Lianas diversity in Gambung area Gunung Tilu Nature Reserve

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Abstract. Lianas is one of the conspicuous plants in tropical rainforests. One of remaining tropical rainforest in West Java which potentially as lianas habitat is Gunung Tilu Nature Reserve. This research aims are inventory and determine the diversity of lianas in Gambung area which is the most potential area for lianas habitat in Gunung Tilu nature reserve. This research was carried out by a descriptive exploratory method. Sampling was done by combining transect and quadrat technique method, with the length of the transect is 700m which stretched from an altitude of 1489mpl (the lowest altitude at the study site) to 1580mdpl (highest altitude). The results showed that there were 13 families, 15 genera with 24 species of lianas. Tetrastigma sp. is the type of liana with the highest Important Value Index of 29.24%, while Aeschynanthus sp.2 and Cissampelos pareira have the lowest Important Value Index of 0.47%. Lianas Shannon – Wiener diversity index in Gambung area Gunung Tilu nature reserve is 1.092.

1. Introduction
Liana is a plant that propagates, climbs or hangs. According to Lahaye et al, the term liana is not a grouping in plant taxonomy but rather a description of how a plant grows [1]. Lianas plants climb on other larger and taller plants to get sunlight, but their roots remain in the soil as a means of getting food [2]. Lianas are one of plants that are very abundant in the tropics country such as in Indonesia. The results of several research in the 1980s showed that around 19% of plant species found in lowland tropical regions were lianas, with varies densities according to the land area. Furthermore, Sirami et al noted that at least 43 types of lianas from 30 families were found in Gunung Meja Nature Park Manokwari in West Papua [3]. Based on Mascaro, the abundance of Liana in the wet forest are low. Liana has an ecological role that is very important for the forest and its environment [4]. They can prevent the falling tree due to their growth that spreads between the supporting trees in the forest, as a source of food, and as a supporting tool for animals that cross trees [5].

One of the tropical rainforests in West Java which is rich in biodiversity is Gunung Tilu Nature Reserve. Gambung is a forest area of Gunung Tilu Nature Reserve which is strategic in providing natural services and ecosystems. Gambung also has important biodiversity both flora and fauna endemic to West Java which is important to be saved from the threat of damage and extinction. Gambung has an area of 2500 ha [6]. Considering the potential of Gambung area as a liana habitat and there is no
information about liana diversity in that area, it is necessary to know the diversity of lianas in the Gambung area of Gunung Tili Nature Reserve.

2. Material and method
This study was conducted for three months, start from November 2016 to January 2017. The location of this research is Gambung Conservation Area, Gunung Tili Nature Reserve that located in Pasir Jambu, West Java, Indonesia. We combine transect and quadrat technique method [7]. The plot size is used is 20 m x 20 m [8]. The total plots was 35 plots with total length 700m from the lowest altitude (1350 MASL) to the highest altitude (1580 MASL). We recorded all the liana species and the number of individuals in each plot. We made herbarium for the unknown species. The herbarium was identified based on Flora of Java Book in taxonomy laboratory UIN Sunan Gunung Djati Bandung and verified at Herbarium of Padjadjaran University. Furthermore, the data were analyzed to get Relative Density (RD), Relative Frequency (FR) and Important Value Index (IVI) [7]. The diversity level of liana species was determined by using Shannon-Wiener Index [9].

3. Result and discussion
In Gambung area we found 24 species of liana from 15 genera and 13 families (Table.1). The Important Value Index (IVI) is one of the parameters used to describe the level of domination of a species towards the community. If IVI of one species of vegetation is high, it means that, its species greatly affects the stability of the ecosystem [8]. In Gambung area, Tetrastigma sp has the highest IVI, it can be seen from the Frequency Relative (13.53 %), although the highest density was Ficus sp.3 of 19.49%, followed by Tetrastigma sp with a value of 15.71%. But Ficus sp.3 has a lower frequency than Tetrastigma sp. This shows that not only the density affect the IVI but, the presence of liana species in each observation plot also influences. In accordance with Mohammad et al, that there are 2 constituent factors of IVI in lianas, namely frequency and density [10]. The presence of liana species in each observation plot shows the spread of the liana species. So that it can be said if Ficus sp.3 has the highest density but its presence and its spread are a little still will not show the highest IVI. IVI for every liana species can be seen on Table 1 below:

| No. | Species                  | Family       | FR (%) | RD (%) | IVI  | H’   |
|-----|--------------------------|--------------|--------|--------|------|------|
| 1   | Tetrastigma sp.          | Vitaceae     | 13.53  | 15.71  | 29.24| 0.124|
| 2   | Ficus sp. 3              | Moraceae     | 7.32   | 19.49  | 26.81| 0.137|
| 3   | Piper sp.4               | Piperaceae   | 10.98  | 9.40   | 20.38| 0.095|
| 4   | Epipremnum pinnatum      | Araceae      | 10.43  | 8.83   | 19.26| 0.092|
| 5   | Smilax zeylanica         | Smilaceae    | 8.24   | 4.93   | 13.17| 0.063|
| 6   | Rubus chrysophyllus      | Rosaceae     | 4.32   | 7.45   | 11.81| 0.079|
| 7   | Ficus sp. 4              | Moraceae     | 6.41   | 5.27   | 11.68| 0.065|
| 8   | Rubia cordifolia         | Rubiaceae    | 7.32   | 3.89   | 11.21| 0.061|
| 9   | Piper sp 3               | Piperaceae   | 5.12   | 5.27   | 10.39| 0.065|
| 10  | Ficus sp.2               | Moraceae     | 4.02   | 3.66   | 7.68 | 0.051|
| 11  | Piper sp 1               | Piperaceae   | 4.57   | 2.86   | 7.43 | 0.043|
| 12  | Epipremnum sp.           | Araceae      | 2.56   | 2.98   | 5.49 | 0.045|
| 13  | Piper sp. 2              | Piperaceae   | 2.01   | 2.63   | 4.64 | 0.027|
| 14  | Homalomena sp.           | Araceae      | 2.01   | 2.17   | 4.18 | 0.035|
| 15  | Mikania sp               | Asteriaceae  | 2.01   | 1.94   | 3.95 | 0.032|
| 16  | Hydrocotyle sp.          | Araliaceae   | 1.46   | 1.37   | 2.83 | 0.024|
| 17  | Hoya purpureo            | Apocynaceae  | 0.91   | 0.57   | 1.48 | 0.011|
| 18  | Aeschynanthus sp.1       | Gesneriaceae | 0.91   | 0.45   | 1.36 | 0.009|
| 19  | Belum diketahui          | Gesneriaceae | 0.91   | 0.22   | 1.13 | 0.005|
| 20  | Ficus sp.1               | Moraceae     | 0.36   | 0.34   | 0.7  | 0.011|
Tetrastigma sp. hang and propagate on a large tree as its host. The host trees used are huru (Actinodaphne prodera Nees) and Rasamala (Altingea exelsa Noronha). In line with the statement of Suwartini that in its life Tetrastigma requires the existence of supporting trees to propagate to the crown of the canopy in order to get direct sunlight [11]. Supporting trees that are widely used are Ketapang (Terminalia catappa L), Kopo (Eugenia cymosa Lamk), huru (Actinodaphne prodera Nees), Kiara Kebo (Ficus altissima Blume), and others with a diameter more than 40 cm.

Whereas the type of liana that has the lowest IVI is Cissampelos pareira and Aeschynanthus sp.2. This has been seen from the frequency relative value of the Cissampelos pareira and the low density relative value of Aeschynanthus sp.2. Cissampelos pareira and Aeschynanthus sp.2 are small and herbaceous lianas. As a small herbaceous plant that lives in locations with very tight canopy cover, it will be very difficult to adapt. Under these conditions Cissampelos pareira and Aeschynanthus sp.2 difficult to get enough sunlight. The genus Aeschynanthus belongs to the Family of Trichosperae from Gesneriaceae. This lianas are mostly epiphytic or in rock crevices [12]. Cissampelos pareira is found throughout the world but only one species in India. This plant is commonly found in arbor orchids, hedgerows, and with moist soils spread throughout tropical and subtropical India [13]. According to Jhuna and Bhattacharya, Cissampelos pareira was first described in America, but actually it found throughout the tropics [14]. In some countries it has been introduced as an ornamental plant. Throughout the tropical country Cissampelos pareira is used by the community to cure some disease such as diarrhea, dysentery, boils, colic, intestinal worms and digestive disorder, and also urogenital problems such as menstrual problems, venereal disease, infertility, uterine bleeding and the threat of miscarriage.

Species diversity is a characteristic of the level of the community based on its biological organization. Species diversity can be used to express community structure. Species diversity can also be used to measure community stability, namely the ability of a community to keep itself stable even though there are disturbances to its components [7]. According to Asrianny et al., the species diversity index (H’) is classified into 3 categories. If the Shannon-Whiener H’<1 index is low, if 1>H’> 3 is classified as moderate and if H’>3 is high [9].

The magnitude of the diversity index of lianas using the Shannon Wanner index shows that liana diversity is classified as moderate with H’1.092. This shows that the condition of the lianas in the Gambung area is still balanced and stable. As stated by Indriyanto, high species diversity community means that community composed by many species [7]. Environmental factors that affect the diversity of liana are air humidity, light intensity, temperature, soil moisture and pH. Air humidity and soil moisture in the Gambung area is 84.6% and 82% with soil pH 6. In this condition the lianas can develop well. According to Asrianny et al., lianas can grow well in areas with humidity of 80%. The temperature at the time of observation in the Gambung area was 21.5°C [9]. Extreme temperatures will inhibit plant growth and can even lead to death for plants [9]. So lianas can develop well in Gambung area because Gambung area has a moderate temperature. Besides that the environmental factors that influence lianas diversity is light intensity. The light intensity in the Gambung area was 1273.9 cd, according to Iji et al., sunlight provides energy for the ecosystem, which supports the photosynthesis process goes well [2]. The light intensity at Blok Gambung, which is 1273.9 Cd is classified as good and can provide good sunlight. Altitude and topography also affect the value of diversity. Liana cannot spread to high areas because in areas with high slopes generally have a very thin layer of soil and a little nutrient so that the liana seeds will be carried by water to flat areas which contain more nutrients than hilly areas.

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Table 1. Cont.

| No. | Species          | Family       | FR (%) | RD (%) | IVI | H’ |
|-----|------------------|--------------|--------|--------|-----|-----|
| 21  | Dioscorea sp.    | Dioscoreaceae| 0.36   | 0.34   | 0.7 | 0.007|
| 22  | Rhapidophora sp. | Araceae      | 0.36   | 0.22   | 0.58| 0.005|
| 23  | Aeschynanthus sp.2 | Gesneriaceae | 0.36   | 0.11   | 0.47| 0.003|
| 24  | Cissampelos pareira | Menispermaceae | 0.036 | 0.11   | 0.47| 0.003|
|     | Total            |              |        |        |     | 1.092|
In addition to abiotic factors, biotic factors such as the availability of hosts to support liana growth are considered to be quite important for lianas growth. Liana climbs and wraps around the host trees using tendrils and stems to reach a certain height, sometimes to form canopies which cause competition in getting sunlight [2]. Availability of host trees in the Gambung area is moderate. The Gambung area located close to residential areas, allowing human activities within forest areas such as cut down tree branches and shrub for firewood, that activities can damage liana habitat, because lianas grow twisted, hang and climb on trees.

4. Conclusion
Based on Shannon –Wiener index, the diversity of lianas in the Gambung Block classified as moderate with $H'= 1.092$ with 24 species of Lianas. *Tetrastigma* sp. is the dominant liana species in Gambung area, it has the highest IVI (29.24). *Tetrastigma* sp. also has the highest frequency relative value (FR) it proved that *Tetrastigma* sp has a wide distribution and Gambung area fits as *Tetrastigma* sp. Habitat.

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References
[1] Lahaye R, Civeyrel L, Speck T and Rowe N P 2005 Evolution of shrub-like growth forms in the lianoid subfamily Secamonoideae (Apocynaceae s.l.) of Madagascar: phylogeny, biomechanics, and development *American Journal of Botany* 92 81-96
[2] Iji S, Hamidun M S and Rahman S R 2015 Keanekaragaman Jens Liana di Dataran Rendah Suaka Marga Satwa Nantu Kabupaten Gorontalo *Jurnal Penelitian Jurusan Pendidikan Biologi Fakultas MIPA Universitas Negeri Gorontalo*
[3] Sirami, E Y I V, Sadono and Marsono D 2014 Karakteristik Habitat Merbau [*Intsia bijuga* (Colebr.) O. Kuntze] di Taman Wisata Alam Gunung Meja Manokwari *Jurnal Beccariana* 15 (1) 39-44
[4] Mascaro J, Schnitzer S A and Carson W P 2004 Liana Diversity, abundance, and mortality in a tropical wet forest in Costa Rica *Forest Ecology and Management* 190 3-14
[5] Setia T M 2009 Peran Liliana Dalam Kehidupan Orangutan *Vis Vitalis* 2 (1) 55-61
[6] BKSDA 2003 *Cagar Alam Gunung Tilu* [Online] Retrieved from [http://bbksda-jabar.dephut.go.id](http://bbksda-jabar.dephut.go.id) [Accessed on 22 Agustus 2018]
[7] Indriyanto 2008 *Ekologi Hutan* (Jakarta: Bumi Aksara)
[8] Fachrul M F 2007 *Metode Sampling Bioekologi* (Jakarta: Bumi Aksara)
[9] Asrianny M dan Ngakan P O 2008 Keanekaragaman Dan Kelimpahan Jens Liana (Tumbuhan Memanjat) Pada Hutan Alam Di Hutan Pendidikan Universitas Hasanuddin *Jurnal Perennial Univ*. 5 (1) 23-30
[10] Mohammad, Wahyu, Ramadhanil P and Syamsurizal M S 2014 Keanekaragaman Jens Liana Berkayu di Hutan Dataran Rendah Taman Nasional Lore Lindu Sulawesi Tengah Indonesia *Bioclebes* 8 (2) 48-56
[11] Suwartini R 2008 *Kajian Kondisi Populasi Rafflesia patma Blume dan Sikap Masyarakat Sekitar di Cagar Alam Leuwung Sancang Kabupaten Garut* (Bogor: Departemen Konservasi Sumberdaya Hutan dan Ekowisata, Fakultas Kehutanan, Institut Pertanian Bogor)
[12] Chaturvedi S K and Moaku W 2008 *Aeschynanthus* W. Jack (Gesneriaceae) in Mokokchung and Zunheboto districts of Nagaland, India *Pleione* 2 (1) 106-110
[13] Manu A, Sharma T, Devi A, Bainsal N and Siddiqui A A 2012 An Inside Revies of *Cissampelos Pareira* Linn: A Potential Medicinal Plant of India *IRJP* 3 (12) 38-41
[14] Jhuma S and Bhatta C 2011 *Cissampelos pareira*: A Promising Antifertility Agent *IJRAP* 2 (2) 439-442