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The Potency of Apiculture in Pattaneteang Village Forest, Bantaeng Regency, Indonesia

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Abstract

This study aims to analyze of vegetation of honey bee feed and determine the potency of apiculture development in the Pattaneteang Village Forest, Bantaeng Regency, Indonesia. This study conducted by inventory and analysis of vegetation to know the types of vegetation in the Pattaneteang Forest Village. Vegetation analysis using stratification sampling. Vegetation data collected by making sample units (plots) for tree, pole, piling, and seedling levels. Size of plot used was 20 m x 20 m for tree level, 10 m x 10 m for pole level, 5 m x 5 m for sapling level, and 2 m x 2 m for seedling level. The inventory results were analyzed to determine: density, frequency, dominance, relative density, relative frequency, relative dominance, and important value index. The value of diversity index (H ') of tree, pile, sapling and seedling level in Pattaneteang village forest were 3.25; 3.36; 3.19 and 3.26. This shows that the level of diversity of species for apiculture development in the Pattaneteang Village Forest is high on all levels of vegetation. Percentage types of tree, poles, sapling and seedlings that include bee feed were 86.05%; 88.10%; 87.50%; and 83.87%. This shows that the potency of the plant that produce bee feed (nectar and polen) in the Pattaneteang Village Forest was very abundat. The condition in Pattaneteang Village Forest area is very supportive for the development of apiculture. One of honey bee feed that has potential to be developed in the form of agroforestry in Pattaneteang Village Forest is coffee plant which flowering throughout the year.

Keywords: apiculture; honey bee; forest village Pattaneteang.

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1. Introduction

Apiculture activities produce quality food products that can help improve the nutrition and income of rural communities[1]. The nutritional value of bee pollen is higher than meat and eggs in terms of protein content. Through pollination function, honeybees also play a big role in increasing the production of fruits and seeds and maintain the survival and diversity of plant species. The development of beekeeping is considered important considering Indonesia has enormous potential in this field. Indonesia's natural and climatic conditions are very supportive for beekeeping, such as the availability of bee forage throughout the year and various types of honey bees. In addition, the community has traditionally known beekeeping, as well as the potential of beekeeping products, especially honey is still widely open, both to meet domestic demand and foreign demand.

Wild honeybees around the forest can be enhanced by honey yields when managed well through honeybee method or technique, which in this management can of course be harvested with a regular system. With good management can be known periodically when time the colonies can be harvested, so that will produce quality honey.

Honey beekeeping is generally done in forest areas and around forest areas because feed for honeybees is widely available in the form of nectar produced by trees contained in forest areas and crops and plantations. Forest Village is a state forest managed by the village and utilized for village welfare. Village forest is formed on the consideration of community empowerment in and around the forest area, and to realize a fair and sustainable forest management.

Holders of Village Forest Management Rights in protected forest areas and production forests are entitled to utilize the area through, among others, cultivation of medicinal plants, ornamental cultivation, mushroom cultivation, bee keeping, wildlife breeding, or forage cultivation. Communities may also undertake activities in the field of environmental services, including the use of water services, water use, nature tourism, biodiversity protection, environmental protection and protection, or sequestration and or storage of carbon.

Non-timber forest products that can be utilized by holders of Village Forest Management Rights include rattan, honey, sap, fruits, mushrooms, or swiftlet nests, including cultivation, harvesting, enrichment, maintenance, security and marketing of yields. To regulate the management of village forests, the government in this case the Ministry of Forestry has issued the Minister of Forestry Regulation Number P.49 / Menhut-II / 2008 on Village Forest.

In 2008, the Government of Bantaeng District implemented the Village Forest Development Program as an alternative solution to overcome the problems of forestry development. In the early stages, the program was implemented in one of the villages of Pattaneteang Village. Community has developed a coffee plant in forest village area. The community has also developed the cultivation of plantation crops and agriculture on lands outside the forest area, and the plant has the potential to support the beekeeping within the forest area through the development of agroforestry patterns. This study aims to analyze of vegetation of honey bee feed and

determine the potency of apiculture development in the Pattaneteang Village Forest, Bantaeng Regency, Indonesia

2. Research methods

2.1. Time and Site Studies

The research was conducted at Pattaneteang Village Forest Land in Pattaneteang Village Tompobulu Sub-district, Bantaeng Regency, South Sulawesi Province, Indonesia, shown in Figure 1. It started from preparation, pre-research to data analyze during one year, beginning from January to December, 2016.

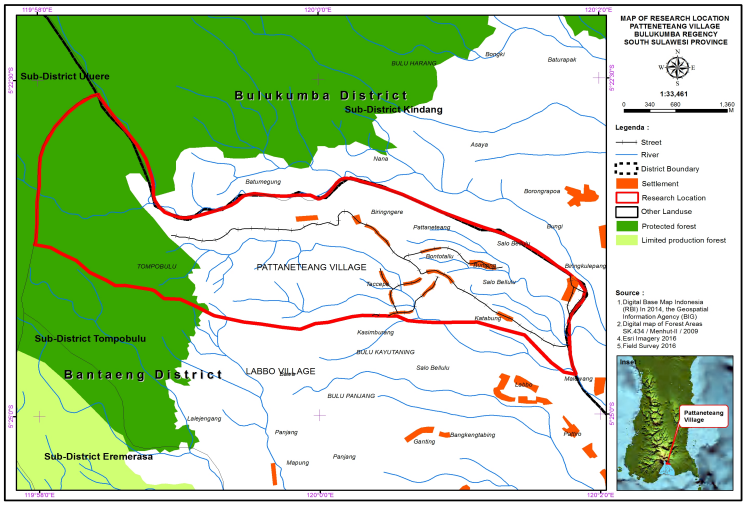

Figure 1: Study site

2.2. Categories and Data Sources

The data categories were primary and secondary data. Primary datawere obtained from field survey in the study area. Secondary data were gathered from literature review, documents and reports from various agencies involved in the research topic.

2.3. Methods

The potency of apiculture development was known from the inventory and analysis of vegetation conducted to know the types of vegetation in the Pattaneteang Forest Village. Vegetation analysis using stratification sampling (known stratification sampling) known as bee activity area take honey.

Vegetation data collection in the field was conducted by making sample units (plots) for tree, pole,sapling, and seedling levels. Size of plot used were 20 m x 20 m for tree level, 10 m x 10 m for pole level, 5 m x 5 m for sapling level, and 2 m x 2 m for seedling level by defenition:

1) Tree is all trees with a trunk diameter equal to or more than 20 cm (≥ 20 cm).

2) Pole is the regeneration of trees with a trunk diameter of 10-20 cm.
3) Sapling is regeneration of tree with stem diameter <10 cm and height above 1.5 m.
4) Seed is the regeneration of trees ranging from sprouts up to 1.5 m high.

The way of sampling plots and measurements in the field are as follows:

1) Placement of sample unit plot is done by purposive sampling
2) The sample plot is made by nested sampling (20 m x 20 m for tree level, 10 m x 10 m for pole level, 5 m x 5 m for sapling level, and 2 m x 2 m for seeding level.
3) Levels of trees, poles, sapling, and seedlings of data collected include the name of the tree species and the number of individuals of each species.

The inventory results were analyzed by vegetation analysis to determine: density, frequency, dominance, relative density, relative frequency, relative dominance, and important value index.

2.3. Data Analysis Methods

The Importance Value Index (IVI) for each level calculate using data collected. The formula used in calculating IVI was the quadrat method [2] :

$$\text{Density (De)} = \frac{\text{Number of individuals of a species}}{\text{Area of all sample units}}$$

$$\text{Relative Density (RDe)} = \frac{\text{Frequency of a certain species}}{\text{Total number of species}} \text{x } 100\%$$

$$\text{Frequency (F)} = \frac{\text{Number of quadrats containing a certain species}}{\text{Frequency of a certain species}}$$

$$\text{Relative Frequency (RF)} = \frac{\text{Frequency of a certain species}}{\text{Total number of species}} \text{x } 100\%$$

$$\text{Dominance (Do)} = \frac{\text{Basal area of a species}}{\text{Area of all sample units}}$$

$$\text{Relative Dominance (RDo)} = \frac{\text{FRelative Dominance (RD)}}{\text{Dominance of all species}} \text{x } 100\%$$

The Importance Value Index for tree, pole anda sapling levels were calculated based on the formula:

$$\text{Importance Value Index (IVI)} = \text{RD} + \text{RF} + \text{RD} \qquad (1)$$

For seedling level, Importance Value Index was calculated using the formula:

Importance value index (IVI) = RD + RF (2)

The Diversity Index can be calculated using the formula

$$H' = -\sum_{i=1}^{n}\left(\frac{n_i}{N}\right)\ln\left(\frac{ni}{N}\right) \quad (3)$$

Where :

H '= Shannon's diverse index

Ni = An important value of a type

N = Value of all types

Table 1: Diversity index value

Diversity index value (H')	Level of diversity
< 1.0	Low species diversity
> 1.0 - <3.0	Moderate species diversity
≥ 3.0	High species diversity

Source: Odum, 1971

3. Results and Discussion

3.1. General Description of Pattaneteang Village Forest

Pattaneteang Village is administratively included in the District of Tompobulu, Bantaeng District, South Sulawesi Province. The location of this village is 28 km from the capital District and 146 km from the capital of South Sulawesi Province. Location of Pattaneneang Village Geographically is $119^0$58'00 "- $119^0$59'20" East Longitude and $05^0$22'40 "- $05^0$24'20" South Latitude, with altitude between 650 - 1700 meters from sea level. Result of overlay of map of Banteang Regency slopes with boundary map of Desa Pattaneteang show tahtthe distribution of forest village slopes. Mostly (82,95%) area of Pattaneteang Village including slope class is very steep (slope> 40%). This area is located in the western part of Pattaneteang Village while the area with a rather steep of slope is in the eastern part of Pattaneteang Village (17.05%).

The lowest altitude of Pattaneteang Village is the height of 725 meters from sea level (located in the residential area) and the highest area up to 1750 meters from sea level (in Pattaneteang Village Forest). While the Pattaneteang Village Forest Area itself is at an altitude 1150 to 1750 meters from sea level.

Observation results in the field can be known that land cover on the working area of Pattaneteang Village Forest consists of natural forest, mixed forest and coffee monoculture (Table 2).

Table 2: Village forest cover area

No.	Cover area	Largce (ha)	Percent of cover area (%)
1	Natural Forest	174.5	51.44%
2	Mixed Forest	135	39.7%
3	Monoculture of Coffee	29.7	8.75%
	Total	339.2	100%

Table 2 show that land cover in the Pattaneteang Village Forest is dominated by natural forest around half of the area (174.5 ha) or 51.44%, while the mixed forest is 135 ha (39.7%) of the total total area of Pattanetang Village Forest.While monoculture coffee is 29.7 ha (8.75%). Descriptions on each land cover area are as follows:

a. Natural Forest

Natural forests are areas where the vegetation is still natural and in this area tree age> 40 years old. Vegetation commonly found in this area is Albisia, Galatiri, Damar, Damar Gana, Lutuh, Lossong and Balanteh.

b. Mixed Forest

The mixed forest are natural forest mixed plants used by community. In general, natural forestmixed coffee under stands, without cutting down that already exist in the forest. In this area the average coffee plant is 10 years old.

c. Coffee Monoculture

The coffee monoculture are the area where the dominant crop of coffee and tree plant used as shade that the average age is still 10 years old. Shade plants such as Jackfruit, Guava stone, Alpokat, Albisia, Kaleandra, Cembang, Mango, and Galitiri. In this area the average coffee plant is 6 years old.

Geographic information siystem analysis, show that the cover of Natural Forest (174.5 ha) in Pattanetang Village Forest area is approximately 3.7 to 4.1 km from the nearest settlement. In Mixed Forest (135 ha) in Pattaneteang Village Forest area is approximately 3.1 to 3.7 km from the nearest settlement. While the coffee monoculture is located at 2 to 3.1 km from the nearest settlement. Land cover area of Natural Forest is located at the altitude of 1650 - 1775 meters from sea levelwith a distance of ± 3.7 km more, from the nearest settlement, Mixed Forest is at an altitude of 1600 – 1650 meters from sea level and is ± 3.1 km from the nearest settlement. While the Coffee Monoculture is ± 2 km distance from the nearest settlement with an altitude of 1450 – 1600meters from sea level.

3.2. Potency of Apiculture

The vegetation structure is defined as the organization of plants in space that form stands and more broadly form vegetation types. The frequency of a species indicates the distribution of a species within an area, the more uniform the distribution of a particular species, the greater the frequency value, whereas the species whose frequency value is small, the more uneven distribution in an area. The density of a species is a value that represents a type of mastery of another species in a community. The greater the value of dominance of a type, the greater the influence of mastery of the type to other types. A type of Importance Value Index (IVI) is a value that describes the role of the existence of a species within the community. The larger the Importance Value Index, the greater the role of the species in the community. Importance Value Index (IVI) that is evenly distributed in many species is also an indicator of the increasing of biodiversity in an ecosystem.

Based on field observations, the location of honeybee development in Pattaneteang Village Forest is generally secondary forest (mixed forest) and primary forest (natural forest) with forest type generally belong to lowland and upland forest.The results of relative frequency calculations, relative density, relative dominance and IVI values of all flora species in village forests for tree level are presented in Table 3. Based on the data in Table 1, that each species has a relative frequency value, relative density, the relative dominance of a different IVI. The frequency of a species indicates the dispersion of a species within an area. The more uniform the spread of certain types, the greater the frequency value whereas the type of small frequency value, the more uneven spread in an area or area observed. The density of a species is a value indicating the number or amount of a type of broad unity. The dominance of a species is a value that indicates the mastery of a species against another species in a community. The greater the value of dominance of a type, the greater the influence of mastery of the type to other values. A type of IVI is a value that describes the role of the existence of a species within the community. The larger the IVI value of a type the greater the role of the species in the community. The value of IVI at honeybee development sites in Pattaneteang Village Forest shows that species adaptability varies. The types that have the highest IVI include pakkeng wood, nossong, kanepolo and katilaporo. The ability of species to live in a place depends on its ability to adapt to the environmental conditions in place. Therefore, the environment is very important in selecting species to survive in a habitat. Ecologically it can be argued that the IVI shown by each species is an indication that the species concerned is considered dominant in that place, which has a higher frequency, density, and dominance value than any other species.Based on IVI values in each level of stata, it shows that most species have relatively low but relatively uniformly important values. Symptoms are so common in vegetation types that lead to climactic and stable conditions. IVI with evenly distributed scores indicates the creation of more and more widely distributed niches (niche), specific and varied. A uniform IVI can be an indicator of higher biodiversity in a good ecosystem to achieve stability at the climactic stage. The value of diversity index (H ') of tree, pile, stake and seedling level at village forest location were 3.25; 3.36; 3.19 and 3.26 (Table 4) show the level of diversity of species that make up the communities that exist in the honeybee business development location in the Pattaneteang Village Forest is high on all levels of vegetation. The species diversity index is an important information about a community. Type diversity is a characteristic of the community level based on its biological organization that can be used to express community structure. This concept can be used to measure the ability of a community in a habitat to balance its components from the various disturbances that arise. The diversity of organisms can also describe

the calm of genetic richness, ecological functions and resilience of ecosystems.

Table 3: Relative domination value, relative density, relative frequency, importance value index, and diversity index of some trees in Pattaneteang Village Forest

No	Species	F	De	Do	RF (%)	RDe (%)	RDo (%)	IVI	H'	Bee Food
1	Kayu Pakkeng	0,51	27,86	2,95	8,38	10,51	13,45	32,34		√
2	Kayu Putih	0,57	27,57	2,56	9,31	10,78	11,68	31,77		√
3	Batta-batta	0,51	30,00	2,16	8,38	11,32	9,86	29,56		√
4	Nossong	0,43	20,00	1,22	6,98	7,55	5,56	20,09		√
5	Langsat	0,37	14,29	0,97	6,05	5,39	4,44	15,88		√
6	Bakkang	0,34	13,57	0,82	5,58	5,12	3,73	14,43		√
7	Beringin	0,20	7,86	1,31	3,26	2,96	5,98	12,20		−
8	Kayu Bambang	0,11	10,00	1,17	1,86	3,77	5,33	10,96		√
9	Pacciu	0,14	7,14	0,74	2,33	2,70	3,39	8,41		−
10	Kayu Dupa	0,20	5,00	0,66	3,26	1,89	3,00	8,15		−
11	Lutu	0,20	6,43	0,50	3,26	2,43	2,27	7,95		√
12	Mawa'	0,09	6,43	0,90	1,40	2,43	4,10	7,92		√
13	Kayu Mamana'	0,17	6,43	0,59	2,79	2,43	2,69	7,90		√
14	Katapala	0,17	5,71	0,40	2,79	2,16	1,84	6,78		−
15	Kayu Kaleleng	0,17	6,43	0,33	2,79	2,43	1,48	6,70	3,25	√
16	Napa-napa	0,20	5,00	0,29	3,26	1,89	1,33	6,47		√
17	Mappala	0,14	3,57	0,58	2,33	1,35	2,65	6,32		√
18	Kanepolo	0,11	4,29	0,30	1,86	1,62	1,39	4,86		√
19	Sengon	0,09	5,71	0,26	1,40	2,16	1,19	4,74		√
20	Arrang	0,11	4,29	0,27	1,86	1,62	1,25	4,73		√
21	Bandeng	0,09	3,57	0,28	1,40	1,35	1,27	4,02		√
22	Galattiri	0,11	3,57	0,15	1,86	1,35	0,70	3,91		√
23	Damara	0,09	3,57	0,26	1,40	1,35	1,17	3,91		−
24	Lambiri	0,11	2,86	0,16	1,86	1,08	0,74	3,68		√
25	Nangka	0,09	3,57	0,17	1,40	1,35	0,75	3,50		√
26	Bunara	0,09	2,86	0,18	1,40	1,08	0,83	3,30		√
27	Bumbungang	0,03	2,86	0,39	0,47	1,08	1,76	3,30		√
28	Ki Hujan	0,06	3,57	0,22	0,93	1,35	1,02	3,30		√
29	Ka'ne	0,06	2,86	0,18	0,93	1,08	0,82	2,83		√
30	Butta Beru	0,09	2,14	0,12	1,40	0,81	0,55	2,76		√

Table 3: (Continued)

No	Species	F	De	Do	RF (%)	RDe (%)	RDo (%)	IVI	H'	Bee Food
31	Mi'misang	0,06	1,43	0,16	0,93	0,54	0,74	2,21		√
32	Suren	0,06	2,14	0,08	0,93	0,81	0,36	2,10		√
33	Lassa-lassa	0,06	1,43	0,08	0,93	0,54	0,36	1,83		√
34	Bu'ne	0,06	1,43	0,06	0,93	0,54	0,27	1,74		√
35	Buno Bampo	0,03	1,43	0,1	0,47	0,54	0,45	1,45		√
36	Rici Borong	0,03	1,43	0,08	0,47	0,54	0,39	1,39		√
37	Kaloa	0,03	1,43	0,05	0,47	0,54	0,21	1,22		√
38	Pamera	0,03	0,71	0,06	0,47	0,27	0,29	1,02		√
39	La'lakang	0,03	0,71	0,04	0,47	0,27	0,20	0,94		√
40	Karoci	0,03	0,71	0,03	0,47	0,27	0,15	0,88		–
41	Kayu Anging	0,03	0,71	0,03	0,47	0,27	0,13	0,86		√
42	Kayu Manis	0,03	0,71	0,03	0,47	0,27	0,12	0,85		√
43	Kopi	0,03	0,71	0,02	0,47	0,27	0,11	0,84		√
Total		**6,14**	**265**	**21,94**	**100,00**	**100,00**	**100,00**	**300,05**		

Table 4: Vegetation analysis in Pattaneteang Village Forest

No.	Vegetation strata	Diversity index (H')	The highest of IVI	Percentage of bee feed (%)
1	Tree	3.25	Kayu Pakkeng, Kayu Putih, Batta-batta, Nossong, Langsat	86.05
2	Pole	3.36	Nossong, Batta-batta, Bu'ne, Kayu Pakkeng, Bakkang	88.10
3	Sapling	3.19	Kanepolo, Bu"ne, Batta-batta, Nossong, Kopi	87.50
4	Seedling	3.26	Katilaporo,Arrang, Kopi, Ruku Bulo-bulo, Paku-paku	83.87

Potential for feed and flowering calendars at different levels of vegetation in the Pattaneteang Village Forest. Percentage types of tree-level vegetation, poles, stakes and seedlings that include beekeeping 86.05; 88.10; 87.50; 83.87%. This shows that the potential of the plant in the Pattaneteang Village Forest which belongs to the type of bee feed is very large.

Based on the observation, there is cultivation Vegetation found in and around the development of honeybee business in Pattaneteang Village Forest. Types of cultivated vegetation that are widely found are cultivated ie coffee.Vegetation composition in a forest type is very important. Based on the results of identification of vegetation types that have been found at the study site, it can be seen that the vegetation found in the Pattaneteang Village Forest very abundant and vary. A considerable number of species were found in the study sites indicating that the composition of forest constituent species varied widely with the diversity index at all levels (trees, piles, stakes and seedlings / plants below). Almost all the plants identified in the village forest location belong to flowering plants that are the producers of nectar and pollen that feed bees.

The part of the plant that becomes the feed is a sweet liquid substance called nectar. In addition to nectar, plants and flowers also have polen. Peak polling activity occurred at 08.20-10.00 with an average number of 337 individuals every 10 minutes [3].

Based on the results of research on the composition of vegetation species in the village forest at the level of trees, poles, stakes, and seedlings there are as many as 265; 743; 3303 and 37143 per ha and almost all belong to bee feed. The highest IVI value is a bee feed plant so that the type of feed at the tree level in the village forest is potential because of the availability of sufficient feed.

There are several factors that influence the composition and structure of vegetation, ie flora, habitat (climate, soil, etc.), time and opportunity so that vegetation in one place is the resultant result of many factors both now and in the past [4]. Based on the results of vegetation analysis, the level of honey bee feeding potential at the research location indicated that in Pattaneteang Village Forest honey bee plant is very potential because almost all types of vegetation is a feed bee plant. For level of diversity of honey bee feed in the study site, related to the availability The type of vegetation as a whole can be said to be sufficient or in the category of large quantities. Even for tree-level vegetation the availability of honey bee feed is fairly abundant. Given the condition of the forest environment that can be said is still very supportive for the survival of the habitat of honey bees[5,6], the preservation of forest and environment in the research location should be maintained. This shows that the Pattaneteang Village Forest is very potential for the development of honey bee cultivation because the availability of feed on the village forest is very available because almost all the plants in the village forest is honey bee feed

The condition in Pattaneteang Village Forest area is very supportive for the development of bee cultivation. The availability of feed in this region is very abundant. Bees are nectar and pollen. Nectar is in the form of a sweet liquid produced by the flower of food plants, forestry crops, plantation crops, horticultural crops (fruits and vegetables), ornamental plants, grasses and shrubs [7, 8].

One of honey bee feed that has potential to be developed in the form of agroforestry in pattaneteang village forest is coffee plant. Flowering coffee plants throughout the year. The results of Saepuddin (2011) show that the number of coffee flower buds per tree is 1506 buds / plants / year. The average production of coffee nectar is 0.64 ml per 25 buds per day. The average daily production of coffee nectar within one year of flowering period, which shows fluctuations in coffee nectar production with average nectar production per day of coffee plantations is 18.14 ml / tree / day.

4. Conclusion

The value of diversity index (H ') of tree, pile, sapling and seedling level in Pattaneteang village forest were 3.25; 3.36; 3.19 and 3.26. This shows that the level of diversity of species for apiculture development in the Pattaneteang Village Forest is high on all levels of vegetation. Percentage types of tree, poles, sapling and seedlings that include bee feed were 86.05; 88.10; 87.50; 83.87%. This shows that the potency of the plant that produce bee feed (nectar and polen) in the Pattaneteang Village Forest was very abundat. The condition in Pattaneteang Village Forest area is very supportive for the development of apiculture. One of honey bee feed that has potential to be developed in the form of agroforestry in Pattaneteang Village Forest is coffee plant which flowering throughout the year.

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