DIVERSIFICATION OF FOREST FOOD PLANTS ON AGROFORESTRY SYSTEM IN KUNINGAN DISTRICT

Ai Nurlaila[1*], Ika Karyaningsih[2], Nina Herlina[3]

[1,2,3] Departement of Forestry, Forest Faculty, Kuningan University
*E-mail: ai.nurlaila@uniku.ac.id

A B S T R A C T

Dependence on food, especially carbohydrates can be reduced by digging for forest food sources, one of which is in the agroforestry system. This study aims to determine the diversity of forest food crops in agroforestry systems in Kuningan District, whether wild or cultivated. The method used for location determination is purposive sampling based on the location of agroforestry adjacent to the conservation area. The following villages 1) Cigugur Sub-district: Cisantana Village, Puncak Village, 2) Mandirancan Sub-district: Seda Village, Trijaya Village, 3) Darma Sub-district: Gunungsirah Village, Karangsari Village, and 4) Pasawahan Sub-District: Pasawahan Village, Desa Padabeunghar. Respondents were chosen based on purposive sampling which had land closest to conservation area with a minimum land of 0.25 ha. The result of the research is forestry food crop found in the agroforestry system in Kuningan District. Each is the plant as a source of carbohydrates as many as 6 species, plants as a source of fat as many as 5 species, and plants as a source of fruits as many as 19 species. The plants are almost evenly distributed in all villages, except for persimmon plants found only in Gunungsirah and Karangsari villages.

Keywords: biodiversity, food plants, agroforestry, wild, cultivated

1. Introduction

Food demand continues to increase along with population growth. Indonesia becomes a country importing staple food, especially rice and wheat in the world (Muiana, 2011, Jaramaya, 2015). During the period 1996-2011 the share of food continues to increase at a rate of 9.6%/year, on the contrary, the share of paddy food decreased at a rate of 2.7% / year. The relatively small portion of tubers also decreased at a rate of 5.9%/year. Similarly, the share of protein sources derived from livestock and fish also tended to decrease at a rate of 2.5%/year for livestock and 1.2%/year for fish. The share of food sources of minerals and vitamins derived from vegetables and fruits in the same period also tended to decrease at a rate of 3.9%/year for vegetables and 1.7%/year for fruits. During this period the share of expenditure for flour increased at a rate of 7.55%/year, while most popular wheat processed products, instant noodles, increased at a rate of 5.95%/year (Rusono *et al*., 2013). Dependence on food, especially carbohydrates can be reduced by digging for forest food sources, one of which is in the agroforestry system.

Potential land that can be used for agroforestry in Kuningan District is 67.863,26 ha, consist of community forest, PHBM program area, garden area, field, the temporary area not cultivated, and PHBM area managed by Perhutani KPH Kuningan.

Some studies related to forest food have not specifically addressed the types of food as a source of carbohydrates, fats, and fruits. Wijayanto's research, *et al.* (2015) found 29 types of fruits plants in mixed gardens in Purwakarta District and at least 5 types of fruit trees in the Repong Damar agroforestry system in West Lampung District. This study has not provided other types of food information as a source of carbohydrates and fats. Apriyanto, *et al*. (2016) stated that community forests contribute to daily food of households where from 23 types of food crops of 61.34% are obtained from community forests.

The purpose of this research is to know the diversity of forest food crops in an agroforestry system in Kuningan District. Limitations of research:

1. The research area is limited to villages directly adjacent to conservation forest areas, in this case, is Gunung Ciremai National Park (TNGC)
2. Food crops in this study are commodities of non-timber forest products that are the affairs of the forestry department based on Forestry Minister's Regulation No. P.35/Menhut-II / 2007 on Non-Timber Forest Products (NTFP)

2. Methods

The study was conducted from April to September 2017 in Kuningan District, West Java. The data taken is secondary data and primary data. Secondary data collected include a general condition of research location and general data which exist in government institution of village and sub-district and also result in research related to research purpose. While the primary data collected, among others, is the type of forest food crops either as a source of carbohydrates, types of fruits, or sources of fats and oils.

The target areas of observation are the sub-districts adjacent to the conservation area. Sample Village is taken by purposive sampling method based on closeness with conservation area (village closest to conservation area are taken). The village that became the location of observation as follows:

1. Cigugur Sub-district: Cisantana Village, Puncak Village
2. Mandirancan Sub-district: Seda Village, Trijaya Village
3. Darma Sub-district: Gunungsirah Village, Karangsari Village
4. Pasawahan Sub-district: Pasawahan Village, Padabeunghar Village

The sample of respondents is agroforestry farmers, determined by purposive sampling. The number of respondents is 2 people for each village, so total respondents are 16 people.

The selected respondents have at least 0.25 hectares of land with the location closest to the conservation area (TNGC).

3. Results and Discussion
3.1. Characteristics of Respondents

Characteristics of respondents by age indicate that 62.5% of respondent are 41-60 years old, with the majority of the land area is 0.5 - 1 hectare (56.3%). Land ownership status of almost all (81.3%) is owned land alone, 2 respondents utilize village land and 1 respondent use lease land. Farmers have the freedom to determine the types of crops to be cultivated primarily on self-cultivated land, mostly containing timber crops with wood end products but others planting fruits in addition to income even though the economics of fruits are underestimated.

Knowledge of forest food crops, as much as 56.2% of farmers of respondents have no knowledge about forest food crops, either in terms of terms or types of plants. The results of interviews of farmers respondents mentioned that forest food crops are agricultural food crops such as corn, upland rice, peanuts, and other types of crops. This shows that even at the farmer level the term forest food crop is still foreign and is assumed to be an agricultural food crop grown on forest land, but these are two different things.

Respondents' perceptions of the economic benefits of forestry crops show that 56.2% of farmers perceive the benefits of their own forestry crops although these benefits cannot yet be calculated with certainty because the product marketing system is still simple. Respondents explained that the types of food crops grown on their land still lack the value of economic benefits directly to income and the fulfillment of their needs so that it is considered less profitable. This shows that the product yield is not hampered as income, only considered as an inferior product.

3.2 The diversity of Forestry Food Plants
3.2.1 Food Plants as Source of Carbohydrate / Starch

There are 6 types or as many as 66.7% of 9 types of plants source of carbohydrate/ starch listed on Permenhut P.35 / 2007 on NTFP. The plants are aren (*Arenga pinnata*), bamboo (*Dendrocalamus asper*), gadung (*Dioscorea hispida*), *Agaricus spp*, sago (*Metroxylon spp.*), and suweg (*Amorphophallus campanulatus*).

Aren (*Arenga pinnata)* used to processed into palm sugar which is marketed directly either to the collectors or sold in retail. Bamboo usually grows naturally although it is preserved with a select harvest system. Bamboo shoots are also used for food sources of vegetables for the needs of their own families (rarely sold). All the carbohydrate plants found are wild or existing in the agroforestry field, allowed to grow and harvest, but there are also some types of crops cultivated by farmers though not the main crop with a limited number when compared to the area of arable land. Plants that have been cultivated with a limited number of aren, bamboo, gadung, and suweg.

Table 1. Forest Food Plants as Source of Carbohydrate/Starch

No.	Scientific Name	Local Name	Habitus	Product Based on Permenhut P.35 / 2007	Product Utilization in Community	Status Cultivation Wild	Status Cultivation Cultivated
1	*Arenga pinnata*	Aren	Palm	Aren Flour, Aren/Palm Sugar	Nira (tap result), Palm Sugar	√	√
2	*Dendrocalamus asper*	Bambu	Bamboo/ Grass	Rebung	Rebung	√	√
3	*Dioscorea hispida*	Gadung	Liana	Gadung Flour	Tuber & gadung crispy chips	√	√
4	*Agaricus spp*	Jamur	Mashroom	Mashroom	Mashroom	√	
5	*Metroxylon spp.*	Sagu	Palm	Sago Flour	-	√	
6	*Amorphophallus campanulatus*	Suweg	Shrub	Suweg Flour	Tuber	√	√

Gadung is the most widely cultivated species, especially in the Trijaya Village and Seda Village, Mandirancan District. This is because the gadung has been used by the community into processed food in the form of gadung crispy chips which is one of the typical food of Kuningan District.

Forestry food has an advantage in nutritional value, contains essential nutrients and low in calories. The realization of food security system will be reflected by the availability of food in sufficient quantity and the price reachable by public purchasing, and the diversification of food both from production side and from consumption side. Therefore, food development is aimed at increasing food self-sufficiency, which is not only rice oriented but also other types of strategic commodities, such as crops, as main food ingredients (Suhardi *et al*., 2002). As expressed by Kuswiyati *et al*. (1999), which says that 143 million hectares of Indonesia's forest area contained 77 types of food sources of carbohydrates, 26 types of nuts, 75 types of oils and fats, 389 types of grains and fruits, 228 types of vegetables, 110 types of spices and spices, 40 types of beverages and 1,260 types of medicinal plants. Government Regulation No. 68 of 2002 on food security affirms that the fulfillment of food demand takes precedence over domestic production (Abidin, 2015)

3.2.3. Food Plants As Sources of Fats

There are 5 types or as many as 26.32% of 19 types of food sources of fat listed in Permenhut P.35 / 2007 on NTFP, consisting of kelor, kemiri/candlenut, kenari/walnut, nyamplung, and picung.

Table 2. Forest Food Plants As Sources of Fats and Oils

No.	Scientific Name	Local Name	Habitus	Product		Status Cultivation	
				Based on Permenhut P.35 / 2007	Utilization in Community	Wild	Cultivated
1	*Moringa oleifera*	Kelor	Tree	Kelor Oil	Leaf	√	√
2	*Aleurites mollucana*	Kemiri	Tree	Kemiri Oil	Fruit	√	√
3	*Canarium odoratum*	Kenari	Tree	Kenari Oil	-		√
4	*Callophyllum inophyllum*	Nyamplung	Tree	Nyamplung Oil	-	√	√
5	*Pangium edule*	Picung	Tree	Picung Oil	Fruit	√	√

Table 2 shows the sourcesof fat extracted from the fruit. In reality, in the community, none of these types are processed into fats and oils. All habitus of the fat sources plant is a tree both wild and cultivated. The low variety of sources of fat caused by lack of knowledge about the processing of fruit/seeds, in addition to the absence of a growing market for these types. The low availability of food in forests is also due to changes in the consumption patterns of forest communities who prefer processed food, salt, and refined sugars so that forestry products can not compete with processed products that are more easily obtainable, their prices are relatively cheap, and have a favorable taste.

3.2.4 Food Plants as Source of Fruits

Food crops as a source of fruits found there are 18 species or as much as 52.78% of the 36 types of plant sources of fruits listed on Permenhut P.35 / 2007 on NTFP. The plant habitus of the fruits source is listed in table 3.

Table 3. Forest Food Plants As Sources of Fruits

No.	Scientific Name	Local Name	Habitus	Product		Status Cultivation	
				Based on Permenhut P.35 / 2007	Utilization in Community	Wild	Cultivated
1	*Arenga pinnata*	Aren	Palm	Fruit	Fruit	√	√
2	*Artocarpus chempeden*	Cempedak	Tree	Fruit	Fruit	√	√
3	*Lanium domesticum*	Duku	Tree	Fruit	Fruit		√
4	*Durio zibethinus*	Durian	Tree	Fruit	Fruit		√
5	*Phythecelobium sp.*	Jengkol	Tree	Fruit	Fruit		√
6	*Canarium commune*	Kenari	Tree	Fruit	-		√
7	*Diospyros sp.*	Kesemek	Tree	Fruit	Fruit		√
8	*Dimorcarpus longan*	Lengkeng	Tree	Fruit	Fruit		√
9	*Mangifera indica*	Mangga hutan	Tree	Fruit	Fruit	√	
10	*Gnetum gnemon*	Melinjo	Tree	Fruit	Fruit	√	√
11	*Morinda citrifolia*	Mengkudu	Tree	Fruit	Fruit	√	√
12	*Arthocarpus integra*	Nangka	Tree	Fruit	Fruit	√	√
13	*Parkia sp*	Petai	Tree	Fruit	Fruit	√	√
14	*Myristica fragran*	Pala	Tree	Fruit	Fruit	√	√
15	*Nephelium lapaceum*	Rambutan	Tree	Fruit	Fruit	√	√
16	*Acras zapota*	Sawo	Tree	Fruit	Fruit		√
17	*Annona muricata*	Sirsak	Tree	Fruit	Fruit	√	√
18	*Annona squamosa*	Srikaya	Tree	Fruit	Fruit		√

People used fruit as daily, there is no further processing of both the fruit that has been harvested and other plant parts so that the product is not diverse. Only some types have been processed such as breadfruit, soursop, melinjo, and jackfruit. Processed products such as breadfruit chips, soursop sweets, melinjo chips, and jackfruit chips.

In Gunungsirah village, there is a very important potential fruit of persimmon. Persimmon fruit has been cultivated and exported to Singapore and Thailand. Demand for Persimmon fruit from that countries is large, but the yield is not sufficient to fulfill of demand so that persimmon must bring from other district. The cultivation of persimmon fruit shows that the type of food crop from the forest, especially the community forest (in this case agro-forestry) has the potential of high economic value if it can be managed properly.

Apriyanto *et al*. (2016) explained that community forests contribute to household daily food of 23 types of food crops obtained from community forests by 61.34% and 38.66% obtained from buying. In addition to the fruit harvested these forest food crops have other benefits. Like soursop leaf is widely used for diabetes herbal medicine, The palm trees can produce "nira" (tap result) that used to make brown sugar or known as palm sugar. Palm sugar is actually has a high economic value in the community with the price of palm kawung is Rp. 15.000,00/kg. People are able to sell in large quantities even Kuningan district has been known as a producer of palm sugar and used as souvenir/gift as well. Ijuk (palm fiber) is also often sold by the community as a material for making a broom or roof of the house. So the farmers get actually benefits even though the economic value has not been directly documented.

3.3 Distribution of Forestry Food Crops

Trijaya, Seda and Padabenghar Villages have almost all types of forest food crops, both food crops producing carbohydrates, fats and, fruits. The third area of the village is

close to the zone of protection of the Gunung Ciremai National Park or forest area farther from residential areas. This condition encourages people to develop tree-like plants that produce fruits rather than agricultural crops that require more intensive cultivation.

Fat source plants are not found in Puncak Village, Gunungsirah Village, and Karangsari Village. This may be because the land in the three villages is dominated by agricultural crops, especially vegetables and crops, as well as fruits.

The types of fruit crops that are spread evenly in almost all villages are durian, jackfruit, melinjo, petai, breadfruit, rambutan, and soursop. This is a potential large enough to be developed, especially in Kuningan District is now known some excellent fruit such as durian sinapeul and rambutan walahar.

An example of the management of a fruit plant forest is to adjust the spacing of a tree according to the size of the tree canopy. Large titled trees such as longan, rambutan, sawo, and mango were planted with a distance of 10 x 10 m, medium titled trees such as duku planted with a distance of 7 x 7 m, and trees narrowly titled as srikaya and soursop planted with a distance of 4 x 4 m. With the spacing, plantation forest has about 50% canopy (Puspitojati, 2014). In addition to setting the spacing, other cultivation activities also need to be done intensively so that the results obtained optimally. These activities are weeding, fertilizing, pruning, irrigation, pest and disease control, and harvesting. Each activity is adapted to the type of plant.

4. Conclusion

There is a forest food crop found in an agroforestry system in Kuningan District. Each is the plant as a source of carbohydrates as many as 6 species, plants as a source of fat as many as 5 species, and plants as a source of fruits as many as 18 species. The plants are almost evenly distributed in all villages, except for persimmon plants found only in Gunungsirah and Karangsari villages. The majority of these plants are still not intensively cultivated.

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