

**Full Length Research Paper**

Vegetation Profile of Plants Species that has Value Of Ecotourism in Mount Mahawu Tomohon, Indonesia

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Abstract

This paper aims to identify and describe the vegetation profile of plant species that have the value of ecotourism in mountain Mahawu Tomohon and analyzed with methods ANVEG. The study lasted for six months starting in July 2012 until January 2013, which is located in the mountain Mahawu Tomohon, North Sulawesi, Indonesia. This research is qualitative research. Sampling method is carried out in the field transect method's plots. The data were analyzed descriptively captured and presented in the form of tables, drawings and described in the description for each type of vegetation. The results of the research that has been processed and analyzed indicate that there are 22 species of plants in the mountain Mahawu. Important Value Index (IVI) is highest at the poles habitus level tree species *Cyathea contaminans* with 50.33 % and the lowest value in the *Elmerillia ovalis* Dandy species with IVI of 30.71 %. IVI at a rate dominated by *Canarium vulgare* amounted to 36.00 %, while the lowest was in the type of *Cempaka Wasian* (*Elmerillia celebica* Dandy) with IVI of 14.80%. The plants species that have a high ecotourism value are *L. camara* LINN, *Pinus merkusii*, *Blechnum capense* (L.) Schltdl and *Hedychium coronarium* Koenig.

Keywords: Mount Mahawu, Vegetation Analysis (ANVEG), Important Value Index (IVI), plant species that have the value of ecotourism.

Introduction

North Sulawesi has a unique vegetation typical of the area that does not exist in other areas such as Sumatra, Java and Borneo. Botanists estimate in North Sulawesi there are 5000 species of plants, but measly is known of its existence and its distribution (Whitten *et al.*, 2002).

In the region there are three mountains Tomohon which became the focus of governments which serve as tourist attractions is Mount Lokon (1.579,6 m dpl), mountain Tampusu (1.474 m dpl) and mountain Mahawu (1.331 m dpl). Mount Mahawu located in 1°21'30" North Latitude and 124°51'30" East Longitude in Tomohon, precisely contained in Tomohon sub district in the East Village Rurukan (Central Bureau of Statistics Tomohon, 2013). Mahawu wide is 550 ha. The status Mahawu mountain was used as a protected forest and nature better known as ecotourism.

One of the tourist destinations of Tomohon city visited by many tourists is the mountain Mahawu because it has a lot of the variety of plants including *Ficus chelebensis*, *Pinanga* sp, *Saccharum spontanum*, *Acanthus* sp, *Sauraria minahassae*, *Pinanga caesia*, *Pigafeta filiaris* (Lasut *et al.*, 1998). In addition there is an endemic animal found that *babi hutan* and several bird species that must be protected and preserved as Scalybreast kingfisher (*cakaka hutan dada bersisik*), Mountain tailorbirds, Crimson-crowned Flowerpeckers, Sooty-headed bulbuls (*Pycnonotus aurigaster*), Grey-sided Flowerpeckers (Tasirin and Hunowu, 2010).

The diversity of plant species ranging from seedlings, saplings, poles and trees provide important value in ecotourism. It affects the interest of tourists, both local and foreign tourists to visit Indonesia mount Mahawu because it has a rich vegetation of charm. The purpose of this study was to determine and describe the vegetation profile of plant species that have the value of ecotourism in the mountain Mahawu Tomohon.

Materials and Method**Study Area**

This research was conducted during six months starting from July 2012 to January 2013, located in the mountain

Mahawu Tomohon (Figure 1 and 2).

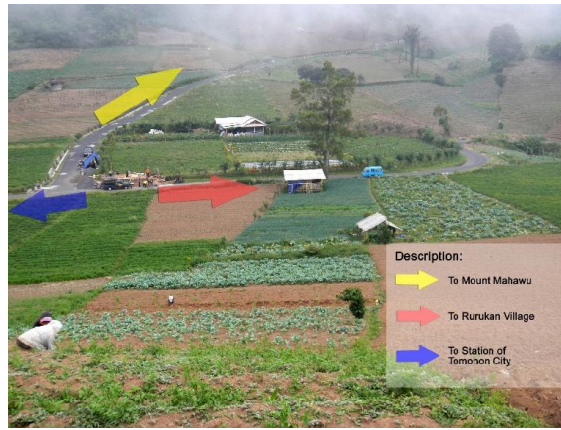


Figure 1. Location Ecotourism Research Mahawu Tomohon, North Sulawesi, Indonesia. (Source: Regina Butarbutar, 2012)



Figure 2. The Landscape Seen From the Top of Mount Mahawu, North Sulawesi. (Source: Regina Butarbutar, 2012)

The materials used in this study consist of a GPS, a roll meter, stationery, raffia rope, cutter, digital camera NIKON COOLPIX AW 100, spreadsheet of data (questionnaire), maps of the area, Computer and Software Adobe Photoshop 7.0.

The sampling technique was conducted in the field transect method comprising terraced plots per transect (Figure 3). Transect measurements carried out starting from the body of the mountain Mahawu the starting point (start) is located at an altitude of 900 m above sea level. Cut lengthwise transect topography created by the distance between transects 10 meters.

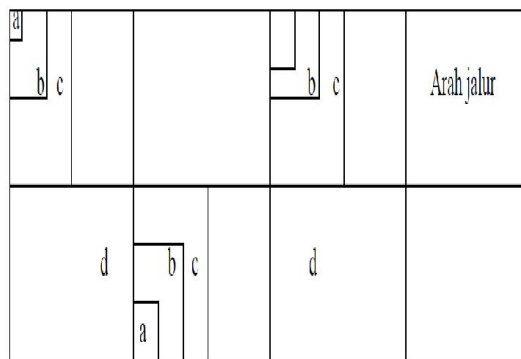


Figure 3. Sample Transects in Study Design. (Source: Krebs, 1989)

Measurements carried out based on the level of tree species of plants (Sorianoegara and Indrawan, 1998), namely: (1) Mature trees with a diameter of trees over 20 cm, (2) Pole with a diameter of trees 10-20 cm, (3) Sapling with a diameter of trees <10 cm and height > 1.5 m, (4) Seedling with plant height <1.5 m and plants under soil or cover. Measurement of trunk diameter (DBH / Diameter Breast Height) conducted at an altitude of approximately chest height or 1.3 m above sea level (Krebs, 1989; Stilling, 1996).

Plant species information obtained in two ways: (1) primary data, based on interviews and questionnaires were distributed to tourists or visitors. All information obtained through the plant during the field survey were recorded in the field diary and documentation carried throughout the plant. (2) Obtained from secondary data of search libraries.

The data has been collected in this study will be processed by using the analysis of Vegetation (ANVEG) i.e. by calculating the Relative Density values (KR), the relative Frequencies (FR), Relative Dominance (DR). Furthermore, the results of the calculation of the value of each parameter that is retrieved will be calculated Important Value Index (IVI). Important Value Index (IVI) aims to describe or assess the importance of the role of a type of vegetation in the ecosystem (Fachrul, 2007; Leksono, 2007). When a type of vegetation with high IVI value types that greatly affect the stability of the ecosystem (Stilling, 1996; Barbour *et al*, 1999).

Results and discussion

Based on the results of this research found 22 species of plants in mountain Mahawu (Table 1). There are three (3) families of plants that dominate in this research include the family Magnoliaceae (*Michelia champaca* L., *Elmerillia celebica* Dandy, *Elmerillia ovalis* Dandy), Euphorbiaceae (*Macaranga minahassae*, *Homalanthus populneus* (Giesel) Pax) and Verbenaceae (*Gmelina arborea*, *L. camara* LINN).

Table 1. Species of Plants are found on Mount Mahawu

No.	Scientific name	Local Name	Family	Status
1	<i>Michelia champaca</i> L.	CampakaKuning	Magnoliaceae	Local
2	<i>Macaranga minahassae</i>	Makaranga	Euphorbiaceae	Endemic
3	<i>Trema orientalis</i> (L)	Mengkirai, Anggerung	Ulmaceae	Exotic
4	<i>Pterocarpus indicus</i>	Sonokembang, Angsana	Caesalpiniaceae	Local
5	<i>Elmerillia ovalis</i> Dandy	Cempakahutankasar	Magnoliaceae	Local
6	<i>Canarium vulgare</i>	Kenari	Burseraceae	Local
7	<i>Cyathea contaminans</i>	Pakupohon	Cyatheaceae	Local
8	<i>Areca vestiaria</i> Giseke	Enau, Seho (Minahasa)	Arecaceae	Endemic
9	<i>Elmerillia celebica</i> Dandy	Wasian, Cempakahutanalus	Magnoliaceae	Endemic
10	<i>Pinus merkusii</i>	Pinus, Tusam	Pinaceae	Local
11	<i>Gmelina arborea</i>	JatiPutih	Verbenaceae	Local
12	<i>Litsea elongate</i>	Medang	Lauraceae	Exotic
13	<i>Tabernaemontana pandacaqui</i> Poir	JelutungBadak	Apocynaceae	Local
14	<i>Swietenia macrophylla</i> King	MahoniBerdaunLebar	Meliaceae	Exotic
15	<i>Pandanus spp</i>	PandanBesar	Pandanaceae	Exotic
16	<i>Homalanthus populneus</i> (Giesel) Pax	Kareumbi	Euphorbiaceae	Exotic
17	<i>Spathodea campanulata</i> Beauv.	PohonHujan	Bignoniaceae	Exotic
18	<i>Schefflera elliptica</i> (Blume) Harms	Tanganan, KayuTulak	Araliaceae	Local
19	<i>Samanea saman</i> (Jacq.) Merr.	Trembesi, Pohon Ki Hujan	Fabaceae	Exotic
20	<i>L. camara</i> LINN	Kembangtelek, Saliara	Verbenaceae	Exotic
21	<i>Blechnum capense</i> (L.) Schldtl	PakuMerayap, Pakusepat, Pakupedang, PakuMunding, Pakis kinca (Jawa)	Blechnaceae	Local
22	<i>Hedychium coronarium</i> Koenig	Gandasuli, Mandasuling (Bali)	Agavaceae	Local

Source: Steenis and Holtum, 2005; Nooteboom *et al*, 2014 (Determining the Status of Plants).

Based on research conducted in the protected forests of Mount Sahendaruman there are 70 species of trees from 32 families, all included in the class Magnoliopsida (dicotyledonous plants) and the division Magnoliophyta (flowering plants) (Kainde, 2011). Nine of the 76 timber species in the region Buton wildlife are those species which is high enough economic value including *biti/owala* (*Vitex coffasus*) *kondongia* (*Cinnamomum parthenoxylon*) and *dongi* (*Dillenia serrata*) (Uji, 2005).

Species of ferns in the nature reserve of Mount Sill found 19 families, the highest number found in the family Polypodiaceae and Aspleniaceae respectively 8 and 6 species (Arini and Kinho, 2012). While Sunarti and Rugayah (2008) found 208 species of plants in the mountainous region Waworete, two of which are new records for Sulawesi (*Diplocaulobium brevicole* and *Anoectochilus setaceus*) and one is a genus and a new collection for Indonesia (*Cyrtochloa cf. toppingii*).

At the plant level pole is highest IVI in Nail Tree species (*Cyathea contaminans*) amounted to 53.33% and the lowest found in the species *Elmerillia ovalis* Dandy with IVI of 30.71% (Table 2).

Table 2. Important Value Index Plants Species at Pole Level

No.	Scientific name	Local Name	Status	KR	FR	INP
1	<i>Cyathea contaminans</i>	Paku pohon	Local	33.33	20	53.33
2	<i>Pinus merkusii</i>	Pinus, Tusam	Local	19.67	20	39.67
3	<i>Schefflera elliptica</i> (Blume) Harms	Tanganan, Kayu Tulak	Local	19.67	20	39.67
4	<i>Macaranga minahassae</i>	Makaranga	Endemic	16.67	20	36.67
5	<i>Areca vestiaria</i> Giseke	Enau, Seho (Minahasa)	Endemic	16.67	20	36.67
6	<i>Elmerillia celebica</i> Dandy	Cempaka Wasian	Endemic	16.67	20	36.67
7	<i>Trema orientalis</i> (L)	Mengkirai, Anggerung	Exotic	16.67	20	36.67
8	<i>Gmelina arborea</i>	Jati Putih	Local	16.67	20	36.67
9	<i>Swietenia macrophylla</i> King	Mahoni Berdaun Lebar	Exotic	16.67	20	36.67
10	<i>Pandanus spp</i>	Pandan Besar	Exotic	16.67	20	36.67
11	<i>Elmerillia ovalis</i> Dandy	Cempaka Hutan Kasar	Local	10.71	20	30.71

Table 3 shows that the value of the highest IVI mature trees in the mountain Mahawu contained in *Canarium vulgare* species was 36.00% and the lowest at *Elmerillia celebica* Dandy species with IVI value of 14.76%. This means spreading type or species of *Canarium vulgare* provide ecotourism mount Mahawu categorized stable.

Table 3. Plants Species Important Value Index at Mature Tree Level

No.	Scientific name	Local Name	Status	DR	KR	FR	INP
1	<i>Canarium vulgare</i>	Kenari	Local	23.42	7.32	5.26	36.00
2	<i>Cyathea contaminans</i>	Pohon Paku	Local	21.47	7.32	5.26	34.05
3	<i>Tabernaemontana pandacaqui</i> Poir	Jelatung Badak	Local	6.52	12.2	10.53	29.25
4	<i>Macaranga minahassae</i>	Makaranga	Endemic	18.23	2.44	5.26	25.93
5	<i>Trema orientalis</i> (L)	Mengkirai, Anggerung	Exotic	16.32	2.44	5.26	24.02
6	<i>Homalanthus populneus</i> (Giesel) Pax	Kareumbi	Exotic	2.97	7.32	10.53	20.82
7	<i>Spathodea campanulata</i> Beauv.	Pohon Hujan	Exotic	1.9	7.32	10.53	19.75
8	<i>Pterocarpus indicus</i>	Angsana, Sonokembang	Local	7.16	7.32	5.26	19.74
9	<i>Litsea elongata</i>	Medang	Exotic	4.15	4.88	10.53	19.56
10	<i>Michelia champaca</i> L.	Cempaka Kuning	Local	4.27	7.32	5.26	16.85
11	<i>Schefflera elliptica</i> (Blume) Harms	Tanganan, Kayu Tulak	Local	4.18	7.32	5.26	16.76
12	<i>Pinus merkusii</i>	Pinus, Tusam	Local	8.27	2.44	5.26	15.97
13	<i>Elmerillia celebica</i> Dandy	Cempaka Wasian	Endemic	4.62	4.88	5.26	14.76

The results of the analysis of the obtained difference species that dominates at the pole level and mature tree. The level of mature trees dominated by *Canarium vulgare* species, whereas in plants the tree level pole is dominated by *Cyathea contaminans* species. The dominance of a different kind in the region due to environmental conditions relating to competition between species. Species that dominate the growth rate of trees as seedlings, saplings, poles and trees will mature characterize or describe a plant community in the region (Leksono, 2007; Agustina, 2010).

Plants Species that have value of Ecotourism in Mount Mahawu

Based on interviews of some tourists, records and documentation at the study site found four (4) species of plants that have a value of ecotourism is *Pinus merkusii* (local name : *Pinus*), *Lantana camara* LINN (Local name : *Kembang telek, Saliara*), *Blechnum capense* (L.) Schldtl (Local name : *Paku merayap, Paku pedang*), *Hedychium coronarium* Koenig (Local name : *Gandasuli, Mandasuling*). This plant species which are an element of charm or attraction that is not owned elsewhere.

1. *Pinus merkusii*

Plant species of pine, known by the scientific name *Pinus merkusii* and including Pinaceae family (Figure 4). Plants belonging to the genus *Pinus* is naturally found in Sumatra, but also successfully cultivated in Java (Steenis and Holttum, 2005). Also spread from Southeast Asia, among others: Burma, Thailand, Vietnam, Laos, Cambodia, and the Philippines.



Figure 4. *Pinus merkusii* (Local name: *Pinus /Tusam*). (Source: Regina Butarbutar, 2012)

In morphology, the species has a high tourism value due to the appeal of the leaves and fruit. The leaves are green, elongated spherical shape and appear to droop. The fruit is dark brown, hard, jagged shaped like a tree and is often used as a Christmas ornament. Pine trees have rough skin gray brown to dark brown, not buttressed, no peeling and grooved wide and deep and has a long fiber.

2. *Blechnum capense* (L.) Schldl

Plant species of local name *Paku Pedang* or in Javanese *Pakis Kinca* have a scientific name is *Blechnum capense*(L.) Schldl. These spikes found living at an altitude of 1,200 m above sea level or near the crater of Mt. Mahawu (Figure 5). This species has a high tourism value due to the attraction in morphology that is unique on the color of the leaves. At the time of leaf bud covered by brown sorus, at a young age leaves open red color and over time will turn green.



Figure 5. *Blechnum capense* (L.) Schldl (Local Name: *Paku Pedang*). (Source: Regina Butarbutar, 2012)

The leaves are still buds will fully wrapped with brown sorus. Leaves monomorphic or dimorphic, pinnate or pinnatifid and rarely simple or bipinnate. Stipules have scales at the base and not attached to the rhizome (Arini and Kinho, 2012; Wikipedia, 2013).

3. *Lantana camara* LINN or Saliara

The plant which has the name of a local kembangtelek or saliara is known by the scientific name *L. camara* LINN. In morphology, these plants have herbaceous stems hairy and thorny and measuring approximately 2 m. The leaves are rough, flavorful and a length of several centimeters with a serrated leaf edges. Much branched, the branches form a rectangle, there are varieties of prickly and not prickly.

This species has a high tourism value due to the morphology there is a special appeal of fruit and flowers (Figure 6). Flowers in a series that is rasemos have white, pink and orange yellow. The fruit is like a shiny black buni fruit when ripe.



Figure 6. *Lantana camara* LINN (Local Name : *Saliara*). (Source: Regina Butarbutar, 2012)

Flower color ranges from white to yellow, orange, red, pink to rose in combination are limited, in addition to a blossoms usually changes color with increasing age. How this type of reproduction is by seed or cuttings through the generative stem (Rusyana, 2012; Nooteboom et al, 2014).

4. *Hedychium coronarium* Koenig

Known by the scientific name *Hedychium coronarium* Koenig, these plants belong to the tribe or family of ginger with local name gandasuli (Figure 7). In the area of Central Java is called by the name Gondosuli, Mandasuling in Bali and Maluku or Halmahera is known as Dagasuli.



Figure 7. *Hedychium coronarium* Koenig (Local Name : Gandasuli). (Source: Regina Butarbutar, 2012).

Characteristic of *Hedychium coronarium* Koenig is a single leaf and intermittent leaves, has midrib, lanset. The leaves are cuneiform, flat leaf edges, base obtuse leaves, leaf length 20-50 cm, width of leaves 3-10 cm, bone pinnate leaves, green and has a fibrous root. This species has a high herb with 1.5 to 2 m. Pseudo-stem, rounded, not branched, wrapped in leaf midrib and form a green-colored rhizome.

This species has a high tourism value because there is an attraction in the shape of flower morphology. Compound interest is white or yellowish and white flowers at the tip, the position of the stem, petals green, cone-shaped and fragrant. Petal shaped like butterflies, four petals, stamens white, embedded and has a pistil length \pm 5 cm (Nooteboom, 2014).

Conclusion

1. There are 22 species of plants are found on Mount Mahawu and the most dominant is the family Magnoliaceae, Euphorbiaceae and Verbenaceae. Most high level vegetation IVI pole *Cyatheacontaminans*(local name is PakuPohon) species, of which 53.33%, while the highest IVI mature trees found in species of *Canariumvulgare* (local name is Kenari) by 36.00%
2. The results of this research there were found (four) species of plants that have a value of ecotourism are *Pinusmerkusii* (Pinus is the local name), *Lantana camara* LINN (local name is kembangtelek, Saliar), *Blechnumcapense* (L.) Schldtl (local name is Pakumerayap, Pakupedang), *Hedychiumcoronarium* Koenig (local name is Gandasuli).

Acknowledgements

The authors are thankful to the government in this case the Director General of Higher Education (DIRJEN DIKTI) which has provided scholarships BPPS so this study can be resolved properly. Our thanks are Department of Forestry in Tomohon, Forestry Police, Department of Tourism Tomohon for their data, discussion and information contribution in the field.

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