Ethnoecological study on the utilization of plants in Ciletuh-Palabuhanratu Geopark, Sukabumi, West Java, Indonesia

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Abstract. Wulandari I, Iskandar BS, Parikesit, Hudoso T, Iskandar J, Shanida SS, Megantara EN, Gunawan EF. 2021. Ethnoecological study on the utilization of plants in Ciletuh-Palabuhanratu Geopark, Sukabumi, West Java, Indonesia. Biodiversitas 22: 659-672. Plants can provide benefits for community as food, medicine, fuel, building materials, furniture, and others. Plant utilization should be conducted sustainably in a region with high importance of geological, biological, and cultural diversity, such as in Ciletuh-Palabuhanratu Geopark, Sukabumi, West Java, Indonesia. This study aimed to reveal: (i) plant utilization by local community in Ciletuh-Palabuhanratu Geopark based on land cover; and (ii) community dependence on the plants being utilized. Method used in this study was mixed of qualitative and quantitative methods using direct observation, semi-structured and structured interviews data collection techniques. The result of study showed that the community in Ciletuh-Palabuhanratu Geopark still uses plants for food (80 species), medicinal plants (73 species), livestock fodder (9 species), firewood (27 species), building materials, furniture (38 species), and others (23 species). The highest plant utilization came from gardens (131 species), home gardens (99 species), natural forests (77 species), dry-paddy fields, and wet-paddy fields (7 species). Generally, various agroecosystems and also forest in Ciletuh-Palabuhanratu Geopark have an important role in providing plant products to fulfill the daily needs of rural people.

Keywords: Ciemas Village community, Pelabuhanratu Geopark, plant utilization

INTRODUCTION

There is a strong relationship between humans and the environment, making environmental conditions strongly influence human life behavior and vice versa. Human behavior in an environment will be affected by ecosystems' ability to provide resources that can be used to maintain human life. Through continuous thinking, reasoning, and experience, one will take immediate resources available to support his daily activities or the needs of his group (Hutauruk et al. 2018). One of such resources provided by ecosystem is the plant.

Plants provide a wide range of uses, such as food, traditional medicines, fuel, building materials, furniture, etc. For example, bamboo is very closely related to people’s lives, especially in rural areas. People make household items and livings from this species. Many Indonesian ethnicities, including Sundanese living rural villages in West Java, cannot be separated from bamboo. Bamboo has been used widely for various purposes, such as building materials, home furnishings, handicrafts, foodstuffs, and medicines (Tamang et al. 2013; Honfo et al. 2015; Partasasmita et al. 2017; Setiawati et al. 2017).

In terms of ecological functions, bamboo produces the highest amount of oxygen among other trees. Its ability to absorb carbon is also high enough to overcome CO₂ concentration in air as known as one of the greenhouse gases that can cause global warming and climate change (MaCCraken 2019). In addition, bamboo serves as a water purifier that can be used to remediate critical soil (Mishara et al. 2014).

Geopark is an area that has outstanding geology, including archaeological, ecological, and cultural values by involving local communities to play a role in protecting and enhancing natural heritage. Geopark is different from other natural conservation areas. Geopark is a protected area on a national scale containing a number of important geological heritage that have important attractions that can be developed as part of an integrated concept of conservation, education, and local economics. Geopark is a form of utilization to achieve sustainable development. Geopark presents natural beauty, harmony of location, archeology, geology, and culture (Yanuar et al. 2018). Meanwhile, the natural conservation areas based on law no.5, 1990 on Conservation of Living Natural Resources and their Ecosystems, natural conservation areas can be divided into 2 categories, namely "Nature Reserve Areas
(Kawasan Suaka Alam-KSA) consisting of ‘Cagar Alam’ (protection of flora and fauna and natural landscapes) and ‘Suaka Margasatwa’, wildlife reserves (protection of special and unique animal species); and "Nature Conservation Areas (Kawasan Pelestarian Alam-KPA)’ consisting of National Parks, ‘Taman Nasional’, ‘Taman Wisata Alam’, Nature Tourism Parks; Taman Hutan Raya ‘Grand Forest Parks, including ‘Cagar Biosfer’, Biosphere Reserves (Wiratno et al. 2004).

Currently, in the world it has been recorded as having 161 UNESCO Global Geoparks in 44 countries. There are 4 UNESCO Global Geoparks in Indonesia, including Batur UNESCO Global Geoparks (Bali), Gunung Sewu UNESCO Global Geopark (Yogyakarta), Ranjani-Lombok Global Geopark (West Nusatenggara), and Ciletuh-Palabuhanratu Unesco Global Geoparks (West Java). The Ciletuh-Palabuhan Ratu Geopark, Sukabumi Regency, West Java, was officially declared a national geopark on 22 December 2015 (Andriany et al. 2016; Yuniarti et al. 2018). It has approximately 128,000 hectares, consisting of 74 villages across eight districts, namely Cisolok, Cikakak, and Palabuhanratu. Simpenan, Ciemas, Ciracap, Waluran and Surade. The Ciletuh-Palabuhanratu Geopark is characterized by rare geological diversity classified into three zones: uplifted rock subduction zones, the Jampang Plateaus landscape, and ancient magmatic zone shift and forearim evolution (UNESCO 2017). In addition, it has rich biodiversity and local cultural diversity. To preserve nature in Ciletuh-Palabuhanratu, the geopark concept is used as a sustainable conservation effort (UNESCO 2017).

Some researches on various aspects of the Ciletuh-Palabuhanratu Geoparks were undertaken, including study on exploration of rock diversity and other geological elements (Andriany et al. 2016; Hadian et al. 2016; Ikhram et al. 2017a; Ikhram et al. 2017b; Wahidah et al. 2017; Pradana et al. 2017; Hardini, et al. 2018); and study on terrestrial and aquatic biodiversity (Sulaksa et al. 2015; Partasasmita et al. 2016; Permatasari et al. 2016; Triana et al. 2017; Wulandari et al. 2018; Winantris et al. 2018; Wulandari et al. 2019; Suhanda et al. 2019; Yuniarti et al. 2019; Riyantini et al. 2020). In addition, study on culture (Supendi 2017; Sobandi et al. 2019) and tourism aspects (Darsiharjo et al. 2016; Yuliawati et al. 2016; Yanuar 2018; Rahardjo et al. 2018; Mustikaningsih et al. 2019) were carried out in the Ciletuh-Palabuhanratu Geopark.

Excellent and appropriate management is needed to support sustainable development in the Ciletuh-Palabuhanratu Geopark (Wulandari et al. 2018). One important information that can serve as reference for policy and management of the geopark is information on traditional ecological knowledge (TEK) of the local communities. The traditional ecological knowledge is culturally inherited from generation to generation, including traditional knowledge, innovations, beliefs, and practices of indigenous peoples and local communities embodying traditional lifestyles relevant to conservation and sustainable use of biological diversity (Toledo 2002; Berkes 2012; Halim et al. 2012; Iskandar 2018).

Based on an exploratory study undertaken by Padjadjaran University in 2017 (unpublished), 194 plant species (cultivated and non-cultivated) were found in the Ciletuh-Palabuhanratu Geopark. Yet, the information about plant species presented in such study was not completed with local knowledge about plant utilization. Documenting ethnoecological information in the Ciletuh-Palabuhanratu Geopark is immediately important since traditional ecological knowledge owned by the community is only transmitted in oral form from generation to generation (Wulandari et al. 2019). Therefore, written documentation on plant utilization by local community is necessary to avoid knowledge loss. This study aimed to elucidate: (i) plant utilization by local community in Ciletuh-Palabuhanratu Geopark based on land cover; and (ii) community dependence on the plants being utilized.

MATERIALS AND METHODS

Study period and area

This study was carried from February to May 2020 in Ciamas Sub-district, Sukabumi District, West Java Province, Indonesia (Figure 1). Administratively, Ciamas Subdistrict is bordered by Simpenan Subdistrict to the north, the Indian Ocean to the south and to the west, and Ciracap Subdistrict to the east. Ciamas Subdistrict consists of nine villages, namely Tamanjaya, Mekarjaya, Ciamas, Giri Mekarsakti, Cibenda, Mandrajaya, Ciwaru, and Sidumulya. In this study, however, Sidumulya is not included since this is a new village as the result of expansion program (program pemekaran desa). Besides, Sidumulya is also culturally different from the eight villages as the residents are majority of Javanese immigrants.

Data collection

Data collection method used in this study was mixed-method of qualitative and quantitative using ethnoecological approach as prescribed by Albuquerque et al. (2014) and Iskandar (2018). Based on this approach, the researchers study the point of view of local people who have traditional ecological knowledge on plants embedded with their culture (Berkes 2012). Some techniques in collecting the primary data, including observation, semi-structured and structured interviews were employed in this study (Creswell 2009).

The observation was undertaken to obtain general information on local environmental conditions of the villages. The researchers visited and observed village community settlements, forest ecosystems, and various agroecosystem types, including homegardens, gardens, wet-rice paddy fields and dry-paddy fields (swidden cultivation system).
The semi-structured interview was conducted to determine plant species used based on the land cover types and community’s dependence on plant utilization. The semi-structured interview was conducted through depth interviews with nine key informants of local experts that were purposively selected (Iskandar et al. 2016; Iskandar 2018), with the guidelines for interviews made previously and developed during the interview (Husodo et al. 2019). Informants were chosen through snowball sampling technique by selecting one local expert with excellent knowledge on plant utilization, then based on this initial informant, some other local experts were recognized and purposively selected as informants (Albuquerque et al. 2014). The informants included formal village leaders and their staff, non-formal village leaders, old male and female farmers, village middlemen, agricultural extensions, and tourism managers.

While the structured interview was employed to determine plant species used based on the land cover types only. The interview was conducted using a questionnaire for respondents who were randomly selected. Respondents selected were the household’s head, assuming he/she representing his/her family knowledge. The number of respondents was determined based on the Lynch et al. (1974) formula as following:

\[
    n = \frac{Nz^2P(1-P)}{Nd^2+z^2(1-P)}
\]

Where:

- \( n \) : Number of samples
- \( N \) : Population size (15,787 families)
- \( Z \) : Number of normal variables (1.96)
- \( P \) : The greatest possible proportion (0.50)
- \( d \) : Error (0.10)

The respondents were selected randomly to be proportional to the population of each village which resulted in a total of 94 respondents (Husodo et al. 2019).

In order to identify unknown plant species, herbarium specimens were made and identified in the laboratory of plant taxonomy, Department of Biology, Faculty of Mathematics and Natural Sciences, University of Padjadjaran, Sumedang, Indonesia.

**Data analysis**

The qualitative data was analyzed by cross-checking, summarizing and synthesizing as the basis for developing narrative writing (Newing et al. 2011; Partasasmita et al. 2019). Cross-checking data was conducted using triangulation method using the information obtained from
informants collected from the interview, observation, and participant observation. While the quantitative data were analyzed using descriptive statistics, including the frequency and proportion of respondents’ answers on particular issues (Wulandari et al. 2019).

RESULTS AND DISCUSSION

Results
Our study revealed at least 182 species of plants used by village community of Ciemas Subdistrict, consisting of food (80 species), medicinal plants (73 species), livestock fodder (9 species), firewoods (27 species), building materials and furniture (38 species), and others (23 species). For more detailed complete species can be seen in Table 1.

Based on the type of land cover, plants obtained from forest (70 species), gardens (81 species), homegardens (69 species), dry-paddy fields (5 species), and wet-paddy fields (8 species). Based on the data obtained from the interviews, in total the respondents mentioned 116 species, while all the informants mentioned 96 species (Table 2).

Species diversity across land cover types
As can be seen from Table 1, most plant species used by community in the studied area were documented with various uses including for food, livestock fodder, and fuelwood. However, most plant species for food in the garden is secondary food, while most of the essential foods were cultivated in wet-paddy fields and dry-paddy field. On the other hand, plants used for medicinal purposes were mostly found in the homegardens, while building materials and furniture, and other uses were primarily found in the forests. Despite the low level of species diversity on the paddy field and dry-paddy field, community’s dependence on these land-use types was high because their utilization is to fulfill essential food needs in daily life.

Forest
Based on study results, it revealed that the village people tend to use the forest to obtain firewood. Only a few people use the forest to get food, livestock fodder, and medicinal plants. In addition, logging activities in the Cileteh-Palabuhanratu Geopark have been banned by the local government and environmentalist communities. Over time, the use of firewood decrease due to concerns that this activity could damage the habitat of Rafflesia patma although most people don’t know about the Rafflesia patma and its conservation status, so it needs further education.

Food plants obtained from the forest included billygoat-weed (Ageratum conyzoides L.), the barerlier’s wood sorrel (Oxalis barcelleri L.), argus pheasant tree (Dracontomelon mangiferum (Blume) Blume), leaved yam (Diocorea hispida Dennst), queenland-cherry (Antidesma bunius L.), cluster fig (Ficus racemosa L.), banana (Musa sp), melastome clearweed (Pilea trinervia Wight), and salak hutan (Eleioidoxa conferta (Griff.) Buret). Only a few people use this food plant. Besides, this food plant is only a side dish, not an essential food.

Table 2. Plant species being utilized by village community in the studied area in Cileteh-Palabuhanratu Geopark, West Java, Indonesia based on land cover types

| Land cover types | Number of species | F | M | L | FW | B | O |
|------------------|-------------------|---|---|---|----|---|---|
| Forest           | 47                | 11| 24| 4 | 6  | 18| 14|
| Garden           | 81                | 49| 31| 6 | 18 | 17| 10|
| Home garden      | 69                | 43| 38| 1 | 7  | 4 | 6 |
| Dry paddy field  | 5                 | 3 | 1 | 3 | 0  | 0 | 1 |
| Wet paddy field  | 8                 | 3 | 1 | 2 | 0  | 2 | 1 |

Note: F: Food; M: Medicines; L: Livestock Fodder; FW: Fire woods; B: Building Material and Furniture; O: Other

Some people knew the use of plants as medicine from the forest with informants and people who live close to forests, such as Girimukti Village, tended to use this utilization. Some traditional medicine plants, including Ageratum conyzoides L., Blumea balsamifera L., Centella asiatica (L) Urb, Curcuma longa L, and Orthosiphon aristatus (Blume) Miq.

Livestock fodder obtained from the forest included banana (Musa sp), pinto peanut (Arachis pintoi Krapov & W.C. Greg), and elephant grass (Pennisetum purpureum cv. Mott). These species can still be found in other land covers such as gardens. Usually, breeders herd their livestock by eating wild grass along the roadside, including the natural forests’ edge.

Plant species found in the forest used as firewood included hampelas (Ficus ampelas Burn.fil.), njaval (Syzgium densiflorum Wall. ex Wt &Arn ), teak (Tectona grandis Lf.), ki sampang (Melicope latifolia (DC) T.G Hartley), nangsi (Vilabebrunea rubescens Bl), and rengas (Gluta renghas L.). The community knew that various timber plants can be used as firewood when these are dry. Even though there were restrictions in accessing the forest, people tended to take firewood from the gardens, both privately owned and from neighbors, so that the need for firewood for daily life can still be adequately fulfilled.

Timber trees that were used as building materials and furniture can be found in the forest. However, the use of timber trees from the forest was no longer occurring due to the geopark ban. The knowledge on the use of wood from the forest was passed down from previous parents who used the wood.

Other species with various uses, such as spiny bamboo (Bambusa blumeana J.A & J.H Schultz), whorled bamboo (Gigantochloa verticillata (Willd) Mildunro), common bamboo (Bambusa vulgaris Schrad ex J.C.Wend), giant clumping bamboo (Gigantochloa nigrocollata Kurz), string bamboo (Gigantochloa apus (Schult F.) Curtz), tamiang bamboo (Schizostachyum blumei Nees), terap (Artocarpus elasticus Reinw. ex Blume), hairy fig (Ficus hispida Lf.), the barerlier’s wood sorrel (Oxalis barcelleri L.), mother of cacao (Gliricidia sepium (Jacq) Steud), winged boat tree (Sterculia campanulata Wall. ex Mast), fig tree (Ficus sumatrana Miq), pisang batu (Banana sp.), and pisang...
kepok (Musa acuminata L. × balbisiana), can be found in the forest.

Similar study in Talang Mamak Tribe in Riau, Indonesia (Titisari et al. 2019), the utilization of plants varied widely which the plants were obtained from cultivation or extraction from the forest. In this tribe, plants were used for construction materials, foods, medicines and traditional and cultural ceremonies with the utilization of bioresources was carried out by considering the sustainability, function and productivity of forests (Titisari et al. 2019).

Garden and home garden

Usually, people grew various plant species in their garden and homegarden including woods, bamboos, fruits, spices, medicinal plants, etc. Often the garden was planted with decorative plants. This result is similar to other studies which found that home garden system in West Java is planted with various diversity of plants which has an important role for ecological and socio-economic functions (Iskandar and Iskandar 2016). Some species of foods, including species and fruits, are commonly grown in both garden and homegarden, such as Allium cepa L., Allium sativum L., Alpinia galanga (L.) Willd, Amomum compactum Soland ex Maton, Capsicum annuum L., Cucumis sativus L., Musa x paradisiaca, Carica papaya L., Lansium domesticum Corr., Muntingia calabura L., and Nephelium lappaceum L.

Dry paddy field and wet paddy field

Various cultivars of paddy/rice (Oryza sativa L) were cultivated in the studied area. The rice cultivars that grow in the dry field included brown rice (pare pupuay), pare begog, black rice (pare hideung) and glutinous rice (pare sticky rice). In the dry paddy field, the Sundanese people are familiar with the intercropping system (tumpang sari) by growing rice and chayote, banana, cassava, and cucumber. On the other hand, the rice cultivar grown in the wet field was white rice. In this field, the community also grew several species, including maize (Zea mays L.), cayenne pepper (Capsicum annuum L.), cowpeas (Vigna unguiculata (L.) Walp) and bananas (Musa sp).

Species diversity across utilization categories

Food

Most people in the studied area still relied on agricultural products to meet their daily needs, both commercial and subsistence. The foods referred to in this study include essential food, fruits, vegetables, and spices. In the land with flat contour, most of the people grew wet rice, while at higher and sloping areas, such as Girimukti, the community tended to grow dry rice.

Based on our observation, people did not have other food alternatives if there is a failure in rice cultivation or other disasters that might cause a reduction in the food supply. For example, if the community experiences a failed rice harvest and runs out of rice stocks, the community borrows rice from neighbors and repay the rice loan when the next crop is made. Besides, people who commercialize rice will experience a decrease in farmers’ income. Because of that, people are very dependent on agricultural products.

Of the many plants used as food sources, leaved yam ( Dioscorea hispida Dunnst) was used as a side dish in the form of chip despite it has risk of poisoning. The use of yam for chip was one of the characteristics of Ciletuh-Palabuhanratu Geopark in which the community processed the poisonous leaved yam or gadung into chips that are safe for consumption. To get rid of the poison, they have to go through the drying-boiling process for up to 10 days. After that, it can be cooked either steamed or fried into chips, according to taste. Even though it has gone through a long process, hangover symptoms sometimes occur when consumed in large quantities.

Medicinal plants

The results of the study showed that the community used medicinal plants to cure various diseases. For example, Asiatic pennywort (Centella asiatica (L.) Urb is to treat gout, garden onion (Allium cepa L.) to cure fever, kepel fruit (Stelechocarpus burahol) (Blume) Hook and Thomson to reduce body odor, sea holly (Acanthus ilicifolius) L., god's crown (Phaleria macrocarpa (Sheff) Boerl), white lead tree (Leucaena leucocephala (Lam.) De Wit.), and calabura (Muntingia calabura L) to treat diabetes and high blood pressure. Medicinal plants are a vital source to combat human diseases and play an essential role in healing many serious diseases worldwide due to active phytochemical compounds (Rahmawati et al. 2020). According to Islam and Sarwar (2020), Terminalia arjuna (Roxb.) W & A) is used to treat heart diseases. Ipomoea alba L. for snakebites, Moringa oleifera Lam. for chickenpox, Vitex negundo for gouts, Centella asiatica (L.) Urb is used to treat itching in the eye, dry catarrh, and bronchitis. According to Rana et al. (2010), Centella asiatica (L.) Urb is also used against flatulence, dysentery, and piles bleeding. Other ethnic groups said that Centella asiatica (L.) Urb is used against diarrhea, menstrual problems, stomach pain, and stimulants (Mohiuiddin et al. 2012). Parts of plants commonly used as medicines include leaves, stems, roots, and rhizomes. Leaf, root, bark, herbaceous parts, and seed are the five highest utilization parts of plants (Rahmawati et al. 2020; Karthiayini 2012; Town 2018).

Besides there were various medicinal plants available in the studied area, some people choose treatment at clinics, health centers, midwives (bidan), mantri (traditional healer), or drugs sold freely in the conventional market. Also, every village has a health center. The rationale of preferring these modern medications is that it is easier to obtain and quicker in the healing process. In addition, not all the parent’s knowledge is passed down, so they do not know the dosage of medicinal plants, and they never even try to use medicinal plants. According to Agbor and Naidoo (2016), the main reasons for attending a traditional healer were linked to the educational level, the type of dwelling, and the patient’s residence place.

Some people grew medicinal plants in their home garden or asked neighbors’ home gardens. The long-distance between the house and the health center/clinic and
free of cost were the reasons why medicinal plants still being used by the community, especially for first aid, but people turn to modern medicine if they have not recovered. The knowledge on medicinal plants was generally passed down from mothers to daughters, although this knowledge can also be transferred to sons in few cases.

Livestock fodder

Some people in the studied area owned livestock, such as cows, goats, and sheep. The people used the remaining harvested rice plants and some plants as livestock fodder to feed this livestock. In this study, although a few people raise livestock, the level of dependence on forage plants was low. Also, as long as there is wild grass on the roadside, livestock can still be used. According to Shiferaw et al. (2018), the primary livestock feed resources were natural grazing lands, crop residues, and cultivated forages such as sesbania (Sesbania sesban), pigeon pea (Cajanus cajan (L) Millsp), and napier grass (Pennisetum purpureum S).

Firewood

Firewood was obtained from various species of wood plants, mostly from the tree branches and wood/bamboo handicraft waste. Some examples of plants are usually used as firewoods, namely Paraserianthes falcatoria L.Nielsen, Bambusa glaucophylla Widjaja, Bambusa vulgaris Schrad ex J.C. Wendl, and Hevea brasiliensis (Willdex Juss) Muel.Arg. Also, firewood can be brought from a used lift net. These used lif net only used by fishing communities, such as in Ciwaru and Mandrajaya Villages. People tended to use firewoods for cooking that take a long time, such as boiling water, and people tended to use gas stoves for short cooking times. Firewood was freely available, and people believed that cooking with firewood makes food taste and smell better than using a gas stove. Based on the observation, some of the gas stoves owned were subsidized by the government, so that many people had gas stoves. However, the people were still very dependent on firewood even though they already have a gas stove.

Building material and furniture

The community in the studied area commonly depends on the use of woods or bamboos for building materials and furniture (Table 1 and Table 2). Some plants are commonly used for building and materials, such as Paraserianthes falcatoria L.Nielsen, Albizia procera (Roxb.) Benth, Alstonia scholaris (L) R.Br and Gigantochloa apus (Schult.f) Kurz. The utilization of building materials is predominantly undertaken by men who work as construction workers. Construction workers can build houses (rumah panggung), saung, and furniture such as bamboo benches and tables. According to Setiawati et al. (2017), giant black bamboo is commonly used to make furniture such as tables and chairs. People rarely use timber plants. Also, utilization for buildings is carried out every few years. People tend to buy wood, so people do not depend on this use. Hutaurung et al. (2018) said that the timber is obtained from outside the protected forest area or bought from the village or elsewhere for people who want to build the house.

Other uses

Several plant species were used traditionally as ropes and fibers, such as string bamboos (Gigantochloa apus Kurz), giant clumping bamboos (Gigantochloa nigricellata Kurz), hairy figs (Ficus hispida L.f) and sugar palms (Arenga pinnata Merr) (Figure 2). Some bamboos were used as lift nets, such as common bamboo (Bambusa vulgaris Schrad. ex W.C. Wendl.) and spiny bamboo (Bambusa buneana J.A & J.H Schultz) Giant black bamboo (Gigantochloa atrovirens Widjaja) can be used as a coconut sugar molder, while several bamboos can also be used to make musical instruments, such as bamboo tamiang (Schizostachyum blumei Nees). Several species can be used as additional fertilizers, such as whorled bamboo (Gigantochloa verticillata Wild.) Munro) and mother of cacao (Garcinia sepium (Jacq) Steud).

The community used terap (Artocarpus elasticus) and banana (Musa sp) for food wrappers, while the barrelier's wood sorrel (Oxalis barleyeriana L.) can be used as a hand sanitizer. Several species were used as decorative plants, including hogplum (Spondias mombin L.) and kiara beers/bonsai (Ficus sumatrana Miq). The sap from terap (Artocarpus elasticus Reinw ex. Blume) can be used to catch birds, while beurish (Sterculia campanulata L.) can be used as a bioindicator for forest honey (i.e., if the leaves have fallen off and are left with flowers, it signifies the best quality forest honey season). The honey from the beurish tree is the best honey than the other trees.

Charcoal can use several bamboos, such as spiny bamboo (Bambusa blumeana J.A & J.H Schultz) and common bamboo (Bambusa vulgaris Schrad. ex. W.C. Wendl). Sassen et al. (2015) said that wood fuel, such as charcoal or firewood, is the most common form of biomass utilized in Sub-Saharan African Countries. Charcoal is a highly consumed form of biomass in Uganda due to the lack of modern alternatives (Dastan et al. 2017; Bamwesigye and Hlavackova 2018; Lee 2013).

Based on this study, it can be concluded that rural people in Ciwasu Sub-district, which is the part of Cileunir-Palabuhanratu Geopark, still used various plants to meet their daily needs, such as food, medicinal plants, livestock fodder, firewood, building materials, furniture, etc. This variety of uses was provided by high plant diversity on various land covers including forest, garden, home garden, dry paddy field, and wet paddy field.
Figure 2. The various utilizations of plants by local communities in Ciletuh-Palabuhanratu Geopark. A-B-C. Bamboo handicraft; D. Collecting of firewood; E. Timber as building material; F. Bamboo as the mold for coconut sugar

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Table 1. Plants and various utilizations recorded in the community of Ciletuh Pelabuhanratu Geopark, West Java, Indonesia

| Family          | Scientific name                          | Vernacular name  | Fo | M | L | Fi | B | O | Utilizations                                                                 |
|-----------------|------------------------------------------|------------------|----|---|---|----|---|---|--------------------------------------------------------------------------------|
| Acanthaceae     | Acanthus ilicifolius L.                  | Daruju           |    |   |   |    |   |   | Main function                                                                 |
| Amaranthaceae   | Acrideranthus aspera L.                  | Jaring           |    |   |   |    |   |   | Side dishes and stop the nose bleed                                            |
| Rutaceae        | Acronychia pedunculata (L) Miq.          | Kaya Semidra     |    |   |   |    |   |   | Building material                                                             |
| Asteraceae      | Ageratum coryzoides L.                  | Babadotan         |   |   |   |    |   |   | Decorative plants (bonsai)                                                    |
| Fabaceae        | Albizia chinensis (Osbeck) Merr          | Sengon           |    |   |   |    |   |   | Firewood                                                                      |
| Fabaceae        | Albizia procera (Roxb.) Benth.           | Wera             |    |   |   |    |   |   | Building material                                                             |
| Amaryllidaceae  | Allium cepa L.                           | Bawang Beureum   |   |   |   |    |   |   | Kitchen spices and reduce fever                                               |
| Amaryllidaceae  | Allium sativum L.                        | Bawang Putih     |   |   |   |    |   |   | Kitchen spices                                                                |
| Amaryllidaceae  | Allium tuberosum Rothler Ex Spreng      | Kacai            |   |   |   |    |   |   | Kitchen spices                                                                |
| Zingiberaceae   | Alpinia galanga (L.) Wild                | Lengkuas         |   |   |   |    |   |   | Kitchen spices and lowering blood sugar                                        |
| Apocynaceae     | Alstonia scholaris (L.) R.Br.            | Lame Putih       |   |   |   |    |   |   | Building material                                                             |
| Amaryllidaceae  | Alstonia sp.                             | Lame Kunung      |   |   |   |    |   |   | Building material                                                             |
| Amaryllidaceae  | Alstonia spinosa L.                      | Bayam            |   |   |   |    |   |   | Sidedishes                                                                    |
| Zingiberaceae   | Anomum compactum Soland Ex Maton        | Kapulaga Jawa    |   |   |   |    |   |   | Kitchen spices and treat smell breath                                          |
| Zingiberaceae   | Anomum dealbatum Roxb.                   | Wresah           |   |   |   |    |   |   | Reduce fever                                                                  |
| Anacardiaceae   | Anacardium occidentale L.               | Jambu Monyet     |   |   |   |    |   |   | Sidedishes and treat diarrhea                                                  |
| Bromeliaceae    | Ananas comosus L.                        | Nanas            |   |   |   |    |   |   | Sidedishes                                                                    |
| Acanthaceae     | Andrographis paniculata Nees            | Sambiloto        |   |   |   |    |   |   | Reduce blood sugar                                                            |
| Annonaceae      | Annona muricata L.                      | Sirsak           |   |   |   |    |   |   | Firewood, side dishes, reduce back pain and blood pressure                    |
| Annonaceae      | Annona squamosa L.                      | Srikaya          |   |   |   |    |   |   | Sidedishes                                                                    |
| Basellaceae     | Anredera cordifolia (Ten.) Steenis       | Binahong         |   |   |   |    |   |   | Relieve fatigue                                                               |
| Phyllanthaceae  | Antidesma bunius (L.) Spreng            | Huni             |   |   |   |    |   |   | Side dishes                                                                   |
| Apiaceae        | Apium graveolens L.                     | Seledri          |   |   |   |    |   |   | Lowering blood pressure                                                       |
| Fabaceae        | Arachis pintoi                           | Kacang Hias      |   |   |   |    |   |   | Livestock fodder                                                              |
| Fabaceae        | Archidendron pauciflorum (Benth.) L.C. Nielsen | Jengkol        |   |   |   |    |   |   | Reduce blood sugar                                                            |
| Primulaceae     | Ardisia elliptica Thunb                 | Lempeni          |   |   |   |    |   |   | Side dishes                                                                   |
| Areceae         | Arenga pinnata Merr.                     | Aren             |   |   |   |    |   |   | Firewood rope, broomsticks making, and as a sweetener                         |
| Moraceae        | Artocarpus altillus (Parkinson) Fosberg. | Sukun            |   |   |   |    |   |   | Side dishes and treat uric acid                                               |
| Moraceae        | Artocarpus elasticus Reinei Ex Bl       | Benda            |   |   |   |    |   |   | Catching the bird (sap)                                                       |
| Moraceae        | Artocarpus heterophyllus Lam.           | Nangka           |   |   |   |    |   |   | Side dishes and kitchen furniture                                             |
| Poaceae         | Axonopus compressus (Sw.) P. Beauv       | Rumpat Pahit     |   |   |   |    |   |   | Adding body insulin                                                           |
| Poaceae         | Bambusa blumeana Schult & Schult.f.     | Bambu Durî       |   |   |   |    |   |   | Charcoal and lift net making                                                  |
| Poaceae         | Bambusa glaucophylla Widjaja             | Bambu Putih      |   |   |   |    |   |   | Firewood                                                                      |
| Poaceae         | Bambusa tuloides Munro                   | Bambu Hijau      |   |   |   |    |   |   | Wicker fence and kitchen furniture                                             |
| Poaceae         | Bambusa vulgaris Schrad ex. J.C. Wendl   | Bambu Kuning     |   |   |   |    |   |   | Building material, firewood, and lift net                                    |
| Family                              | Species                                             | Uses                                                                 |
|------------------------------------|-----------------------------------------------------|----------------------------------------------------------------------|
| Asteraceae                         | Blumea balsamifera (L.)                            | Side dishes, Decorative plants (bonsai)                                |
| Zingiberaceae                      | Boesenbergia rotunda (L.) Mansfeld                  | Kitchen spices, Eye drops, Treat back pain and lowering the blood pressure |
| Crassulaceae                       | Bryophyllum pinnatum (Link) Oken                    | Agriculture, Firewood, Firewood, Eye drops, Reduce fever               |
| Cucurbitaceae                      | Citrullus lanatus (Thunb.) Matsumura & Nakai       | Decorative plants                                                    |
| Areaceae                           | Cocos nucifera L.                                  | Kitchen spices, Eye drops, Treat ulcers, Firewood                    |
| Asparagaceae                       | Cordyline fruticosa (L.) A.Chev.                    | Treat dystersity, Firewood, Livestock fodder                          |
| Asteraceae                         | Cosmos caudatus Kunth.                             | Decorative plants                                                    |
| Costaceae                          | Costus speciosus (Koen ex Retz.) Sm                | Firewood, Side dishes, Side dishes and lowering blood pressure        |
| Zingiberaceae                      | Crassocephalum crepidiosum (Benth) ex. S.Moore     | Eye drops                                                             |
| Poaceae                            | Cymbopogon citratus (DC.) Stapf                    | Side dishes, Firewood, Kitchen spices and clean the eyes              |
| Urticaceae                         | Dendrocnide stimulans (L.fil.) Chew                | Firewood, Eye drops, Remove numb body parts                         |
| Menispermacae                      | Cyclea barbata L.M                                 | Building material, Firewood                                           |
| Poaceae                            | Dinochloa scandens (Blume ex Nees) Kuntze          | Eye drops, Side dishes                                               |
| Dioscoreaceae                      | Dioscorea hispida Dannst                           | Side dishes, Firewood                                                |
| Anacardiaceae                      | Dramacontelen mangiferum (Blume) Blume             | Food                                                                 |
| Malvaceae                          | Durio zibethinus Murr                              | Food                                                                 |
| Meliaceae                          | Dysoxylum densiflorum Miq                          | Building material                                                    |
| Poaceae                            | Echinocloa crus-galli (L.) P.Beauv                  | Livestock fodder                                                      |
| Areaceae                           | Eleocharis conferta Burett                         | Livestock fodder, Side dishes                                         |
| Asteraceae                         | Elephantopus scaber L.                             | Treat rheumatism, Antibiotics                                         |
| Poaceae                            | Eleusine indica (L.) Gaertn                        | Livestock fodder                                                      |
| Areaceae                           | Epipremnum aureum (Lind & Andre) G.S              | Firewood, Eye drops                                                   |
| Zingiberaceae                      | Etlingera elatior (Jck) R.M. Smith                 | Kitchen spices                                                        |
| Myrtaceae                          | Eugenia polyantha (Wight) Palp                      | Antidote bitter taste in drinks, reduce cholesterol, Firewood ropes  |
| Moraceae                           | Ficus ampelops Burm.f                              | Making huts and stables                                              |
| Moraceae                           | Ficus hispida L.f.                                 | Fire wood ropes                                                       |
| Moraceae                           | Ficus racemos Linn                                 | Side dishes                                                           |
| Moraceae                           | Ficus sumatrana Miq                                | Decorative plants (bonsai)                                            |
| Clusiaceae                         | Garcinia mangostana L.                             | Side dishes                                                           |
| Rubiaceae                          | Gardenia augusta Merr                              | Reduce fever                                                          |
| Family                     | Species                                      | Common Name                      | Uses                                                                 |
|----------------------------|----------------------------------------------|----------------------------------|----------------------------------------------------------------------|
| Poaceae                    | Gigantochloa apus (Schult.f) Kurz            | Bambu Tali                       | Building material and bamboo bench straps                              |
| Poaceae                    | Gigantochloa atrovilacea Widjaja             | Bambu Hitam                      | Firewood, the material for making roof hut, booths, and lift net      |
| Poaceae                    | Gigantochloa nigriciliata Kurz               | Bambu Lenga                      | Bamboo bench strips                                                   |
| Poaceae                    | Gigantochloa verticillata (Willd.) Munro     | Bambu Gombong                    | Building material, lift net, and making liquid fertilizer             |
| Fabaceae                   | Glocidion borneense (Mull.Arg.) Boerl         | Marene                           | Clean the eyes                                                        |
| Phyllanthaceae             | Gluta renghas L.                            | Renggas                          | Side dishes                                                           |
| Malvaceae                  | Grevia acuminata Juss                       | Derewak                          | Firewood and building material                                        |
| Sapindaceae                | Guioa diplopetala (Hassk) Radlk              | Kihoe                            | Firewood                                                              |
| Euphorbiaceae              | Hevea brasiliensis (Willd ex Juss) Muel.Arg.| Karet                            | Bamboo bench strips                                                   |
| Malvaceae                  | Hibiscus tiliaceus L.                        | Waru                             | Firewood                                                              |
| Campanulaceae              | Hippobroma longiflora (L.) G.Don             | Kitolod                          | Treat dysentery                                                       |
| Cactaceae                  | Hylocereus undatus                          | Bua Naga                         | Side dishes                                                           |
| Balsaminaceae              | Impatiens balsamina L.                      | Bunga Pacar Air                  | Decorative plants                                                     |
| Poaceae                    | Imperata cylindrica Raesch                   | Halang                           | Making roof hut                                                       |
| Convolvulaceae             | Ipomoea aquatica Forsk                      | Kangkang                         | Side dishes                                                           |
| Convolvulaceae             | Ipomoea batatas L.                          | Ubi Jalar                         | Treat ulcers                                                          |
| Rubiaceae                  | Ixora javanica (Blume) DC                    | Bunga Asoka                      | Kitchen spices, treat coughs, and relieve body bruises               |
| Zingiberaceae              | Kaempferia galanga Reviw                    | Kencur                           | Building material                                                     |
| Lythraceae                 | Lagerstroemia speciosa (L) Pers              | Bungur                           | Side dishes                                                           |
| Meliaceae                  | Lansium domesticum Corr                     | Dukuh                            | Antibiotics                                                           |
| Verbenaceae                | Lantana camara Linn                         | Saliara                          | Treat diabetes                                                        |
| Fabaceae                   | Leucaena leucocephala (Lam) De Wit           | Petai Cina                       | Side dishes                                                           |
| Cucurbitaceae              | Luffa acutangula Roxb                       | Ovong                            | Kitchen furniture making                                             |
| Lygodiaeae                 | Lygodium sp.                                | Paka Hata                        | Firewood and building material                                        |
| Rhamnaceae                 | Maesopsis eminii Engl                       | Kaya Afrika                      | Side dishes and firewood                                             |
| Anacardiaceae              | Mangifera indica L. var.                    | Mangga                           | Side dishes                                                           |
| Euphorbiaceae              | Manihot esculenta Crantz                    | Sampeu                           | Side dishes                                                           |
| Sapotaceae                 | Manilkara zapota (L.) P.Royen               | Sawo                             | Side dishes                                                           |
| Melastomaceae              | Melastoma affine D.Don                      | Harendong                        | Treat vaginal discharge                                              |
| Rutaceae                   | Melicope latifolia (DC.) T.G Hartley        | Kisamang                         | Firewood and building material                                        |
| Rutaceae                   | Micromelon minutum Wight & Arn              | Kihuut                           | Building material                                                     |
| Fabaceae                   | Mimosa pudica Linn                          | Patri Malu                       | Blood circulation                                                     |
| Rubiaceae                  | Morinda citrifolia L.                       | Mengkuda                         | Antibiotics                                                           |
| Moringaceae                | Moringa oleifera Lam                        | Kelor                            | Body growth                                                           |
| Moraceae                   | Morus alba L.                               | Murbai                           | Reduce cholesterol                                                    |
| Muntingiaceae              | Muntingia calabura L.                       | Kersen                           | Side dishes, reduce blood pressure, uric acid, and cholesterol        |
| Musaceae                   | Musa acuminata                              | Pisang Kole                      | Side dishes                                                           |
| Musaceae                   | Musa acuminata × balbisiana                 | Pisang Kepok                     | Sidedishes, treat diarrhea, livestock fodder, and food wrapper       |
| Musaceae                   | Musa balbisiana                             | Pisang Batu                      | Side dishes, treat diarrhea, livestock fodder, and food wrapper      |
| Musaceae                   | Musa sp.                                    | Pisang                           | Side dishes, treat diarrhea, livestock fodder, and food wrapper      |
| Rubiaceae                  | Neolamarckia cadamba (Roxb.) Bosser         | Jabon                            | Firewood and building material                                        |
| Sapindaceae                | Nephelium lappaceum L.                      | Rumbutan                         | Side dishes and firewood                                             |
| Plant Family            | Scientific Name                                      | Common Name          | Uses                                                                 |
|------------------------|------------------------------------------------------|----------------------|----------------------------------------------------------------------|
| Lamiaceae              | Ocimum sanctum Linn.                                 | Kemangi              | Side dishes                                                          |
| Lowiaceae              | Ocichandra longifolia Ridl.                          | Lobak Hutan          | Sore throat                                                          |
| Lamiaceae              | Orthosiphon aristatus (Blume) Miq                    | Kusim Kucing         | Body deodorizer and reduce smell breath                               |
| Poaceae                | Oryza sativa L. var.                                | Padi                 | Food and livestock fodder                                            |
| Oxalidaceae            | Oxalis barlieri L.                                   | Colincing            | Side dishes and hand sanitizer                                       |
| Acanthaceae            | Pachystachys lutea Nees                             | Bunga Lolipop        | Decorative plants                                                    |
| Pandanaceae            | Pandanus amaryllifolius Roxb                         | Pandan Wangi         | Relieve stiffness                                                    |
| Pandanaceae            | Pandanus sp.                                         | Pandan Pecat         | Mat making                                                           |
| Pandanaceae            | Pandanus tectorius Parksin ex Zuuc                   | Pandan Gobang        | Mat making                                                           |
| Poaceae                | Pennisetum purpureum Schumach                       | Rumpat Gajah         | Livestock making                                                     |
| Lauraceae              | Persea americana Mill                               | Alpukat              | Firewood                                                             |
| Thymelaeaceae          | Phaleria macrocarpa Scheff                          | Mahkota Dewa         | Reduce blood sugar                                                   |
| Fabaceae               | Phaseolus lunatus L.                                 | Kacang kratok        | Side dishes                                                          |
| Fabaceae               | Phaseolus vulgaris L.                                | Bunci                | Side dishes                                                          |
| Phyllanthaceae         | Phyllanthus emblica Linn                             | Malaka               | Sweetener and firewood                                               |
| Solanaceae             | Physalis peruviana L.                                | Cecenet              | Body deodorizer and reduce smell breath                               |
| Urticaceae             | Pilea trinervia Wight                                | Pohpohan             | Side dishes                                                          |
| Piperaceae             | Piper aduncum L.                                     | Sirihan              | Reduce aches and improves blood circulation                           |
| Piperaceae             | Piper betle L.                                       | Sirih                | Treat nosebleed                                                      |
| Piperaceae             | Piper caducibacteum C.DC                             | Sirih Hutan          | Reduce nausea                                                        |
| Piperaceae             | Piper nigrum L.                                      | Lada Hutan           | Treat bruises                                                        |
| Lamiaceae              | Planchhtus scutellaroides (L.) R.Br                 | Javer Kotok          | Reduce aches                                                        |
| Asteraceae             | Porophyllum rudera (Jacq)                            | Ketumbar Bolivia     | Treat tinea versicolor                                               |
| Myrtaceae              | Psidium guajava L.                                   | Jambu Bijii          | Treat diarrhea                                                       |
| Fabaceae               | Psophocarpus tetragonolobus (L.) DC                  | Jat                  | Sidedishes                                                           |
| Sterculiaceae          | Pterospermum javanicum Jungh                         | Bayur                | Building material                                                    |
| Euphorbiaceae          | Ricinus communis L.                                  | Jarak                | Treat rheumatism                                                     |
| Poaceae                | Saccharum edule Hassk                                | Trubak               | Sidedishes                                                           |
| Phyllanthaceae         | Sauropus androygynus (L.) Merr                       | Katuk                | Side dishes and launch a bowel movement                              |
| Theaceae               | Schima wallichii (DC) Korth                         | Puspa                | Making flute                                                         |
| Poaceae                | Schizostachyum blumei Nees                          | Bamba Tamiang        |                                                                      |
| Cucurbitaceae          | Sechium edule (Jacq) Swartz                          | Lejet                |                                                                      |
| Malvaceae              | Sida rhombifolia L.                                  | Sidagori             |                                                                      |
| Astereaceae            | Smallanthus somchilofia (Poeppl & Endl) H.Robinson  | Insulin              |                                                                      |
| Solanaceae             | Solarum lyopersicum L.                               | Tomat                |                                                                      |
| Solanaceae             | Solarum melongena L.                                 | Terong Ungu          |                                                                      |
| Solanaceae             | Solarum nigrum L.                                    | Leunca               |                                                                      |
| Solanaceae             | Solarum turum L.                                     | Tekokak              |                                                                      |
| Anacardiaceae          | Spondias mombin L.                                   | Kedondong Cina       |                                                                      |
| Annonaceae             | Stelechocarpus barulol (Blume) Hook & Tomson         | Barulol              |                                                                      |
| Malvaceae              | Sterculia campanulata Wall ex. Mast                  | Beurih               |                                                                      |
| Malvaceae              | Sterculia foetida L.                                 | Kepuh                |                                                                      |
| Acanthaceae            | Strobilanthes crispa (L.) Blume                      | K intellectually 1   |                                                                      |
| Meliaceae              | Swietenia mahagoni (L) Jcq                           | Mahoni               |                                                                      |
| Family       | Genus and Species                             | Common Name(s) | Uses and Benefits                                                                 |
|-------------|-----------------------------------------------|----------------|-----------------------------------------------------------------------------------|
| Myrtaceae   | Syzygium aqueum (Burm.f) Alston              | Jambu Air      | Firewood and side dishes                                                            |
| Myrtaceae   | Syzygium aromaticum L                        | Cengkeh        | Firewood, building materials, and kitchen spices                                  |
| Myrtaceae   | Syzygium cumini (L.) Skeel                   | Jambang        | Building material                                                                  |
| Myrtaceae   | Syzygium densiflorum Wall ex Wight & Arn     | Jambu Kopo     | Building materials and firewood                                                    |
| Lamiaceae   | Tectona grandis L.f.                         | Jati           | Building material, firewood, and clean the eyes                                    |
| Combretaceae| Terminalia catappa L                         | Ketapang       | Firewood                                                                            |
| Menispermaceae| Tinospora cordifolia                       | Akar Ali-Ali   | Treat uric acid, ulcer, blood sugar, and malaria                                    |
| Fabaceae    | Vigna unguiculata (L) Walp                   | Kacang Panjang | Side dishes                                                                        |
| Lamiaceae   | Villebrunea rubescens (BL) Bi                | Nangsi         | Firewood and huts making                                                           |
| Poaceae     | Zea mays L                                   | Jagong         | Building material                                                                  |
| Poaceae     | Vigna unguiculata (L) Walp                   | Kacang Panjang | Food                                                                               |
| Zingiberaceae| Zingiber cassunmar Roxb                     | Panglay        | Kitchen spices                                                                     |
| Zingiberaceae| Zingiber officinale Roscoe                  | Jahe           | Kitchen spices and treat rheumatism                                                |
| Zingiberaceae| Zingiber zerumbet (L.) Smith                 | Lempuyang Gajah| Antibiotics                                                                        |
| Rhamnaceae  | Ziziphus mauritiana Lamm                     | Bidara         | Relieve fatigue                                                                    |

Note: Fo: Food; M: Medicines; L: Livestock Fodder; Fi: Firewoods; B: Building Material and Furniture; O: Others