Development of model for honey bee management in Hasanuddin University educational forest

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Abstract. The Potency of Hasanuddin University Educational Forest (HU-Edufor) needs to be managed well as a research and education site, so that the forest concerned can contribute in supporting forest development in a broad sense. Forest Honey is one of mentioned potency that has an important role in the economic development strategy of rural communities and the sustainable agriculture sector. This research aims to study the potential of honey bee products and formulate a honey bee management model in the HU-Edufor. The research method used is the Field Survey and data analysis uses a qualitative analysis approach. The research results obtained about the potential yield of honey bee products in 3 (three) villages, namely Rompegading, Limampocoe and Labuaja villages around the HU-Edufor based on the total amount of honey production per month as much as 584 liters / month and annual production of 4,742 liters / year, while based on the total the number of bee colonies harvested monthly is 351 colonies / month and annually is 1,910 colonies / year. The model of developing honey bees in the HU-Edufor is carried out through community empowerment activities together with the management of the HU-Edufor, village and district governments, related agencies, and banks as capital owners, in terms of cultivation, harvesting and post-harvest, until in processing and product marketing, so that honey and beekeeping business can provide optimal results.

1. Introduction
Hasanuddin University Educational Forest (HU-Edufor) that is located in Cenrana District, Maros Regency, is managed by Hasanuddin University as a place to conduct forestry education and as a pilot area for forest management. The potential of HU-Edufor at this time is quite large, covering an area of 1,300 ha consisting of 521 ha (40%) natural forest and 779 ha (60%) plantations consisting of Pinus mercesii, Acsasia auriculoformis and Swietenia mahogani. This potential, if managed properly, the benefits can be felt directly and sustainably by the community, especially those who live around the mentioned forest area. Utilization of various potentials owned by the HU-Edufor can underlie the development of models including models of multifunctional forest management.

One of the various types of HU-Edufor potential that can be utilized for the above mentioned purposes is Honey bees commodity. Honey bees are one of the potential forest resources to be developed in its cultivation. This is due to the abundant source of bee forage (almost all plants that produce flowers can be used as a food source) both from forest plants, agricultural crops and estate crops [1].

Besides being able to have high economic value [2], this honey bee commodity can also support the increase in income and welfare of the community, especially those who live in and around the
HU-Edufor area. Thus it can also be said that the development of forest honey bees, can be expected to support the optimization of the management and preservation of forest resources.

Based on the description above, the research on Development of Model For Honey Bee Management is one of the important parts of a comprehensive research in the framework of developing various potential of HU-Edufor to support efforts to utilize HU-Edufor as miniature models of sustainable forest management with optimal ecological benefits as well as social and economic benefits. The purpose of this research is to examine the potential of honey bee products and formulate a honey bee management model in the HU-Edufor.

2. Research Methods
This research uses the Field Survey Method. The study was preceded by limiting the research problem, namely by focusing attention on the potential of Honey Bees, with consideration, that optimizing the management of honey bees in the HU-Edufor will be able to contribute to the optimization of the management and sustainability of the HU-Edufor. Data analysis used qualitative analysis approach that is supported by the presentation of quantitative information, especially for matters relating to the potential of the Honey Bee in the HU-Edufor.

3. Results and Discussion
The results of the study of respondents who manage honey bees around the location of Unhas education forest as a source of economic income are spread in 3 (three) villages within the Administration area of Cendrana District. The three villages include: Rompegading Village (Moncong Jai Hamlet), Limampoccoe Village (Jambua and Watang bengo Hamlet) and Labuja Village (Pattiro Hamlet) which administratively the locations of these three villages are directly bordered by HU-Edufor area, so the community is highly dependent on the forest and making the forest area as a place to live and to as a source of meeting the economic needs of the community [3].

The honey bee species cultivated by the community in the three villages around HU-edufor are Apis Trigona, small in size, shaped like a small black ant and lives in bamboo roofs, wood holes, or on the ground. Also, Apis dorsata a type of wasp or wild bee, honey from this bee has been traded as forest honey. The nest is hung on tree branches, cliffs rocks or in building crevices. The size of the nest varies with the longest or highest size can reach 2 meters.

Table 1. The Number of farmer for every Class of Managed Area as Bees Habitat, in every village

| No. | Land area (ha) | Rompegading village | Labuja village | Limampoccoe village | Total |
|-----|----------------|---------------------|----------------|---------------------|-------|
| 1   | < 1            | 4                   | 2              | 0                   | 6     |
| 2   | 1.1 - < 5.0    | 4                   | 1              | 2                   | 7     |
| 3   | 5.0 - < 10     | 3                   | 5              | 4                   | 12    |
|     | Total          | 11                  | 8              | 6                   | 25    |

The furthest cruising range of bees is 124.70 ha, however no farmer manages land as bee habitat more than 10 ha. The land area managed as bees habitat by farmer around UH-edufor ranges from less than 1 until 10 ha, which can be classified in to : less than 1 ha, 1.1 - 5 ha and more than 5 ha.

Number of honey beekeeper (farmer) for every land area, in every village is shown in Table 1. Among 25 respondents, 12 respondents are managing land as bee habitat of more than 5 ha, and this the largest portion (0.48%). Based on the results of interviews, the limited area of beekeeping is the main obstacles faced by respondents in maintaining the sustainability of honey production.

3.1. Potential of host trees and honey bee forage plants
Non-wood forest products are mostly sought by farmers in Indonesia, one of which is forest honey bees. Bee farmers (beekeeper) look for beehives in caves, in holes, trees, and elsewhere to get honey (Siombo, et al., 2014). Potential distribution of host tree vegetation species is classified into 3 (three) classes, namely low class containing of 2 vegetation species (manggos and candlenut), medium class containing of 3 vegetation species (dao, forest mangos and bells), and high class containing of 6 vegetation species (lento-lento, pine, acacia, banyan, kumea, and lomassang).
The activity of honey bees in foraging (nectar and pollen) is influenced by the availability of feed on plants [4]. In the prolonged rainy season the bee colony has difficulty getting nectar and pollen due to damage so that the number of bee populations is reduced due to lack of feed [5]. There are 26 flowering vegetation species which are become a source of honey bee food in 3 (three) villages (Rompegading Village, Limampocoe Village and Labuaja Village). The distribution of vegetation species is grouped into 3 (three) classes, namely small class consisting of 2 vegetation species (watermelon and guava water), medium class consisting of 10 vegetation species (manggo, dao, forest mangosteen, savory night, shy princess, puspa, sengon, teak, sintrong, cashew) and big class consisting of 14 vegetation species (lento-lento, pine, candlenut, kumea, sugar palm, sandalwood lobe-lobe, pulai, porang, water hyacinth, jatropha, coffee, guava, and melastoma).

3.2. The Potential of honey bee production

Honey bee efforts carried out by the community in and around the HU-Edfor are still traditional and mostly depend in nature. Their activities are still rely more on natural factors and based on their own experience or experience of parents, and therefore not yet optimal. The highest honey production is found in Watang Bengo Hamlet (Limampocoe Village), which is as much as 190 liters per month and the lowest was found in Jambua Hamlet (Limampocoe Village) which is as much as 51 liters per month. Meanwhile, the highest amount of honey production is found in Pattiro Hamlet (Labuaja Village) which is as much as 1,840 liters per year and the lowest is found in Jambua Hamlet (Limampocoe Village) which is as much as 418 liters per year.

The highest potential number of bee colonies harvested per month is found in Watang Bengo Hamlet (Limampocoe Village) which is as many as 260 colonies per month and the lowest was found in Jambua Hamlet (Limampocoe Village) which is as many as 9 colonies per month. Meanwhile the highest number of bee colonies harvested is found in Watangbengo Hamlet (Limampocoe Village) 1,030 colonies per year and the lowest is found in Jambua Hamlet (Limampocoe Village) which is as many as 78 colonies per year. Potential Results of Honey Bees Production around HU-Edufor are presented in Figure 1.

![Potential Histogram of Honey Bee Production around the HU-Edufor](Figure 1)

The Potential of honey bee production in 3 (three) villages (Rompegading, Limam-pocoe and Labuaja Villages) around the HU-edufor can be based on the total number of honey production and the total number of colonies. The total number of honey production is 584 liters per month and annual production of 4,742 liters per year, while the number of harvested bee colonies is 351 colonies per month and 1,910 colonies per year.
Beekeepers process honeycomb into forest honey products by squeezing and filtering beehives. This aims to separate honey from the hive and in order to avoid the deterioration of the quality of honey, then the honey product is packaged using a 600 ml bottle. Based on the results of interviews with respondents other than honey products the community manages the bee colony as an ingredient in a mixture of vegetables for cooking, as a medicinal ingredient in particular to treat smallpox and as a raw material for making candles (bantisi). The diagram of the management system of honey bee products around the HU-Edufor is presented in Figure 2.

Figure 2. The Diagram of Product Management System for Honey Bees around of HU-Edufor

3.3. Honey Bee Product Marketing
Marketing of honey bee produced by the community is normaly done through 3 (three) trade schemes, namely marketing at the producer level directly to consumers, marketing at the producer level through collectors and channeled to consumers, marketing at the producer level through collectors and retailers then channeled to consumers.

The marketing of honey bee products in the three villages around the Edufor-HU, namely Rompegading Village (Moncongjai Hamlet), Labuaja Village (Pattiro Hamlet) and Limampoccoe Village (Jambua and Watangbengo Hamlet) are carried out directly from bee farmers to the market, the community take their honey products directly to the Bengobengo market in the Cenrana District, and to the Camba Market which is a distance of about 10 km, located in the neighboring region of the Camba District. Sometime, consumers buy directly by visiting the bee farmer's house to obtain honey products. The results of interviews with respondents were obtained, that some of the bee farmers established cooperative relationships with parties, either collecting traders or their relatives who are live outside the Cenrana District. Some of Bee farmers also market their honey production to the capital of Maros Regency, Makassard City and specially for farmer in Moncongjai Hamlet, they also market their honey product to Kalimantan Island through a cooperative relationship with collecting traders.

The selling price of honey produced by Apis dorsata (forest honey) in bottles of 600 ml, ranges from Rp.60,000,- to Rp.90,000,- per bottle, while selling price of honey produced by Apis trigona is range from Rp.80,000,- to Rp. 100,000,- per bottle. Farmers also sell pulp (remaining beehives) at a price of Rp.20,000 per kg. The marketing process of honey bee products sometimes has obstacles because of the lack honey raw materials. This is due to the lack of tree species that produce flowers throughout the year as bee food so that the production of honey bees is reduced while the market demand remains high. Also, there are no breeding activities or honey beekeeping. These things make bee farmers unable to provide honey products continuously.

3.4. The Model of Sustainability in the Management of Honey Products
For sustainable development and management of honey production in HU-edufor, the empowerment program for farmers has to be carried out and very important to note as a key effor. In this connection, a number of parties are expected to be involved or involved themselves, in various aspect of empowerment, ranging from matters relating to cultivation, harvesting and post-harvest, and to the
processing and marketing of products. The mentioned parties, among others are the Manager of HU-Edufor, the local Government (District Head and Village Head), the Regencial Government (Rigent), Forest Service and the related Manager of Forest Management Unit, Industry and Trade Service, and Banking. The involvement of each party in the honey production process can be described in a model as presented in Figure 3.

**Figure 3.** Honey Bee Business Development Model, in the Edufor-HU

**Table 2.** Agencies (Parties) related to the development of Honey Bee Businesses and their Derivative Products, and their respective roles, respectively

| No. | (Related Agencies/Parties)                                      | (Role)                                                                 |
|-----|------------------------------------------------------------------|-----------------------------------------------------------------------|
| 1.  | Manager of Educational Forest of Hasanuddin University           | Coordinating with parties related to community empowerment, especially the development of the honey bee business |
|     |                                                                  | Coordinating with parties related to community empowerment, especially the development of the honey bee business |
|     |                                                                  | Assist farmers in planting host plants and honey bee feed plants       |
| 2.  | Manger of Forest Management Unit and Forest Service               | Providing training and counseling on the cultivation of host plants and feed plants |
|     |                                                                  | Providing training and counseling on honey-based business development  |
| 3.  | Regional Government (Regency)                                    | Facilitating and or encouraging assistance from third parties or donors concerned with efforts to empower communities in general and honey-based businesses |
in particular
Can be a guarantor for capital assistance to support honey-based businesses from the banking sector

4. Local Government (District and Village)
Facilitating the establishment and strengthening of institutions (village unit cooperatives), and assisting farmers in maintaining the stability of honey production and prices on the market

5. Industry and Trade Service
Granting business licenses, and conducting training for farmers to improve the quality of honey produced and the selling price
Providing honey harvesting and extortion equipment assistance

6. Banking
Monitor business feasibility and provide honey based business capital assistance

### 4. Conclusion
Based on the results of research on optimizing the potential of honey bee management in the Edufor-HU as a miniature model of sustainable forest management, the following conclusions can be formulated:

1. Potential Products of honey bee products in 3 (three) villages namely Rompegading, Limampoccoe and Labuaja Villages around the education forest based on the total amount of honey production per month as much as 584 liters / month and annual production of 4742 liters / year while based on the total number of bee colonies harvested monthly 351 colonies / month and annually 1910 colonies / year.

2. Model of sustainable development and management of non-wood forest products, especially honey bees in the Edufor-HU, is carried out through community empowerment activities together with the management of Edufor-HU, village and district governments, related agencies, and banks as capital owners in terms of cultivation, harvesting and post harvest, to the processing and marketing of results so that the beekeeping products provide optimal results.

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