

Results of ethnoecological studies in the prospect of forest tourism development in Tenganan Pegringsingan traditional village, Karangasem, Bali

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Abstract

This study mainly discusses the lack of implementation of forest development as a tourist attraction in Karangasem, Bali, Indonesia. This research aims to implement the results of ethnoecological studies to develop the Bukit Kangin forest tourism in the traditional village of Tenganan Pegringsingan, Karangasem, Bali. The population in this study area is considered in two aspects, namely the ecosystem aspect and the socio-system one. The population of the ecosystem consists of all plant species in Bukit Kangin, while the population in the socio-system aspect is the entire community of Tenganan Pegringsingan traditional village. The sample of this research from the ecosystem aspect includes plant species covered by squares with a size of 20 × 20 meters including tree habitus (nature), 10 × 10 meters (which includes sapling), and squares with a size of 1 × 1 meters including seedling habitus. The number of squares is 65 squared. For the community sample, community components are selected with a total sample of 50 people. The ecosystem data collection uses the quadratic method with systematic sampling techniques. Meanwhile, the data collection is carried out by interview, observation sheets, and questionnaires. The data related to ecosystem was analysed using ecological statistical analysis, while the data related to the socio-system were analysed descriptively. Descriptive analysis was used to determine the prospects for forest tourism development. The conclusions of this study are the following: (1) the results of ethnoecological studies in the Bukit Kangin forest, Tenganan Pegringsingan village, Karangasem, Bali, has the prospect of being developed into forest tourism as an alternative and complementary tourist destination; (2) some of the results of ethnoecological studies and supported by socio-system that interact with each other can be in the form of plant species composition equipped with descriptions, utilization, processing methods and products of useful plant species. The results of ethnobotanical and ethnobiological studies are very supportive in the development of forest tourism in the Kangin hills, Tenganan Pegringsingan, Karang Asem, Bali.

Keywords: ethnoecological, forest tourism, Tenganan Pegringsingan

Introduction

Ethnoecological studies are basically studies of groups or communities (ethnicity) associated with the environment (Everett 1990, Naah 2020). Furthermore, it was conveyed that the methods of traditional society using ecology and living in harmony with their natural and social environment were explored in the ethnoecological study. In ethnoecology, the main idea is human beings and their environment, which is a bridge between natural science and social science (Bennett et al. 2017).

In the early development, ethnoecology included agriculture, fisheries, plantations and forestry (ethnoforestry) (Bennett et al. 2017). However, in line with the advancement (development) of science, ethnoecology can be applied in tourism. Utilization of the natural environment is made and engineered in such a way as to attract tourists. Therefore, the ethnoecological approach developed into an ethno-ecotouring approach, which is an approach that involves the participation of local and indigenous communities in tourism development (Nurdin and Ng 2013). This

is in line with the opinion stating that the ethnobiological (including ethnoecological) approach rests on the use of biological entities in biosystems by one ethnic group in a timeline. Utilization in the past, present and future is in accordance with the dynamics of community life (Berlin and Berlin 2005).

Ethno-ecotourism is described as the development of ecotourism specifically carried out by local communities through cultural expressions (Iban et al. 2019). Another opinion says that ethno-ecotourism connects natural areas with local culture for sustainable development (Gustavo 2013), while Dipankar and Arnab (2010) describe ethno-ecotourism as a concept that integrates physical, biological, and cultural diversity. Therefore, it can be concluded that ethno-ecotourism is a new concept in developing of sustainable tourism with the idea of integrating ecotourism activities (natural resources) with potential cultural resources in the community.

Many studies related to ethnoecology in conservation orientation have been conducted by some experts, such as Conde et al. (2020) in Brazil, Nurdin and Ng (2013) in Lampung (Indonesia), Batoro et al. (2017) and Nasution et al. (2018) in Mandailing (North Sumatra), Pedroso-Júnior and Sato (2005) in Superagui National Park (Paraná, Brazil), MacDonald (2014) in Guyana, and Bahagia et al. (2020) in the traditional village of Tenganan Pegringsingan (Bali, Indonesia). Meanwhile, among ethnobotanists and ethnoecologists, Berlin and Berlin (2005) describe the ethnoecology of expressions, satire, songs, and various analogies from the culture of the archipelago concerning Balinese culture. In a study of ethno-ecotourism with a tourism orientation, several experts conducting research in the field of ethno-ecotourism which include those in Kulonprogo, Yogyakarta (Nurdin 2016), in Lampung (Peterson et al. 2007), in Bukit Barisan Selatan (de Lima et al. 2016), and in Colombia (Winterhalder and Smith 2000). The study of ethno-ecotourism in Bali was conducted by Hakim et al. (2009), Sujarwo et al. (2014), and Pamungkas et al. (2013).

Bali has enchanting natural beauty, unique culture, customs, and traditions. Cultural uniqueness is the main attraction for tourists who come to Bali. It is essential that local culture and religion have been integrated into the daily lives of Balinese people (Wirawan 2018, Sumiati 2017). The concept of *Tri Hita Karana* is an example of Balinese society's philosophy that unites transcendental and vertical life (Suastra 2017). Thus, the development of tourism in Bali, which is based on ethnoecology, ethnotourism, ethnobotany, etc., has been going on from time immemorial. However, its popularity and scientific studies only develop after the ecosystem has changed in a negative direction due to exploitation of the ecosphere itself.

One of the Bali Aga villages in Bali is Tenganan Pegringsingan village. This village is very well known among tourist destinations. Traditionalism, uniqueness and authenticity are its main characteristics. This village is situated in Karangasem district, Bali Province, at an altitude

of 70 m above sea level. The boundaries of this village area are as follows: Ngis village in the west, Bebandem District in the north, Karangasem District in the east, Nyuh Tebel village and Pesedahan village in the south. Tenganan Pegringsingan village has three hills that surround the village. These hills were used as a natural fortress from enemy attacks in the past. The three hills are Bukit Kauh in the west, Bukit Kangin in the east, and Bukit Kaja in the north. The condition of the forest vegetation on the three hills shows that the forest in Bukit Kangin is still green, with a high density. Likewise, species diversity is in the medium category (Ratnani 2021). This is in line with the results of a study conducted by Sujarwo and Keim (2017), which states that the condition of the Bukit Kangin forest vegetation looks greener compared to Bukit Kaja and Bukit Kauh.

As stated above, the forests in the three hills of Tenganan Pegringsingan village are considered still sustainable from the past to the present. On the other hand, general data related to forests in Indonesia issued by Forest Watch Indonesia (2000–2009) stated that in 2009 there were 88.17 million ha recorded, or around 46.33% of Indonesia's land area. Of the recorded forest area, the largest distribution of forest cover is in Papua Island (38.72% of the total forest cover area of Indonesia). In other words, around 34.13 million ha of forest are on the island of Papua. It is very worrying that within the 2000–2009 period there was a phenomenon of deforestation in Indonesia, covering an area of 15.16 million hectares. The largest area of deforestation is observed on Kalimantan Island where it spans around 5.50 million ha, or 36.32% of forested area. Specifically, for data in Bali, data from 1994 to 1998 in forested areas was 19.91%, and non-forested areas were 80.09%. Deforested land cover is in a different vein than land, which has forest vegetation, namely in the form of shrubs, unproductive land, rice fields, agricultural land, settlements, reeds, etc. It is mentioned that out of 127,271 ha of total forest area in Bali, around 31,817.75 hectares (25%) have undergone land-use conversion (change) (Aldyan 2020).

Compared to the two forest conditions, the condition of the forest in the traditional village of Tenganan Pegringsingan and the condition of the forest in Indonesia or the forest in Bali in general, it turns out that the data in Indonesia and Bali generally indicate deforestation or land conversion. On the other hand, the Tenganan traditional village forest, which is a forest managed by custom, does not experience deforestation. Thus, the role of the customary village in conservation is closely related to the values and behaviour of local communities. At the 1992 Earth Summit in Rio de Janeiro, a discourse on traditional conservation was raised. Efforts to conserve natural resources are always directly related to the values and behaviour of local communities. Therefore, the involvement of local communities in preserving forests is very important. One of the agendas at the 1992 Earth Summit raised the theme of the role of local communities in nature conservation (Figueroa and Waitt 2008).

The concept of forest conservation, which is based on local wisdom, has obtained many benefits, especially in terms of forest conservation itself (Dahana and Resen 2016, Wijana et al. 2018, Wijana and Setiawan 2018), and from other authors such as (Sujarwo et al. 2014, Sujarwo et al. 2015, Sujarwo et al. 2016, Wijana and Setiawan 2019).

In the current development of social life, especially in the economic field, the government has a lot to say about and promote the creative economy, namely making a creative and innovative form of business to improve the people's economy. In the field of tourism in Bali, many have done such as opening tourist village destinations. In opening these tourist village destinations, the government dig more about the home industry's creativity, the community's traditional culture, and traditional culinary diversity. It's worth to remark that the exploitation of existing forest resources, both forests owned by the village community and managed traditionally and government forests whose management is handed over to indigenous peoples, has not yet explored much of their potential to be used as forest tourism destinations.

Wunder (2000), Elsasser (2004), Kiss (2004), and Bhuiyan et al. (2010) generally state that utilizing the forest as a tourist destination can add to the economic value of the local community, provide employment, become educational media, and stimulate the motivation of the local community to maintain the sustainability of the forest; finally, the forest becomes a sustainable destination attraction. To be more emphatic, Wijana (2020) found that local communities in Ubud have been effective in protecting flora and fauna in the Monkey Forest. They argue that forest-based tourism has increased the awareness of local communities to conserve the environment in the Ubud Monkey Forest and protect the attractiveness of tourist destinations.

Developing new forest tourist destinations or as a pioneer requires exploring the potential of existing forest resources, especially something that can be "sold" to tourists, which has its charm and uniqueness. On the journey of tourists to the middle of the forest, they must be equipped with various instructions, descriptions of plant species, maps of the distribution of growing points, and legends of various conservation efforts.

Regarding the forest in the village of Tenganan Pegringsingan, there have been many studies such as executed by Wijana et al. (2021), which results can be used as supporting data for the development of forest tourism. These include a 2008 study on plant species diversity, a 2009 study on socio-cultural forest preservation, a 2017–2018 study on rare plants, a 2018 study on plant symbols of the body, and a 2019–2020 study on mapping useful plants. The research results have provided scientific data to support the development of creative tourism, in this case forest tourism. Data collected from the research results, such as the names of plant species in the three hills, have provided data on the mapping of the distribution of various plant species, especially in Bukit Kangin, data related to body

symbols, and data on forest conservation efforts. These data are the basic capital to support the development of new trends and innovations in tourism, namely the development of forest tourism as a complementary destination for tourism in the village.

Meanwhile, tourist destinations in the traditional village of Tenganan Pegringsingan are oriented toward cultural destinations. The popular attraction of cultural destinations is the sacred culture of the pandan war (*mekare-kare*). Another culture pattern is the unique village layout, in which the residential layout is in the form of liners, cobbled and rocky roads, and residential housing still holds its traditional character. This socio-cultural destination has been going on for a long time and is monotonous. There are no innovative and creative tourism development efforts. One of the natural resources that can be developed for creative and innovative tourism is customary forests. As previously stated, this customary forest is spread over three hills, namely the Bukit Kangin, Bukit Kauh, and Bukit Kaja forests. The preservation of customary forests pursued by local villages is very unique and traditionally religious. Forest preservation is supported by the existence of customary village regulations or *awig-awig*, community beliefs, myths, religion, and local wisdom.

Research methods

Characteristics of location research

This research was performed in the traditional village of Tenganan Pegringsingan, Karangasem Regency, Bali Province. The forest studied is the forest on Bukit Kangin. Data on useful plants based on the socio-cultural experience of the community were acquired in the local village community. This study uses the Shannon-Wiener diversity index, combining density and dominance. The location of this research is presented in Figure 1.

The population of this study is considered into two aspects, namely the ecosystem aspect and the socio-system aspect. The population of the ecosystem consists of all plant species in Bukit Kangin, while the population in the socio-system aspect is the entire community of the Tenganan Pegringsingan traditional village. The sample of this research from the ecosystem aspect includes plant species covered by a square size of 20 × 20 meters covering tree habitus (nature), 10 × 10 meters covering sapling, and square size of 1 × 1 meter covering seedling habitus. The total is 65 m² (Johnson 1995, Handley and Scrimgeour 1997, Van der Maarel 2005, Wijana 2014). For the community sample, community components were selected, including community leaders (15 persons), the common people (18 persons), senior leaders (5 persons), village heads and staff of village offices (5 persons), traditional villagers (5 persons), and traditional healers/*balian usada* (2 persons). The total sample for the socio system is 50 persons (Van der Maarel 2005). In this study, the public defines traditional community in Pegringsingan village.

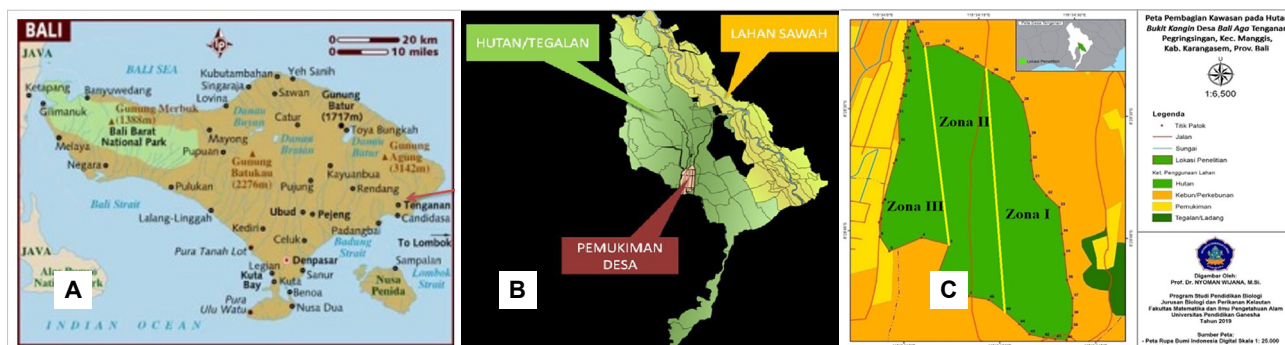


Figure 1. Research location and sampling zone: (A) Bali island, (B) Tenganan Pegriingsingan village, and (C) Bukit Kangin forest

This research requires a variety of tools and materials and instruments for interviews, observations, and questionnaires. The necessary tools such as GPS (Global Positioning System), Compass, Environmental Thermometer, Soil Tester, Anemometer, Hygrometer, Lux Meter, and Altimeter. The materials needed are plastic straps, plastic bags, and herbarium equipment. To collect socio-system data, interview instruments, observation sheets, and questionnaires were needed. Ecological analysis was used to analyse ecosystem data, while data related to socio-systems was analysed descriptively. Descriptive analysis was used to determine the design and strategy for developing forest tourism. The placement of the plots in the field follows the scheme shown in Figure 2.

Biological data was used to determine plant species (local synonyms for plants and scientific plant names), while social data were used to determine the traditional uses of plants. In addition, questionnaires were used to specify further details on the traditional uses of plant species and their conservation. Finally, interviews were used to get answers on the use of plants directly from practitioners.

Social, economic, and biological characteristics

The social characteristics of Tenganan Pegriingsingan are people who strongly adhere to the traditional rules (*awig-awig*). In forest management, the role of traditional villagers is very high. All activities of indigenous people are

based on religious beliefs, myths, and traditions that they have inherited from their ancestors.

Based on economic characteristics, most of the land belongs to the village, although some are privately owned. The results of farmery on the land go to the village treasury and are distributed to the community. In addition, the efforts made by the community are to make *geringsing* cloth (traditional cloth), which is unique to the village. There is an art of making paintings on palm leaves called *prasi*. All the crafts were sold in the art shop and in villagers' respective homes.

Meanwhile, the biological characteristics were investigated on plants in the Bukit Kangin forest, which resources can be used traditionally for picking raw materials for making cloth and craftsmanship, food items, crude medicine, as well as serving Hindu religious ceremonies.

Results

Composition of plant species

In general, the plant species found in the Bukit Kangin forest include Zone I, II, and III. The total plant species found in Bukit Kangin were 77 species belonging to 40 families and amounting 2,574 accessions. The forest area is 32,565 m². Based on standard criteria from the Ministry of Environment in 2004, which states that if the area per hectare of forest is < 1,000 trees (< 1,000 trees/ha), it can be classified as having a low-density level. Based on

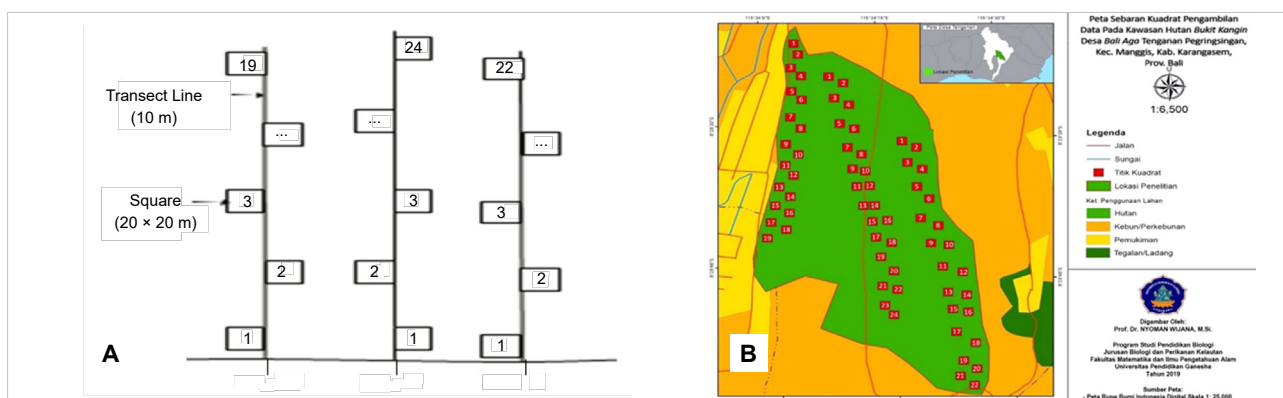


Figure 2. (A) Schematic laying of square plots. (B) A map of the placement of study plots in the field

this statement, it can be concluded that the plant density in the Bukit Kangin research area is low (only 790 trees/ha). From these species' names, both local synonyms and scientific names can be used as supporting data in developing forest tourism destinations. The existing plant species are accompanied by a description of the species and pictures/photos of the plant species in the Bukit Kangin forest. The floristic data has been contained in a book provided with various data for the needs to support forest tourism.

The families with the highest number of species were Moraceae (9 species), Anacardiaceae (6 species), Malvaceae (4 species), and Meliaceae (4 species), respectively. In his case, the families with the lowest number of individuals were Aeraceae, Anacardiaceae, Cucurbitaceae, Dipterocarpaceae, Lauraceae, Malvaceae, Meliaceae, Moraceae and Myrtaceae, each with only one individual. Families with the highest number of individuals were Arecaceae (1,128 units), Malvaceae (201 units), Moraceae (147 units), Apocynaceae (145 units) and Anacardiaceae (120 units), respectively. In this case, the families with the lowest number of individuals were Aecaceae, Cucurbitaceae, and Lauraceae, all of which had only one individual number. Species that have the highest number of individuals are enau palm (*Arenga pinnata* Merr.) with 1,091 individuals (42.38%), bayur (*Pterospermum javanicum* Miq.) (188 individuals) (7.30%) and pule (*Alstonia scholaris* (L.) R.Br.) (145 individuals) (5.63%). Species that have the lowest number of units are salak (*Salacca edulis* (Gaertn.) Voss), anghih (*Lannea coromandelica* (Houtt.) Merr.), dauh (*Dracontomelon mangiferum* Bl.), bitter melon (*Momordica charantia* L.), belalu bali (*Hopea* sp.), avocado (*Persea americana* Mill.), waru (*Hibiscus tiliaceus* L.), kepuh (*Sterculia foetida* L.), suren (*Toona sureni* Merr.), bunut (*Ficus glauca* Dum.Cours), arise (*Artocarpus camansi* Blanco), guava (*Psidium guajava* L.), jangar ulam (*Syzygium polyanthum* Miq.), and juwet (*Syzygium cumini* (L.) Skeels), each species has the number of individuals as much as one individual (0.03%) (Wijana et al. 2021).

Based on the data above, it can be concluded that the family with the highest number of species is the Moraceae family and the dominant species is the enau (*Arenga pinnata* Merr.). Overall, from these data, the plant species in Bukit Kangin are dominated by enau (*Arenga pinnata* Merr.). Thus, in terms of the number of plants, enau are characteristic of the Bukit Kangin forest. Based on this, it is natural for the local community to give the traditional designation of the Bukit Kangin forest with the term *Alas Jake*.

Useful plant species

Data on the total plant species revealed in Bukit Kangin show 46 (60%) of 77 species found are usable plants for the local community, while 31 species (40%) are classified as useless or not used by the local community. Thus, it can be interpreted that most of the plants (60%) are used by local people, while 40% are not used tradition-

ally by local people. There are 31 useful plant families, consisting of 46 useful plant species with 2,249 individual species. The highest number of individuals was detected in the Arecaceae, and the lowest number in the Lauraceae, respectively (Wijana et al. 2021).

The most useful plant species found were enau (*Arenga pinnata* Merr.) (48.51%), bayur (*Pterospermum celebicum* Miq.) (8.35%), pule (*Alstonia scholaris* (L.) R.Br. (6.44%), and ata (*Lygodium circinatum* (Burm.) Sw.) (3.51%). There are 2,574 individuals in Bukit Kangin, and 2,249 (87%) of them belong to useful plants, while 293 (13%) of them belong to non-useful plants (Wijana et al. 2021).

The plants were used for religious ceremonies (65%), medicine (39%), food (37%), housing (28%), crafts (4%), and clothing (4%). The plant species used for religious ceremonies had the highest percentage value (65%). One of the important ceremonies in Tenganan Pegringsingan is the Mekare-kare (pandanus war) ceremony (Wijana et al. 2021).

In utilizing each plant species, the local community does not only utilize one part/organ of the plant. However, there are several species of plants that are used in certain parts/organs. The parts/organs of plants used by the Tenganan Pegringsingan traditional village people who are oriented to the Bali Aga socio-culture are recorded. Based on their utilization, the parts/organs of plants that are utilized can be grouped into 4 sections, namely: 1) plants that are used only for one part of the plant; 2) plants that are used for two parts of the plant; 3) plants that are used for three parts of the plant; and 4) plants where four parts of the plant can be used (Wijana et al. 2021).

Body Symbol Plant species

Body Symbol Plants are plants used to symbolize the human body during cremation ceremonies or at funerals for Balinese Hindus. One stage of the implementation of this ceremony is the *nyiramang* (ceremony/bathing the body). In this ceremony, plants are used as a symbol of human organs (Fatio 2012). In the Tri Mandala area, Tenganan Pegringsingan village has 14 species of plants that are included in the category of body symbol plants. These 14 species belong to 10 families, containing 109 plants. It can be stated that of the 74 plant species in Tri Mandala, 19% are body symbol plant species, and of the 39 (25.6%) families in Tri Mandala are body symbol plant families, while 442 (24.66%) individuals are individual plant symbol of the body. It is known that coconut (*Cocos nucifera* L.) is the body symbol plant species with the largest number of individuals (19 individuals) followed with banana (*Musa paradisiaca* L.) (18 individuals), and peji (*Drymophloeus oliviformis* (Giseke) Mart.) (10 individuals) (Fatio 2012).

The body symbol plant with the least number of individuals is banyan (*Ficus benjamina* L.) which only has 2 individuals, melati (*Jasminum sambac* Ait) with only 3 individuals, and Kecubung (*Datura metel* Linn) in third place with the least number of individuals, i.e. 4 individuals.

Mapping of plant species

Mapping of plant species in the Bukit Kangin forest is intended to determine the location of each plant species in real terms. In Zone I and Zone II, it is clear that the dominant plant species is the species of *enau* (*Arenga pin-nata* Merr.). In Zone III, it can be seen from the number of species that various plant species are distributed in groups. In other words, the number of plant species in Zone III is more than in Zones I and II. Zone II is the study area with the highest number of species, namely 34 plant species. Whereas Zone I is the study area with the highest number of individual species, namely 968 individual plant species (Wijana et al. 2021).

Besides mapping the overall vegetation in Bukit Kangin, a mapping of the distribution of useful plant species was also made. The mapping results show that Zone II is the study area that has the highest number of species, namely 34 plant species, while Zone III has 31 species and Zone I has the least number of species, namely 27 species. The number of individual species, Zone I has the highest number of individual species, namely 968 individual plant species, while Zone II has 687 individual species, and Zone III has the least number of individuals, namely 596 individual species.

Socio-culture in forest conservation

Related to the conservation efforts of the Bukit Kangin forest in Tenganan Pegringsingan village, namely, the community applies local wisdom, aspects of religion, myths, and the *awig-awig* (customary village rules). In the *awig-awig* of Tenganan Pegringsingan village, it is written in article 7 that the forest in the Tenganan Pegringsingan area is a forest belonging to a customary village, so its preservation is very much maintained. In terms of local wisdom, the community is guided to be wise in interacting with the biophysical and supernatural environment. From the religious aspect of the community on certain holidays/feasts for plants (Tumpek Uduh/Tumpeg Ngatag), the people in this village bring offerings in the area of the Tenganan Pegringsingan forest, since people still believe that there are certain holidays to worship Ida Sang Hyang Widhi Wasa (God Almighty), involved with the existence of the Tenganan Pegringsingan forest. In terms of historical myths, Tenganan Pegringsingan village, involved with the existence of an Onceswara horse, which is now used as a barrier to the village of Tenganan Pegringsingan (Astawa et al. 2019).

A questionnaire was distributed on the village workshop of Tenganan Pegringsingan, to Kelian Desa, community leaders, and youth groups to find out the conservation aspects in the community management of the Tenganan Pegringsingan forest. The results related to the sample views of the entire Tenganan Pegringsingan village community, which are related to the knowledge of conservation, trust,

the *awig-awig*, and logic, can be conveyed in the sample of the Tenganan Pegringsingan village. The data shows that the village head had a total score of 187 (83.1%), while the sample of village staff had a total score of 190 (84.4%). Furthermore, the sample of community leaders had a total score of 189 (84%). In general, the population sample had a total score of 190 (84.4%). The sample of leaders had score of 191 (88.8%). The sample of youth group had a total score of 200 (88.8%). Thus, it can be stated that most of the people in Tenganan Pegringsingan village know very well about knowledge of forest functions and customary forest conservation, belief in customary forest management, the *awig-awig* in customary forest management, and logic in preserving Tenganan Pegringsingan customary forest (Astawa et al. 2019).

The data on forest conservation for the village of Tenganan Pegringsingan show that the village head received a total score of 187 (83.1%), village staff of 190 (84.4%), community leaders of 189 (84%), the common people of 189 (84%), elderly of 191 (84.4%), and youth group of 195 (88%). From the 20 samples, they fall into the very good category. Thus, it can be stated that the community in Tenganan Pegringsingan village has a very good view of knowledge, forest functions, preservation of customary forests, belief in customary forest management, the village *awig-awig*, and logic in forest conservation (Astawa et al. 2019).

Forest management is regulated with the aim of community welfare. However, traditional villages have special rights in the form of *ngalang*, *ngambeng*, *ngambang*, and *ngerampag* for religious ceremonies (Hinduism). *Ngalang* is the right to take 7 coconuts, 5 comb of bananas, 9 pineapples, 1 jackfruit, mango, *wani* (*Mangifera caesia* Jack), duku (*Lansium domesticum* Jack), kepundung (*Baccaurea racemosa* Mull.Arg.), ron (palm leaves), edema (coconut leaf), and 1 bamboo stick per clump. *Ngambeng* is the right to take *tuak* (a drink made through palm fruit processing) in quantity of *atakeh* (a certain volume unit) and *acutak* (a certain volume unit), according to the need. *Ngambang* is the right to catch one chick per parent. Meanwhile, *ngerampag* is the right to cut 1 tree per *cutak* (measure of unit area) (Wijana and Setiawan 2019).

There are several regulations according to the criteria for use in terms of felling trees, namely firewood, building material wood, *penaho*, *pengapih* (wean), and *tumapung*. Firewood is felling for firewood, generally coming from the *cutat* (*Planchonia valida* (Bi.) BL), *bayur* (*Pterospermum celebicum* Miq.), *wangkal* (*Albizia procera* (Roxb.) Benth.), *poh* (*Mangifera indica* L.), *pakel* (*Mangifera odorata* Griff.), *gatep* (*Inocarpus fagiferus* (Parkinson) Fosberg), and other trees. Construction material wood for building purposes is derived from jackfruit, *tehep*, durian, *cempaka*, *blalu*, and palm trees, provided that only trees to the west of the river in the village may be felled, while the trees next to it or north of the village should not be cut down. *Penaho* is *kekeran* wood (a tree that is deliberately maintained) that grows in *tegal nyuh* (coconut plantation)

and can be felled only if the plant covers other plants (*penaho*). Weaning (*Pengapih*) is logging for thinning purposes.

In addition to the rules of tree felling, there are other rules called *nuduk ulung-ulungan* (picking up fruit that falls from the tree), collecting forest products, namely four types of fruits: durian (*Durio zibethinus* Murr.), *pangi* (*Mangifera caesia* Jack), hazelnut (*Aleurites moluccanus* Willd), and *tehep* (*Artocarpus elasticus* Reinw.). Land-owners cannot pick these four types of fruits but fallen fruit can be picked by anyone (McLain et al. 2014).

The historical heritage, which is related to the history of the village, is in the form of megalithic relics (stones). These relics are considered sacred or worship places for the local community. The first place is Kaki Dukun. This place is located on a hill in the northern part of Tenganan Pegringsingan village. It resembles the phallus (pubic) of a horse in an upright state. People say that if a husband and wife do not have children in their marriage, they ask the Kaki Dukun sanctuary so that they can have offspring. The second place is Batu Taikik/Talikik. This holy place is also found on the northern hill. It is the largest monolith in the Tenganan Pegringsingan village area. The Batu Taikik is considered the traces of Onceswara's stomach contents or visceral. The ceremony held here aims to ask for prosperity. The third place is Penimbalan. This holy place is located on Papuhur hill in the western part of Tenganan Pegringsingan village. This hoarding is in the form of a monolith that the local community considers a former horse's thigh. The ceremony held in this place is related to the ceremony for Teruna Nyoman (people who have just reached adulthood). The fourth place is Batu Jaran. This holy place is in the northern part which is considered as the place of death of Onceswara the horse. Since these places, which are situated in the middle of the forest, are considered sacred by the local community, so that the forest is also purified. With this belief, the forest remains sustainable.

The village regulations (*awig-awig*) regarding the utilization of forest products which are quite "complex" are related to the historical story of founding Tenganan

Pegringsingan traditional village which was able to shape wisdom and awareness that the area they occupy is a gift from Ida Sang Hyang Widhi Wasa (God the Almighty). Thus, it should be respected, maintained, and preserved. This myth is believed to have contributed significantly to the sustainability of Tenganan Pegringsingan village (Jonarta et al. 2019, Suyadnya 2019). The sacred places, where the body of Onceswara the horse, are located can be seen in Figure 3.

Thus, it can be concluded that the forest management efforts executed by the people of Tenganan Pegringsingan are based on the traditional rules (*awig-awig*), which reflect local wisdom and respect of religious principles and myths that are believed from generation to generation. This effort has proven to be quite effective in maintaining the richness of plant species in the area.

Existing conditions of tourism

The name of Tenganan Pegringsingan village is well known worldwide in the tourism sector. This village is known as a traditional village. This village is famous for cultural tourism, especially the tradition of pandanus warfare (*mekare-kare*) (Astawa et al. 2019).

This Oceanic ceremony preceded the procession, then followed by a *mabuang* ceremony, then symbolically preceded by *mekare* (Aryandari 2010). The Pandan War Ceremony (*Mekare-kare*) in Tenganan Pegringsingan village can be seen in Figure 4.

Besides the traditional *Mekare-kare* ceremony (pandanus war), there is also a traditional residential layout as tourist destination. The layout and management of settlements in Tenganan Pegringsingan village with road facilities are still characterized by rocky and terraced roads (see Figure 5). The shape of the settlement layout is linear. The house's condition is still traditional, with a unique shape, and the condition of the building has not changed from the past until now.

As an agricultural village, the livelihoods of the residents of Tenganan Pegringsingan traditional village are

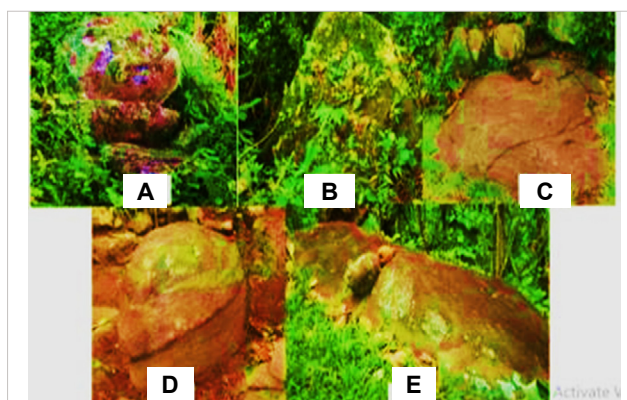


Figure 3. Sacred places where the stones symbolising the body of Onceswara the horse are located: (A) Pura Batu Keben, (B) Batu Jaran, (C) Pura Rambut Pule, (D) Pura Kaki Dukun, (E) Pura Taikik (Source: village documentation)



Figure 4. Pandanus War ceremony (*Mekare-kare*) in Tenganan Pegringsingan village



Figure 5. (A) A spatial layout of Tenganan Pegringsingan village. (B) The gate of Tenganan Pegringsingan village. (C) A traditional house of Tenganan Pegringsingan village

generally rice farmers, but a few of them are craftsmen. The typical handicrafts of Tenganan Pegringsingan traditional village include woven bamboo, carvings, paintings on palm leaves, and woven fabrics (see Figure 6). The woven cloth made by the villagers is named the Gringsing cloth as a typical souvenir for tourism that is in demand by tourists. The Gringsing cloth is done using the double tie technique. This technique is the only one in Indonesia, so the Gringsing cloth, made by the Tenganan Pegringsingan people, is very well known worldwide.

Discussion

Forest tourism development prospects

It has been found that the composition of plant species consists of 77 species belonging to 40 families, and



Figure 6. Community handicrafts in Tenganan Pegringsingan village (A, B – prasi; C, D – Gringsing cloth; D, E – ate crafts)

2,574 individuals. The forest area is 32,565 m². The results of this study are used as an introduction to various plant species in the ecosystem. Examples of the various plant species that can be familiarised are presented in Table 1.

Ata plant (*Lygodium circinatum* (Burm.) Sw.) is considered rare. The local community often uses this plant as a household material in making handicrafts for bags and chairs. This plant condition is increasingly being found in the Bukit Kangin forest. This plant currently requires intensive conservation.

Palm or sugar palm (*Arenga pinnata* Merr) is a plant that is very much found in the Bukit Kangin forest. Therefore, the Bukit Kangin forest is known as the *Jaka* forest (*jaka* = sugar palm). This plant is often used as an ingredient of *tuak* and as a palm fibre producer. Uniquely, this *jaka* plant product is not allowed to be sold outside the village. Thus, this product is specifically for your own needs.

Durian plant (*Durio zibethinus* Murr) as one of the plants (from 4 types of plants, namely *durian* (*Durio zibethinus* Murr), *pangi* (*Mangifera caesia* Jack), hazelnut (*Aleurites moluccanus* Willd), and *tehep* (*Artocarpus elasticus* Reinw)) is a “social” plant, meaning that the fruit of this plant can be found or picked by local residents even if there are cultivars. This means that the cultivars may not be prohibited to the residents who want or need these fruits (Parker et al. 2012).

Useful plants, as explained above, are very supportive in developing forest tourism in the village. Table 2 pro-

Table 1. Some examples of plant species in the Bukit Kangin forest with descriptions









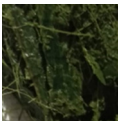


No	Pictures/Photos	Systematics and a brief description
1	Ata/Hata 	Kingdom : Plantae Division : Pteridophyta Class : Pteridopsida Order : Schizaeales Family : Lygodiaceae Genera : Lygodium Species : <i>Lygodium circinatum</i> (Burm.) Sw. Habitus shrub, round stem, single leaf with flat-leaf edges, having tendrils
2	Enau 	Kingdom : Plantae Division : Magnoliophyta Class : Liliopsida Order : Arecales Family : Arecaceae Genera : Arenga Species : <i>Arenga pinnata</i> Merr. Plant height reaches 15 m. In the stem there is a pith that can be used as food in the form of sago. The shape of the leaf bones? is finned, the inflorescence is in the form of a stranger? with a series of hanging flowers. The fruit is round with three seeds. The skin of the fruit contains oxalate crystals that cause itching on the skin
3	Durian 	Kingdom : Plantae Division : Magnoliophyta Class : Magnoliopsida Order : Malvales Family : Bombacaceae Genera : Durio Species : <i>Durio zibethinus</i> Murr. This tree can reach 15–30 m in height, has woody trunk with sympodial branching, single oval leaves with greenish white colour, single flower, round fruit with spines on its surface. Durian can grow well in areas with an altitude of 200–1,000 m above sea level

Table 2. Some examples of useful plants, methods of manufacture, and their products

No	Species	Methods of manufacture	Products
1	Kepunding (<i>Baccaurea racemosa</i> Mull.Arg.) 	Red dye on Geringsing Fabric, by: 1) Babakan (bark) of the kepunding tree is cut into several parts; 2) The pieces of babakan kepunding are dried under the sun to dry; 3) Babakan kepunding which has been dried and then milled until smooth; 4) Babakan kepunding which has become flour is added with water and noni root bark to soak the thread for 3 days, then let stand for 2 months; 5) The process is repeated 4–5 times until the red colour is even and as desired.	 Red thread of Geringsing cloth
2	Enau (<i>Arenga pinata</i> Merr.) 	Consumed with tuak: 1) The palm flowers are beaten using a tool every day for one week; 2) The flowers are cut and the sap that comes out is collected into the container that has been prepared; 3) The collected juice of the sap is transferred to a larger container and added with cuttings (stem bark); 4) Let stand for 3 days.	 Tuak/Nira
3	Kerasi (<i>Lantana camara</i> L.) 	Used to treat ulcers by: 1) Pound a few leaves until smooth; 2) Then attached to the part of the body that has ulcers. Make changes 2–3 times a day.	 Boreh daun kerasi
4	Pandan medui (<i>Pandanus tectorius</i> B.C. Stone) 	Used for Mekered. Several spiky pandan leaves which are joined together and then tied using a rope made of Bamboo Tali. Mekered is used during mekare-kare ceremonies	 Mekered

vides useful plants, including traditional manufacturing methods and their products.

From some of the examples of plants above, it can be said that the use of useful plants can be in the form of clothing, food, medicine potions and for holding ceremonies (Hindu). The way they are made is traditional: products made from useful plant species are natural and free of chemicals when consumed. The utilization of these useful plants is very supportive of the development of forest tourism and the creative economy.

Mapping of vegetation and climatic factors

Mapping the distribution of plant species in the Bukit Kangan forest is very supportive of the design of forest tourism development. The usefulness of this vegetation mapping is especially in knowing the position of the point of plant growth naturally in the original forest. The map of local plant species distribution will be in service as a reference tool for local guides and tourists when it comes to introducing plants in terms of regional names, scientific names, descriptions of plants, benefits of plants, myths about plants, plant ecological conditions, etc. (Wijana et al. 2021). The plant vegetation map is presented in Figure 7.

Body symbol plants

One of the features of uniqueness of Balinese society is the symbolization of human body parts with 18 characters (*hanacaraka*). The characters in the organs of the body become a symbol of the equilibrium and harmonization of the macrocosmic and microcosmic relationships. The parts of the body are marked with *hanacaraka* (Balinese script) characters, starting from the head, body, limbs, and internal contents (visceral organs). This division of the body is called *Tri Angga*. The symbolization of body characters with certain plant species is written on palm leaves which contain many philosophical meanings, namely the palm tree of *Taru Pinaka Raganta* (plants as symbols of the body) (Tahu et al. 2019). The symbolization of the use of this plant is very clear at the time. According to Hinduism, there is a funeral ceremony, namely the Ngaben (cremation), accompanied by various *bebantenan* or means

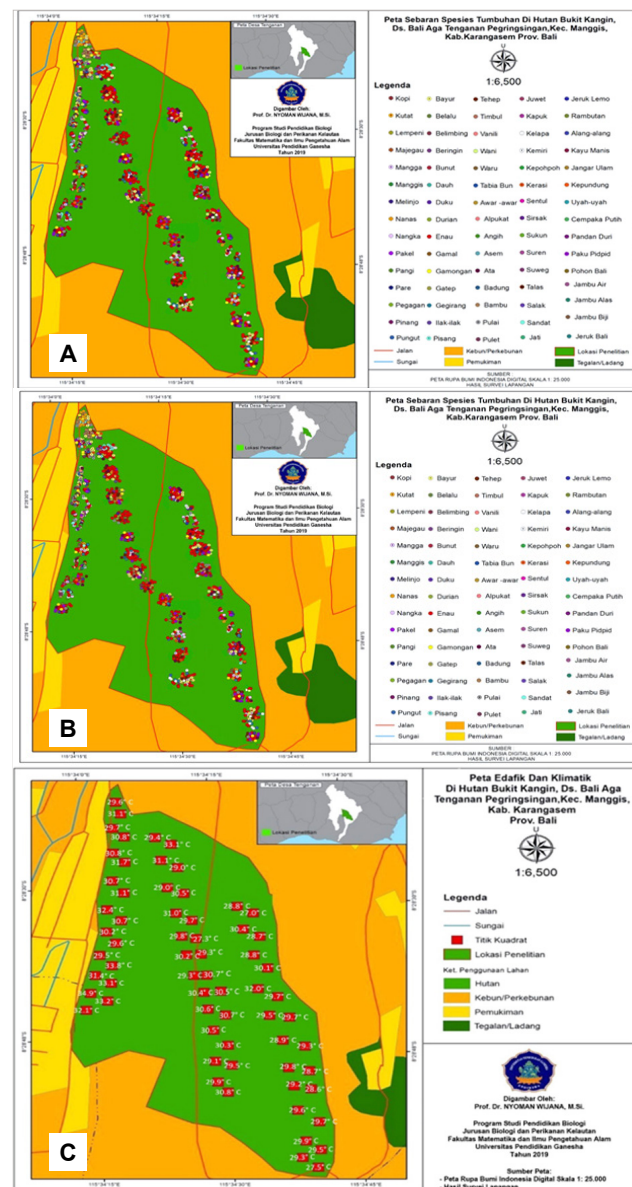


Figure 7. Vegetation and climate map. (A) Overall plant species composition. (B) Useful plant species. (C) Climatic factor (temperature) at each point square

Table 3. Some examples of body symbol plants




No	Script Parts of body	Plants	Picture/Photos	Information
1	(Ang Ung Mang)	Beringin, or benjamin fig? (<i>Ficus benjamina</i> L.)?		The <u>banyan tree</u> [<i>Ficus benghalensis</i>]? is intended as a plant for inhabitants of the realm of heaven, so the distribution of this plant is quite narrow because this tree is often sacred
2	(Ra) Lubang Telinga/ Rambut	Kayu Sugih (<i>Dracaena angustifolia</i> Roxb.)		The leaves of <i>suji</i> wood form a pattern that resembles an ear hole when observed from above as in the photo on the side, and the leaves are seen as a circle (swirl of the ear canal)
3	(Ang) Vagina	Teleng (<i>Clitoria ternatea</i> L.)		The shape of the <i>teleng</i> flower has similarities with the vagina, complete with the shape of the vaginal lips (labium) and clitoris



Figure 8. Research results contained in the book: (A) Ecology and Flora of Bali, (B) Useful Plants Based on Balinese Local Wisdom

ceremonies. However, in Tenganan Pegringsingan village, they do not know the existence of *Ngaben*, but they carry out the *mendem* ceremony at the funeral ceremony of the corpse. Even though they do not know about the *Ngaben* ceremony, neither in the village, nor in other parts of Bali, the body symbol plant remains in the Tri Mandala authority in the village. This means that their conservation is based on the *Tri Hita Karana* philosophy that they have received from their ancestors' formal teaching, but in a traditional form of cultural content that exist in the local village and are regulated by the village's *awig-awig*. Therefore, the implementation of the *Tri Hita Karana* philosophy has been practiced since their ancestors (Tahu et al. 2019).

In residential land and village spatial planning, various plant symbols of the body are found in each of the Tri Mandala (a traditional spatial planning division). Some examples of plant body symbols found are presented in Table 3.

All the research results mentioned above have been compiled in the form of a book that has been published nationally, making it easier to use as a reference for local guides.

The implementation of forest conservation in Tenganan Pegringsingan village is very good. This can be seen from the results of the analysis of the questionnaire distributed among respondents. Most of the people in Tenganan Pegringsingan village know very well about knowledge of forest functions and preservation of customary forests, belief in customary forest management, the *awig-awig* in customary forest management, and logics in preservation of the traditional forest of Tenganan Pegringsingan. Several things can be used as an attractive supporting basis to be used in the development of forest tourism, especially in conservation. For example, there are the concepts of *ngalang*, *ngambeng*, *ngambang*, *ngerampag*, *penaho*, *pengapih tumapung*, and accomplished sitting. This concept regulates the sustainability of ecosystems and socioecosystems that lead to sustainability. In addition, there is a concept from the village history which later evolves into a religious belief that is believed from generation to generation. The distribution of the location where the carcass of the body of *Onceswara* the horse was found to be used as a holy place, such as *Pura Batu Keben*, *Batu Jaran*, *Pura Rambut Pule*, *Pura Kaki Dukun*, and *Pura Taikik*. This location is in the middle of a forest (hill) and is considered sacred so

that the forest (hill) remains sustainable. On the other hand, the customary rules (*awig-awig*) which are strong enough and obeyed by all members of indigenous peoples greatly contribute to the conservation of vegetation, culture, and religion. All of these conservation models can be used as the basis for promotion in the development of forest tourism in a unique and traditional conservation arrangement (Elsasser 2004, Kiss 2004, Bhuiyan, et al. 2010).

The existing conditions of tourist destinations that attract tourists can be used to promote forest tourism as an alternative and complementary tourist destination. Domestic and foreign tourists who come to the village are focused on the unique socio-cultural characteristics of the village. If there are still tourist destinations, the natural view on the hill is very amazing. This site has not been planned systematically and has not got on schedules of tour operators and tourists. Cooperation with tourism actors is very important. Increasing local human resources needs to be educated so that complementary tourism become better known.

Academically, there have been many studies on the economic value of forests to tourism activities (Aldyan 2020). The value of forest recreation in Germany is nearly USD 2.2 billion per year. In addition, local people living in close proximity to protected areas make significant profits from tourism by selling handicrafts, providing accommodation, and services. Wijana and Setiawan (2019), Sujarwo et al. (2015), Sujarwo et al. (2016), and Sujarwo et al. (2014) found members of local communities who in the Amazon region of Ecuador receive significant economic benefits from the tourism sector compared to other sources of monetary income. More people worked in restaurants, bars, and other tourism-related infrastructure in national parks and protected areas in Sweden (Jacobson and Robles 1992). Furthermore, Lundmark et al. (2010) explains that tourism forestry provides jobs for local people, such as drivers, local guides, waiters/waitresses and hotel staff, with the local economy benefiting from the multiplier effect generated by the circulation of their income through the community.

Forest tourism is an important part of educational tourism (Bhuiyan et al. 2010). In the forest, students can study natural ecosystems, the diversity of local flora and fauna, and nature conservation. Students can also study the living conditions of animals and plants in forest areas

and learn how to protect these ecosystems (Bhuiyan et al. 2010). Educational tourism is a valuable learning system for tourists and local communities. Therefore, the findings from this study can be valuable knowledge for tourism managers in the Ubud Monkey Forest to label medicinal plants in this area to be used as materials for educational tourism. This study makes it easier for teachers, students, and local guides to get to know the types of medicinal plants in the forest and learn the benefits of each plant for natural medicine.

Forest tourism is considered to be an effective method for conserving forest resources and protecting ecosystems and biodiversity (Hoque et al. 2018). Furthermore, they explained that the development of forest-based tourism can increase the awareness of local communities to conserve forest ecosystems and attract more visitors. In addition, forest-based tourism generates income for local people, thereby reducing forest dwellers in the destination area.

The local community in Ubud (Bali) has effectively protected flora and fauna in the Monkey Forest. They argue that forest tourism has increased the awareness of local communities to conserve the environment in the Ubud Monkey Forest and to protect the attractiveness of tourist destinations (Elsasser 2004). The availability of medicinal plants in the Ubud Monkey Forest can be an additional attraction for visitors. For certain medicinal plants, visitors are allowed to take some plants for medicinal purposes. However, tourism stakeholders must ensure that the use of the natural environment is sustainable to achieve the long-term sustainability of forest recreational tourism (Lee et al. 2010, Batoro et al. 2017).

Conclusions

From the results of this study, it can be concluded the following: (1) the results of ethnoecological studies in the Bukit Kangin forest, Tenganan Pegriingsingan village, Karangasem, Bali, has the prospect of being developed into forest tourist destination as an alternative and complementary one; (2) some of the results of ethnoecological studies complemented by sociological studies that interact with each other can be in the form of plant species composition, complete with descriptions, utilization, processing methods, and products of useful plant species based on local wisdom.

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