Composition of Vegetation Types and Structures in Gunung Ciremai National Park Forest

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Abstract. Mount Ciremai National Park forest that area had been encroached. Because of that condition, stand structure especially the species composition and vegetation structure need to be researched. The aim of this research was to identify plant species and analyze forest vegetation structure. This research was conducted between March–April 2018 in the 15.500 ha area with 0.02% sampling intensity. Data was collected using grid line method that consisted of 34 sample plots with the 10 m distance between the plots and 20 m between the lines. The numbers of identified plant species at the research location were 43 species, classified by 10 families and 24 genera. *Cinnamomum sintoc* has a high level of dominance species. The forest vegetation was consisting by the different growth phases. The tree phase has the highest density of 3672 species/ha, while the seedling phase was lowest density of 1060 species/ha. The forest crown stratification were consisting of A, B, C, D and E stratum. The highest number of plants were from C strata for 4651 trees and the least from A strata with 25 trees with the highest tree was 42 m. Could be concluded that the composition of Mount Ciremai National Park forest have so many number of species and complex structure vegetation forest.

Keywords: Mount Ciremai, composition, vegetation structure, plant species

1. Introduction

Mount Ciremai is the highest mountain in West Java based on the Decree of the Minister of Forestry No 424/Menhut-II/2004,19 October 2004 has designated as the National Park of Mount Ciremai with an area of 15,500 ha having an altitude of 3,078 m above sea level and located in two regencies, namely Kuningan and Majalengka Regencies **[1].** Mount Ciremai National Park has the potential of abundant and diverse natural resources, in addition this area is not too far from the coastal waters of the Java Sea, so there are quite contrasting ecosystem differences. Jenis flora that can be found in Mount Ciremai National Park are Saninten (Castanopsisargentea), Rasamala (Altingiaexcelsa), Pasang (*Quercus sundaica*), Puspa (*Schimawallichii*), Teureup (*Alstonia ficus*) dan Jamuju (*Podocarpus imbricatus*).

Mount Ciremai National Park is a production forest area and protected forest, but along with the reform era, the community experienced great encroachment for intensive crop cultivation activities such as vegetables, which almost took up about 50% of the total area of Mount Ciremai**[2].**Apart from encroachment of the forest area, there are also other pressures and disturbances, such as timber theft,

land encroachment, forest fires, natural disasters and others. This causes habitat degradation and decreases in ecosystem function which has an impact on decreasing biodiversity and plant species composition [3].

The forest area encroached by the community has an altitude range of 600 - 1200 masl and includ lowland forest **[4]**. stated that biodiversity has two main components that compose it, namely the number of species in an area and the abundance of individuals of each species so that species diversity is one of the most important and fundamental things in biodiversity. Besides that, the composition is a floristic list of plant species in a community**[5,6]**. caused by the many disturbances to Mount Ciremai National Park which causes reduced diversity and composition of species which can lead to reduced diversity of plant species **[7].** Therefor this research was conducted under the title Composition and vegetation structure of Lowland Forest in M nt Ciremai National Park with the aim of analyzing the composition and structure of lowland forest in Mount Ciremai National Park.

2. Methods

This research is located in GunungCiremai National Park which is located 108028'0 "BT - 108021'35" East Longitude, and 6050'25 "LS - 6058'26" LS). The daily average temperature ranges from 18oC to 220C (SchimithFerguson) Lowland forest research boundaries from an altitude of 500-1200 masl. The GunungCiremai National Park (TNGC) is administratively located in the two districts of Majalengka and Kuningan. The research location is focused on an altitude of 500 - 1200 masl. based four slope directions, namely North, South, East and West. For more details, the research location can be seen in Figure 1. The data analyzed in this research were plant species, forest vegetation structures based on the Importance Value Index and growth stratification conditions.

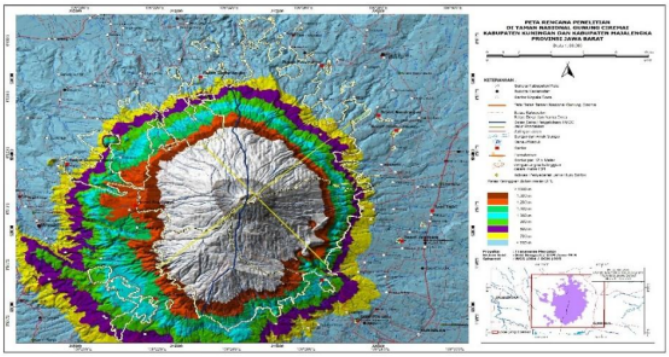

Figure 1. Map of the Research Location

Vegetation data was collected by using the plotted path method which was placed purposively with plots measuring 20x20m² for the tree level, 10 x10 m for the pile level, 5 x5 m for the sapling level and 2x 2 meters for the seedling level with a distance between the plots of 20 meters. All growth stages were measured for their vertical and horizontal structures, recorded their species and numbered. Parameters measured were trunk diameter at breast height (± 130 cm), branch free height and total height.

The collected vegetation data is analyzed in a way that is commonly used in forest ecological studies, namely using vegetation analysis to obtain density, relative density, frequency, relative frequency, dominance, relative dominance, Importance Value Index (INP), Shannon Wiener index and the morhisitaindex (distribution of species) **[8]**.

Data analysis for vegetation using the compartmental path method was carried out in four slope directions (north, south, east and west) and each altitude 500 - 1200 m asl. Square-shaped observation plots are placed along the observation path in the direction of cutting the slope **[9].** The parameters observed are as follows

a. number of species, relative density, relative frequency, dominance, relative dominance

b. Importance Value Index (IVI) for the growth of poles and trees is calculated based on the formula. : INP = FR + KR + DR, while the Importance Value Index (INP) for the growth rate of seedlings and saplings is calculated based on the formula: INP = KR + FR **[15].**

c. Index Individual Spread (Ip)

To determine the distribution pattern of individuals, the Morishita Index is used (Magguran, 1998) as follows.

$$Id = n\left[\frac{\sum_{i=1}^{n} X_i^2 - \sum_{i=1}^{n} X_i}{(\sum_{i=1}^{n} X_i)^2 - \sum_{i=1}^{n} X_i}\right] \quad (1)$$

where:

Id = *IndeksDispersi Morishita*
n = number of examples
$\sum X$ = *Sum of quadrat counts = x1 + x2 +x3*
$\sum X^2$ = *Sum of quadrat counts quared* = $X1^2 + X2^2 + X3^2$

To test the distribution pattern, the formula is used:

$$Mu = \frac{X^2 0{,}975 - n + \sum Xi}{(\sum Xi) - 1} \quad Mc = \frac{X^2 0{,}25 - n + \sum Xi}{(\sum Xi) - 1} \quad (2)$$

where:

X^2 0,975 =*value of chi-sguare from table n-1 degress of freedom that has 97,5% of area to the right*

X^2 0,25 =*value of chi-sgure from table n-1 degress of freedom that has 97,5% of area to the right*

Xi = *Number of organism in quadrat I (i=1….n)*

n = *Number of quadrat*

Standardization of the Morishita Index is used with the following formula:

If $I_d \geq Mc > 1.0$; then $Ip = 0.5 + 0.5\left(\frac{Id - Mc}{n - Mc}\right)$ (3)

If $Mc > Id \geq 1.0$; then $Ip = 0.5\left(\frac{Id - 1}{Mc - 1}\right)$ (4)

If $1.0 > Id > Mu$; then $Ip = -0.5\left(\frac{Id - 1}{Mu - 1}\right)$ (5)

If $1.0 > Mu > Id$; then $Ip = -0.5 + 0.5\left(\frac{Id - Mu}{Mu}\right)$ (6)

3. Results and Discussion

3.1. Types of Plants that make up the GunungCiremai National Park

The number of plant species found in Mount Ciremai National Park based on vegetation analysis on 672 plots in lowland forest in the Mount Ciremai National Park (TNGC) were found to be 7,452 individuals. It consists of seedling rates of 1060 individuals / Ha, sapling rates of 1422 individuals / Ha, pile levels of 1298 individuals / Ha, and tree levels of 3672 individuals / Ha. These results indicate the level of diversity in species that varies due to differences in characters in each tree species. With the differences in character, there is a diversity in the number of species and individuals in each growth stratum

The diversity of the vegetation composition of forest plant species can be seen from the composition of the types of vegetation. Natural forest vegetation types tend to have a higher number and abundance than mixed forest vegetation types [9]. The composition of plant species found in the GunungCiremai National Park Forest can be seen in Table 1 in the form of family names, number of genera and number of plant species found in the research location.

Tabel 1. Family, number of genus and number of plant species that make up the area of Mount Ciremai National Park

No	Family	number of genera	number of plant species
1	*Meliaceae*	2	3
2	*Malvaceae*.	3	4
3	*Lauraceae*	6	11
4	*Myrtaceae*	3	4
5	*Rhamnaceae*	2	2
6	*Rutaceae*	2	11
7	*Moraceae*	2	3
8	*Gnetaceae*	2	3
9	*Euporbiaceae*	2	2

There were 43 plant species found in the research location with the total population of 7,452 individuals. All of these species belong to 9 families with 24 genera. The types of plants found were flowering trees, shrubs and undergrowth. The main families that compose the vegetation at the study site are Lauraceae, Meliaceae, Moraceae and Malvaceae. with a high level of space control. Meanwhile, the family with the most members found at this location is Lauraceae.

The plant families found at the research location form forest vegetation which is dominated by several types of plants. The dominance of this plant is caused by the abundance of plants, the distribution of plants in the research location and the control of space by these types of plants. The plant species that dominate the research location can be seen in Table 2.

Table 2. plant species that dominate found in Mount Ciremai National Park

No	Scientific name	Local Name	INP(%)	Domination Rate
1	*Cinnamomum sintoc*	sintok	25.45	Tinggi
2	*Zyzygiumdensiflorum*	juwet	17.74	Sedang
3	*Glochidionmacrocarpus*	Mareme	15.74	sedang

Based on the Figure above, it explains if INP < 11.6 that meansLow dominance, if INP 11.6 – 22.9 that meansModerate dominance, if INP > 22.9 that meansHigh dominance. In the research location, it was found that one type of plant that has a high dominance value is Cinnamomum sintoc, Types of plants that have moderate dominance are Zyzygiumdensilorum and Glochidionmacrocarpus. Other plant species found at the study site fall into the low dominance category. Cinnamomum sintoc was found in a very large number spread throughout the study area, therefore control of space by Cinnamomum sintoc is the main factor that causes this species to dominate.

Zyzygiumdensiflorum and Glochidionmacrocarpus is a plant species found in all sample plots. These types of plants are native plant species that grow in lowland forests associated with the Dipterocarpaceae. The benefit of this type of plant is that it is a tree forage for various types of primates, birds and others so that the distribution of seeds is assisted by these animals **[10].**

More than 100 trees were found with a trunk diameter of 53 cm to 2.1 m and a plant height of 30 cm to a size of more than 30 m. If viewed from the condition of the location, in general, GunungCiremai National Park is still in good condition even though several research plots have been planted by the community with plantation crops and MPTS.

3.2. Types of Plants that make up the GunungCiremai National Park

The structure and diversity of vegetation is a description of the spatial arrangement by the constituent components, life forms, stratification and vegetation cover **[6]**. There are three types of forest vegetation structures, namely the vertical structure formed by the canopy layer profile of each growth phase, horizontal structures formed by vegetation compilers that describe the location of an individual with other individuals and abundance which describes the density of individuals in a forest vegetation **[9].**

The size of the seedling density at this location is influenced by the abundance of individuals in the area of the research plot. The highest density value found at the research location was in the tree phase and the lowest value was in the seedling phase. Tree density at the study site was 3672 individuals / ha, sapling density was 1422 individuals / ha, pile density was 1298 individuals / ha and the lowest density was in the seedling phase, namely 1060 individuals / haThe abundance of vegetation in the Lowland Forest in the Mount Ciremai National Park at each growth phase can be seen in Figure 2.

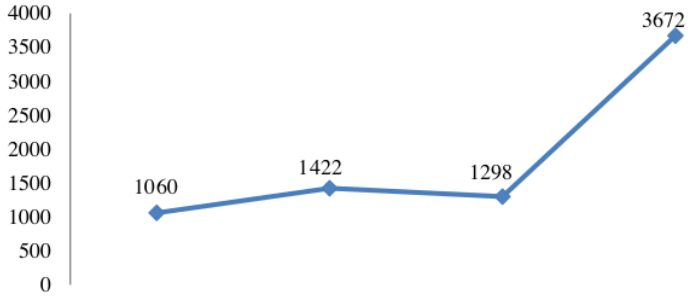

Figure 2. Abundance of All Types in Lowland Forest in the GunungCiremai National Park Area

Based on the data that has been collected, the process of regenerating the GunungCiremai National Park area is still running well. This is based on the abundance of each growth phase which is depicted in the form of a plant density graphThe pattern of density graphs at each growth phase in the GunungCiremai National Park area shows that the mature tree phase has a higher density value compared to the density of seedlings. The value of tree phase density affects the tolerance of tree mortality due to disturbance along with the forest regeneration process [12].

The canopy closure at the research location forms overlapping layers. Trees of various sizes form complex crown closures. The condition of trees that have a large size with a broad canopy stimulates

stressed trees to grow simultaneously [13]. [14] stated that the cover of the canopy had a significant effect on the existence of understorey, the more the density of the crown the number of undergrowth would also decrease. This is in accordance with the coverage area of the seedling canopy which shows the lowest value.

Covering of tree canopy by vegetation in the GunungCiremai National Park area it can be seen from the large number of plant distributions included in the class with the IVI tree. Illustration of vegetation compilers based on height at the research location can be seen in Figure 3.

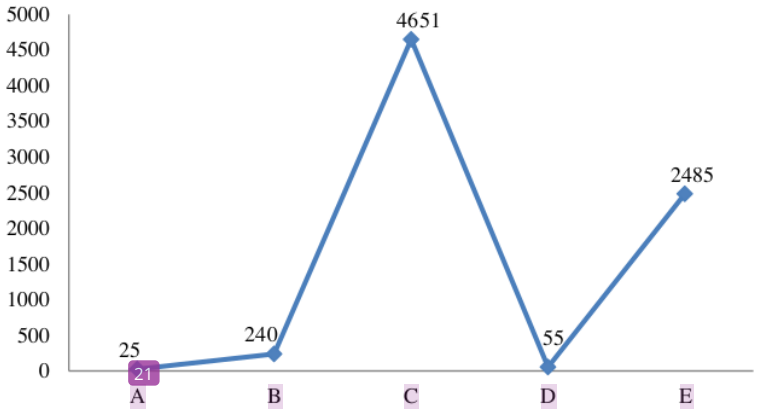

Figure 3. Class based on plant height in the GunungCiremai Forest

Based on the Figure above, it explains that Strata A is a plant that has a height> 30 m, Strata B is a plant that has a height of 20m-30m, Strata C is a plant that has a height of 4m-20m, Strata D is a plant that has a height of 1m-4m, Strata E is a plant that has a height of 0-1m. Strata A consists of 25 individual plants from 10 plant species dominated by Pinus merkusii and Cinnamomum sintoc. Strata B consists of 240 individuals from 39 plant species. Strata C was composed of 4651 individuals consisting of 43 plant species which generally had a denser canopy with relatively low branch free stems. Strata D totaled 55 individuals from 35 plant speciesStrata D was composed by 98 individuals from 43 plant species which were plants in the seedling phase with a tree height of 1 m – 4 mThe plant phase that fills the forest floor (ground cover) and the lowest strata are the E strata totaling 2485 individuals, this stratum is filled with many species, namely saplings, shrubs and low shrubs with a height below 1 m.

Ciremai Mountain Forest has complete forest stratification, namely strataA, strata B, strata C, strata D, and strata E. The completeness of the stratum at the research location is a condition commonly found in tropical rain forests which are still in good condition**[9]**. The completeness of the stratum describes the associations formed by all plant species in forest vegetation. The diversity of the stratum results in the presence of dominant trees, stressed trees and plants that make up the forest floor in an area **[9,10].** The description of the association of plants in the Ciremai Mountain Forest in several sample plots can be seen in Figure 4.

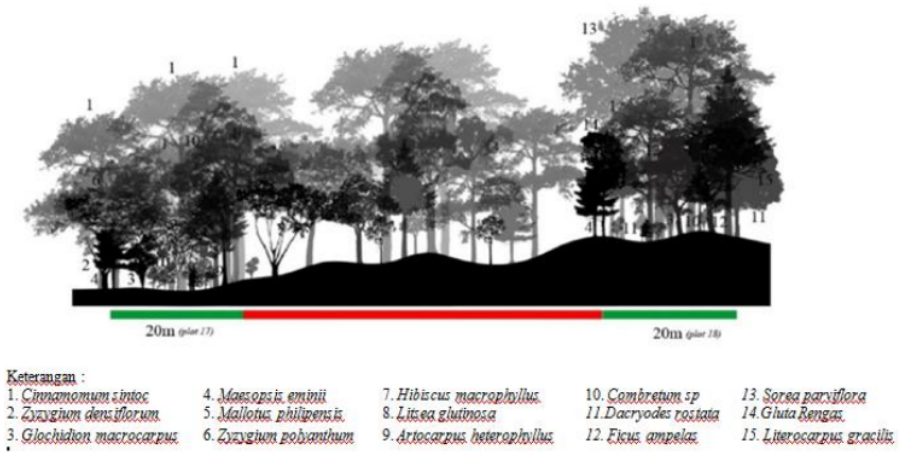

Figure 4. sample plots of plants in the Ciremai Mountain Forest

Ciremai Mountain Forest still has the characteristics of lowland rainforest which has a very complex forest structure, some protected forest that has been cultivated shows that there is a decrease in the complexity of the vegetation. [12] stated that the Tampomas Protected Forest which is managed with a community forest management pattern has an incomplete stratum even though the regeneration process in the forest is still better.

3.3. Domination of plant species

Ciremai Mountain Forest still has the characteristics of lowland rain forest which has a very complex forest structure. These results indicate the level of diversity in species that varies due to differences in characters in each tree species. With the differences in character, there is a diversity in the number of species and individuals in each growth stratum.

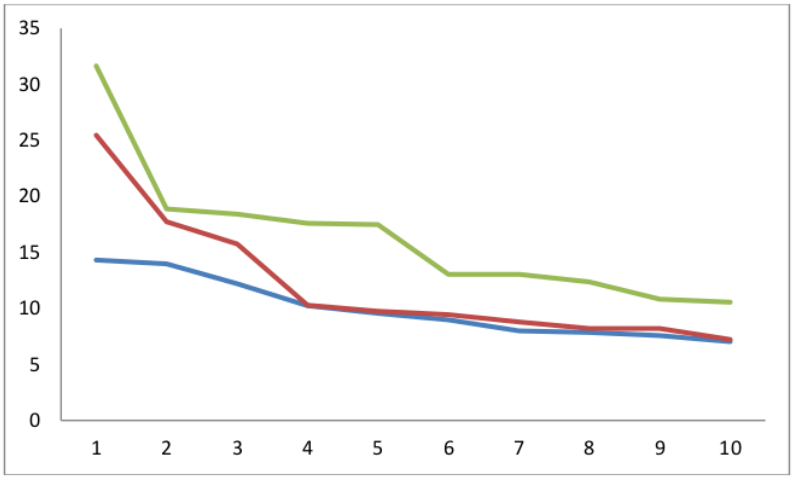

Figure 5. The types of plants that dominateMount Ciremai National Park (TNGC)

These results indicate that for the Importance Value Index, the highest level of seedlings was Zyzygiumdensilorum at 14.31%, followed by Hibiscus macrophyllus at 13.96% and then by

Glochidionmacrocarpus at 12.20%. The highest tree level importance was Cinnamomum sintoc at 25.45%, followed by Zyzygiumdensivelorum at 17.74% and then by Glochidionmacrocarpus at 15.74%. The highest Importance Value Index at the tree level was Pinus merkusii at 73.05%, followed by the Importance Value Index by Cinnamomum sintoc at 17.57%, then by Hibiscus macrophyllus at 12.81%.Pinus merkusiidominates at the tree level because at the beginning the ciremai mountain forest was a homogeneous planted forest. So now the tree level is dominated by pine because of the high age level.

4. Conclusions

Vegetation analysis on 672 plots in lowland forest in the area of Mount Ciremai National Park (TNGC) masl found 7,452 individuals, seedling rate of 1060 individuals / Ha, sapling rate of 1422 individuals / Ha, pole level of 1298 individuals / Ha, and tree level of 3672 individuals / Ha.

With the highest abundance value was in the tree growth stratum, and the lowest was in the seedling growth stratum. The highest Importance Value Index for sapling level was Cinnamomum sintoc at 25.45% followed by Zyzygiumdensilorum at 17.74% and then by Glochidionmacrocarpus at 15.74%. 13.96% and then by Glochidionmacrocarpus by 12.20%. The highest Importance Value Index at the pole level was Swietenia mahagoni at 31.63% followed by Hibiscus macrophyllus with an Importance Value Index of 18.87%, then Cinnamomum sintoc with Importance Value Index of 18.41%, the highest Importance Value Index at the tree level was Pinus merkusii. 73.05%, followed by the Importance Value Index by Cinnamomum sintoc at 17.57%, then by Hibiscus macrophyllus at 12.81%.

Acknowledgement

We thank all who assisted this research. Also, Universitas Kuningan were supported to publish our research. Finally, we were grateful thanks to those who review and provide input for this article.

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