

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Table 1. Quantitative results of tree and poles analysis at Cangkringan Resort, Mount Merapi National Park

Species	Family	D	RD	F	RF	Dom	RDom	IIV
Tree								
Acacia decurrens	Fabaceae	1450	100	0.9	100	61.93	100	300
Poles								
Acacia decurrens	Fabaceae	1100	91.67	0.6	75	20.36	95.33	262
Khaya anthotheca	Meliaceae	50	4.17	0.1	12.5	0.39	1.84	18.5
Schima walichii	Theaceae	50	4.17	0.1	12.5	0.61	2.83	19.5

Table 2. Quantitative results of sapling and seedling analysis at Cangkringan Resort, Mount Merapi National Park

Species			RD	RF	IIV
Scientific name	Local name	Family			
Sapling					
Acacia decurrens	Akasia	Fabaceae	41.18	41.67	82.84
Shorea selanica	Meranti	Dipterocarpaceae	11.76	8.33	20.10
Alstonia scolaris	Pulai	Apocynaceae	5.88	8.33	14.22
Agathis dammara	Damar	Araucariaceae	35.29	33.33	68.63
Syzygium cumini	Jamblang	Myrtaceae	5.88	8.33	14.22
Seedling					
Imperata cylindrica	Alang-alang	Poaceae	1.37	2.27	3.64
Eupatorium riparium	tekelan	Asteraceae	17.81	11.36	29.17
Ageratum conyzoides	Bandotan	Asteraceae	2.85	4.55	7.39
Cyperus rotundus	rumput teki	Cyperaceae	6.64	9.09	15.73
Brachiaria	rumput bede	Poaceae	19.39	11.36	30.75
Synedrella nodiflora	serunen	Asteraceae	2.63	6.82	9.45
Lantana camara	Tembelekan	Verbenaceae	1.05	4.55	5.60
Pennisetum purpureum	kolonjono	Poaceae	27.29	15.91	43.20
Dryopteris cycadina	paku	Dryopteridaceae	2.00	4.55	6.55
Heterogonium sagenoides	Paku jangan	Tectariaceae	13.80	11.36	25.17
Centella asiatica	*Regedeg*	Mackinlayaceae	0.95	9.09	10.04
Aneilema sp.	*rumput pebe*	Commelinaceae	4.21	9.09	13.31

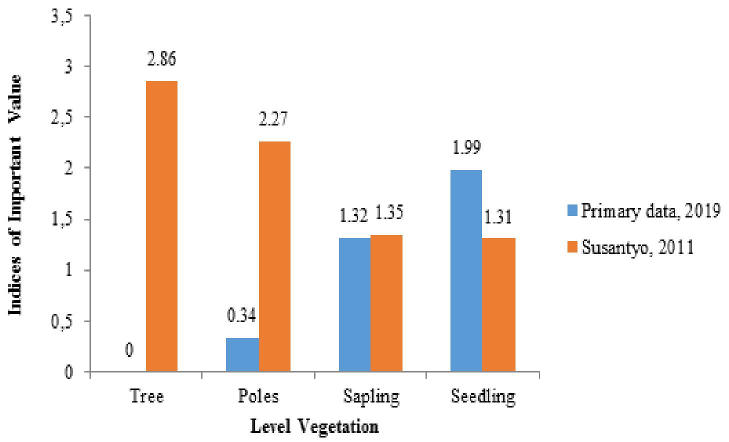

Figure 2. Indices of Important Value tree, poles, sapling and seedling

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