



Ethnoecology of Kaleka: Dayak's Agroforestry in Kapuas, Central Kalimantan Indonesia

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Abstract

*The aims of the research were to describe the socio-cultural aspect of Kaleka and its floristic diversity. The research was done in two villages in Central Kalimantan, namely, Dahian Tambuk and Tumbang Danau. This study confirms that Kaleka plays an important role in social, cultural and economical aspects of Dayak Kapuas. Plant resources in Kaleka are used and distributed by following two basic principles, namely, equality and sustainability. Local people's respect to their ancestors is implemented in maintaining and preserving Kaleka in good quality over generations. The philosophical aspect of local people in such villages contributes to Kaleka preservation in the modern era. Kaleka is habitat for many plant species, ranging from understory to upperstory. The species *D. Zibethinus*, *A. heterophyllus*, *L. domesticum*, *C. nucifera*, *C. domestica*, *N. lappaceum*, *D. kutejensis*, and *A. catechu* are the most important to local people's needs. Many species which are found in Kaleka are local and endemic to Kalimantan Island encompassing *S. koetjape*, *M. casturi*, *D. kutejensis*, *B. motleyana* and *P. canescens*. These fact shows that Kaleka is potential to be promoted as a key for biodiversity conservation in Central Kalimantan.*

Keywords: Indigenous knowledge, tropical biodiversity, conservation, home gardens.

Introduction

Attempts to conserve Indonesian biodiversity has been focused on exploring the potential contribution of indigenous knowledge systems. It is particularly significant due to indigenous systems recently have been acknowledged as effective tools in resource conservation¹⁻³. In Indonesia, such discussion has become crucial because Indonesia is habitat for numerous biodiversity. The biodiversity of Indonesia, ranging from genes, species and ecosystem, has been recognized to play crucial roles in global live in biosphere. Indonesia is also endowed by diverse tribal communities with unique social and cultural background.

Indigenous knowledge has been recognized to contribute to inland management practices, particularly in order to achieve its sustainability. Agro-forestry and home gardens are the manifestation of traditional practices in land management which is nowadays still being practiced. Scholars point out that such practices not only contribute to biodiversity preservation, but it also provides additional farmer subsistence. Agroforestry provides opportunities to increase the socio-economic viability of small farmers. The diverse cultural and social background of Indonesian lead each community to implement different systems of agroforestry praxis^{3,4}. Among them, Javanese home gardens (*pekarangan*) have been studied by many authors as a model of tropical biodiversity conservation in rural society. The

community in West Sumatra has developed an agroforestry system called "Parak Maninjau"⁵. In West Papua, the diversity of species composing the home gardens potentially contributes to tourism development and lake conservation.

Kalimantan Island has been recognized as an important area in the biosphere which contains high biodiversity. Located in tropical regions, this area is endowed by large area of tropical forest. The significant of Kalimantan's biodiversity in global ecological systems has been widely recognized. In the global warming context, Kalimantan's tropical forest is one of the crucial ecosystem in carbon capture and sequestrations. The tropical forests of Kalimantan are habitat for many medical plants species which are important in the recent health issues⁶. Nevertheless, problems of forest decline recently become significant issues in Kalimantan. Attempts to identify roots of the problems and designing mechanisms to conserve the Kalimantan's biodiversity are numerous. Many studies conclude that economical, social, and political aspects are closely related to the rapid forest degradation. The economic prospect of timber leads to the increase of logging activity. Forest preservation has limited supports from local people. Politically, there are many top-down approaches being implemented without involving the local people's participation. These lead the forest conservation efforts to fail in implementation. As far, the rate of deforestation is high^{7,8}.

One of the potential approaches to conserve the Kalimantan's biodiversity comes from the local wisdom of indigenous people. Kalimantan is home to Dayak tribal community with rich culture and traditions to use natural resources. Dayak can be grouped into 7 clans, namely Dayak Apu Kayan, Dayak Iban, Dayak Ketungau, Dayak Nurut, Dayak Punan, Dayak of Danum, and Dayak Ngaju⁹. Dayak Ngaju for a long time has been practicing the agroforestry system that allows biodiversity to be conserved. There also cultural aspects that allow such agroforestry to remain untransformed into other land uses, such as palm oil plantation. This situation provides opportunities for biodiversity conservation in the situation where rapid deforestation is still high in Kalimantan. According to Dayak Ngaju, this form of agroforestry is called the "Kaleka" system. While Kaleka plays an important role in biodiversity conservation, no further information for this is available. The aim of the study is to describe the Kaleka as an agroforestry system in Central Kalimantan. The focus will be paid to the socio-cultural aspects of Kaleka and plant species diversity and its uses inside the Kaleka system.

Methodology

Study Sites: This study was done in two villages in Gunung Mas Regency, Central Kalimantan, namely, Tumbang Danau and Dahian Tambuk. Geographically, these area are located at the heart of Kalimantan Island (figure 1). These villages administratively belong to Mihing Raya sub district. Gunung Mas area has humid tropical climates with the average temperature ranging from 20 to 23°C. The altitude of the study sites is 100 – 500 m asl. The highest rainfall was recorded in

March (856.1 mm) and the lowest was in September 68.4 mm. This area is rich in terms of biodiversity and ecosystem types. The recent status of the humid tropical forest ranges from pristine to degraded forest. The pristine tropical forest ultimately consists of Dipterocarpacea, including giant species of *Shorea* spp. In many parts of the district, the tropical forest is heavily degraded and the vegetation is completely removed. Logging and mining particularly contributes to the forest degradation. The barren land often is occupied by *Imperata cylindrica*. The pressure of population and economic growth lead to the conversion of the forest area into settlements and agricultural lands¹⁰. In many parts of Gunung Mas area, rubber plantation recently was flourish and considered as an important farming activity. According to statistical data, the people's density is about 10.68 persons per Km². The community of such villages is dominated by Dayak Ngaju. The rubber plantation is one of the significant agriculture industry¹¹.

Methods: The philosophical aspect of Dayak Ngaju is rarely found in modern literature. In such a case, the socio-cultural aspect of Dayak Ngaju and Kaleka system can only be done through interviews with elderly people. In this study, such data were generated from interview process with several informants. One informant was an old Dayak, Mr. Yahter Nathan Ilon, who was born on Hurung Bunut in 1929. The interview with Mr. Ilon was conducted several times at his house. The basic principles of the socio-cultural aspect of the live of Dayak Ngaju were asked, encompassing the spiritual belief of the local people in Dayak Ngaju, the social value of Kaleka, management and ownership of Kaleka.

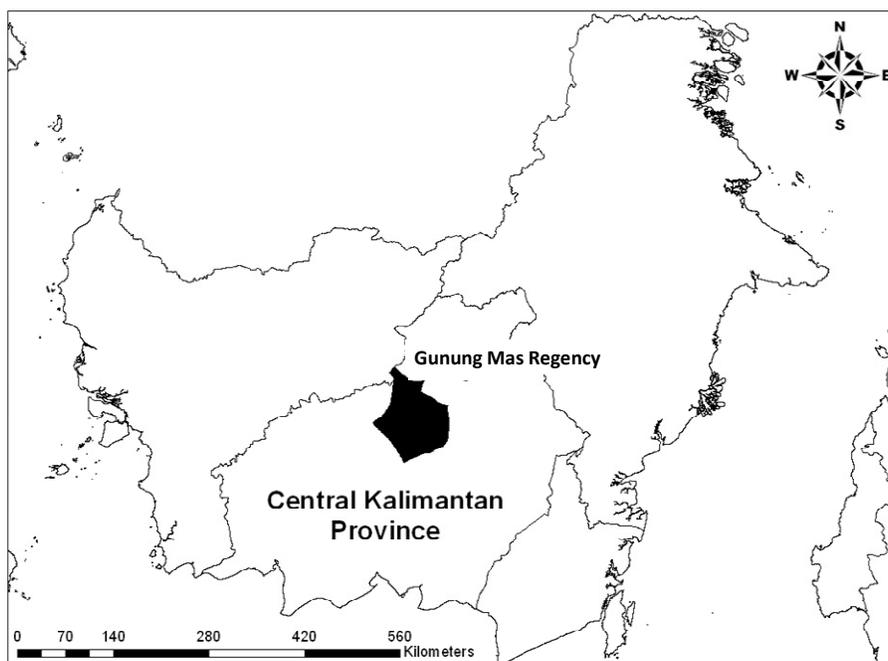


Figure-1
The location of study site located in the hearth of Kalimantan Island

Two villages in Gunung Mas Regency, namely, Tumbang Danau dan Dahian Tambuk, were chosen as the study areas. The field works were carried out from September to December 2012. A floristic survey was conducted at several Kaleka in both study sites, focusing on the plant trees species. Totally, twenty plots by 10 x 10 m were established in Tumbang Danau dan Dahian Tambuk. In each plot, the plant trees species were identified and their roles in human's daily life were asked to the informants. The informants consisted of the Kaleka owner, farmers, and the villages' official. The ages of informants varied from 45 to 70 years old. In many occasion, the interviews were done in field and house with appointment. The plants were identified using field guide books and with the help of the local people. The floristic survey was addressed to provide basic data on plants diversity which is used by local people. The local name of the plants, the form of plant uses and management were recorded. In this research, only valuable species were taken into account and analyzed. The data were analyzed descriptively. The importance of species in Kaleka system was calculated by using cultural important index¹².

Results and Discussion

Socio-ecological Aspect of Kaleka: Dayak Ngaju lives in traditional belief and spirituality called "*Kaharingan*". In Indonesian national religion classification, *Kaharingan* is classified as Hindu religion. As many local beliefs in the world, the *Kaharingan* respects nature as an integral part of the human live in the world. The philosophical live of Dayak Ngaju provides basic principles to see flora-fauna as an integral part of community live. Dayak Ngaju believes that biosphere and its component is holistic living systems which should be respected to ensure human prosperity. Many components have their own spiritual value. According to Dayak people, big trees are home of unseen creatures with somewhat "spiritual" power. They were also prohibited to hunt and kill animals without any purposes. This local respect to the environment seems to be similar among traditional people around the world. This aspect becomes the significant key for community-based conservation action^{13,14}.

Kaleka is a traditional family-based land tenure which is derived from one ancestor in the past. The average size ranges from about 1 to 2 ha, but some Kalakas have areas of more than 5 ha large. Kaleka contains many plant trees and represents the climax agroforestry systems. The climax is indicated by an abundance of giant and tall trees with huge canopy, and it is rich in terms the species in the middle and under storey. According to the informants, their ancestors practiced agroforestry by maintaining native plant trees to grow and introducing new species in the Kaleka systems. Old Dayaks concern with the sustainability of Dayak generation by establishing Kaleka with numerous economic plants species. According to the informants, recent profit sharing among family members are related to the economical benefits of Kaleka (i.e. fruit harvesting), being distributed equally among them. Each party receives their percentage according to their role and cultural

status. As far, there are no conflicts reported regarding the profit sharing distribution, reflecting the stability and sustainability of the Kaleka management. Among Dayak Ngaju people, selling Kaleka is considered as taboo and prohibited. Such practices will decrease family social status in the village community and are psychologically believed to trigger negative impacts to the family.

In Kaleka, ancient tombs often stand inside Kaleka as a social and spiritual monument. Both in Dahian Tambuk and Tumbang Danau, most of the people build the tombs under the giant canopy of trees. The informants argued that the supra-natural power of the ancient tombs maintained positive aura of Kaleka and protected Kaleka from human's bad attitudes. *Kaharingan* system believes that their ancestors remain living in the other unseen world. In many occasion, there was a traditional ceremony in Kaleka, called "*Balian*", as a ceremonial to respect their ancestor. Kaleka was said as home of ancestors and, therefore, should be respected. Kaleka was considered sacred and any activities without positive meaning were prohibited. These local people's perceptions seem to be similar with local people around the world¹⁵⁻¹⁷.

Such socio-culturally aspects allow biodiversity of Kaleka to be conserved and lead some species to grow wild. The local people's respect to Kaleka keeps such agroforestry in excellent conditions. In many cases, the structure is similar to the tropical rain forest.

Plant Diversity and Category Use: Kalimantan is famous for its luxurious tropical forest with its numerous biodiversity inside. The Kalimantan's forest is characterized by *Dipterocarpacea* which can reach 35 m in tall and form huge canopy⁸. The environmental setting of Gunung Mas provides an excellent abiotic factor for plant diversity in Kaleka. The altitude, rainfall and temperature of Gunung Mas regency support the plant diversity in Kaleka.

Structurally, the Kaleka consists of many plant species forming multi stratum, similar with secondary, and climax tropical forest. This complex mixture of plants in Kaleka shows its characters as a humid tropical forest. The species in Kaleka can be classified into ground cover, understorey vegetation, and upper storey. The ground cover consists of small herbs, dwarf grasses, Aroids and fern. Some medical plants also becomes ground cover species, such as *C. domestica*, *Z. officinale* and *A. galanga*. These species grow wild in the Kaleka system. Understorey species consist of young bamboo clumps and banana. Rattans become the significant climber in Kaleka. These species receive less solar radiation and many species are shade tolerant. The upper storey consists of woody trees such as *D. zibethinus*, *D. kutejensis* *G. mangostana*, *C. nucifera*. The old Durian can reach 30 to 35 m in tall. In many Kaleka, tall and giant *D. zibethinus* are frequently found and seem to be the indicator for old Kaleka. These vertical stratifications represent the ultimate characteristics of tropical rain forest in Kalimantan Island¹⁸.

At least, the local people in Tumbang Danau mentioned about 32 species, while the Dahian Tambuk's mentioned about 34 species. These species range from medical herbs to giant trees. Culturally, *D. Zibethinus*, *A. heterophyllus*, *L. domesticum*, *C. nucifera*, *C. domestica*, *N. lappaceum*, *D. kutejensis*, and *A. catechu* are the common species with the highest cultural important index both in Tumbang Danau and Dahian Tambuk (Table 1). The Cultural Important Index is able to show us which species are the most important to the local people's needs. There are remarkable similarities in the utilization of such species in the two villages. The most frequently utilized are fruit trees. According to the informants, the plant species in Kaleka are particularly used to meet some basic needs, such as for food, medical plants, economic resources, fuel wood, material for civil construction, animal feed and material for furniture. These plants' usage categories indicate that the plants in Kaleka are important for the local people. The pattern of plant usage in Kaleka by local people seems to be similar with other local communities in Java, Sumatra and other parts in Indonesia^{19,20}. Compared to the other home garden system, however, Kaleka contains less exotic species. Many of them belong to the native species of Kalimantan Island.

Recently, *Hevea brasiliensis* has intensively been introduced in Kaleka systems and planted ultimately for cash income. Interestingly, other plant with an economic value such as oil palm (*Elaeis guineensis*) is absent in Kaleka. There seems to be little interest on the oil palm cultivation among Kaleka. It is particularly interesting due to the fact that oil palm is recently planted intensively in many sites in Kalimantan. The statistics from Gunung Mas Regency confirm that the oil palm plantation is quite low, being about 310 ha in Manuhing District. Recent intensive and massive introduction of *H. brasiliensis* into Kaleka is problematic. As oil palm plantation in Sumatra dan West Kalimantan, the monoculture rubber plantation area in Gunung Mas has its opportunities to increase if rubber is promoted intensively for economic development. This problems is considered crucial since the monoculture plantation decreases biodiversity^{21,22}.

Herbs and shrubs are economically important. There are also valuable medical plants species which grow wild; some of them has been identified as sources of active compounds, such as *C. domestica*, *P. betle*, *Z. officinale*, and *A. galanga*. The tuber of *C. domestica*, *Z. officinale*, and *A. galanga* is commonly used as tonic. The utilization of such species is common in Kalimantan, Java, Sumatra and eastern Indonesia. Other plant species which are often used as traditional medicine include *L. domesticum* (the leaf is processed as anti malarial), *G. mangostana* (the rind can be used to stop vomiting, the latex is for skin cancer), *D. zibethinus* (the roots and bark is used to overcome stomachache, the leaf shoots are for fever, and the bark can be burned for protecting ourselves from mosquitoes) and *P. canescens* (the young leaf is believed to threats chickenpox).

Trees species are ultimately crucial in economical and ecological aspects. Some notable species are given bellow:

***Durio zibethinus* (Malvaceae):** It is locally called Durian, native to Malaysian peninsula, Sumatra and Java, but recently cultivated in many countries in tropical Asia such as India, Sri Lanka, Myanmar, Thailand and Vietnam. In Kalimantan, Durian is one of the common species to plant in traditional home garden²³⁻²⁵. Among Dayak people, Durian is one of the most important plant trees species due to its numerous functions. The fruits of *D. zibethinus* are consumed by local people and some of them are sold as cash income. Traders often come to Kaleka directly and buy Durian on sites. The wood is often used as the material for civil construction and furniture. Durian is common in agroforestry systems. *D. zibethinus*, *L. domesticum*, *Parkia speciosa* are the component of traditional agroforestry system in Southern Sumatra. Similarly, agroforestry systems in Java contain durian²⁶.

***Durio kutejensis* (Hassk.) Becc. (Malvaceae):** It is locally called Papaken, Lay, Durian Merah, Durian Pulu. Previous report by Soengeng-Reksodihardjo (1962) found such species in tropical home gardens. In Kaleka, a mature individual can grow up to 35 m tall²⁷. Naturally, *D. kutejensis* grows in Dipterocarp forest. Through the field survey, the number of *D. kutejensis* in Kaleka is limited. In some plot observation, *D. kutejensis* is absent, indicating that such species is uncommon in the Kaleka system (Table 2). There are no indications of *D. kutejensis* cultivation, and its natural regeneration seems to be limited. It is relevant with IUCN data where *D. kutejensis* is considered vulnerable species. According to the informants, *D. kutejensis* grows and is preserved in Kaleka for its promising economic value, particularly its fruit and wood.

***Artocarpus heterophyllus* Lam. (Moraceae):** *Artocarpus heterophyllus* is a very useful tree species in Kaleka. This species provides fruit to consume, sell in local market as fruit and vegetable, wood for civil construction and equipment materials. The small and medium branches are often used as fire wood. In Kaleka, the species can reach 25 m in height. The mean of diameter at breast height ranges from 11.45 to 13.77, indicating that many species are young and growing. The individual of *A. heterophyllus* seems to grow spontaneously and spatially and has random distribution. Several reports show that *A. heterophyllus* is a potential plant for anti malaria²⁸.

***Lansium domesticum* Corrêa (Meliaceae):** *Lansium*, locally called Langsat, is a common fruit plant in Kaleka. Its fruits are sold to market. The seeds of *Lansium* are processed traditionally as anti malaria. The wood is used as house material construction. In Kaleka such species grows patchy and each individual can reach up to 20 m tall. *Lansium domesticum* has a potential market value. This species is native to tropical Asia, particularly in Indonesia, Malaysian peninsula and Thailand. In the perspective of pharmacological, *L. domesticum* is considered as interesting due to its rich active compounds which are potential to develop into new drugs²⁹.

Table-1
Cultural Important Index of plant in Kaleka in Tumbang Danau and Dahian Tambuk

No	Local name	Species	Cultural Important Index	
			Tumbang Danau	Dahian Tambuk
1	Durian	<i>Durio zibethinus</i> L.	3.10	1.81
2	Nangka	<i>Artocarpus heterophyllus</i> Lam.	2.80	2.43
3	Langsat	<i>Lansium domesticum</i> Corrêa	2.57	2.03
4	Kelapa	<i>Cocos nucifera</i> L.	2.28	1.86
5	Karet	<i>Hevea brasiliensis</i> (Willd. ex A. Juss.) Müll. Arg.	2.17	1.15
6	Kunyit/Janar	<i>Curcuma domestica</i> Valetton	2.13	1.99
7	Rambutan	<i>Nephelium lappaceum</i> L.	2.11	1.91
8	Papaken, Lay	<i>Durio kutejensis</i> (Hassk.) Becc.	1.89	2.08
9	Sungkai	<i>Peronema canescens</i> Jack	1.75	1.63
10	Pinang	<i>Areca catechu</i> L.	1.73	1.83
11	Pisang	<i>Musa</i> sp.	1.67	1.50
12	Cempedak	<i>Artocarpus champeden</i> (Lour.) Stokes	1.63	1.75
13	Sirih	<i>Piper betle</i> L.	1.63	1.22
14	Manggis	<i>Garcinia mangostana</i> L.	1.57	1.67
15	Jahe	<i>Zingiber officinale</i> Roscoe	1.53	1.20
16	Tangkuhis	<i>Dimocarpus longan</i> Lour.	1.42	1.37
17	Bambu Apus	<i>Gigantochloa apus</i> (Schult. & Schult. f.) Kurz ex Munro	1.40	1.22
18	Tanggaring	<i>Nephelium mutabile</i> Blume	1.38	1.70
19	Nanas	<i>Ananas comosus</i> (L.) Merr.	1.25	1.17
20	Rambai	<i>Baccaurea motleyana</i> (Müll. Arg.) Müll. Arg.	1.01	1.19
21	Rotan	<i>Calamus</i> sp.	0.98	1.20
22	Ruko	<i>Lansium</i> sp.	0.88	0.98
23	Laos/Lengkuas	<i>Alpinia galanga</i> (L.) Willd.	0.76	1.21
24	Keladi	<i>Caladium bicolor</i> (Aiton) Vent.	0.72	0.74
25	Lombok	<i>Capsicum annum</i> L.	0.64	1.02
26	Kecapi/ketapi	<i>Sandoricum koetjape</i> (Burm. f.) Merr.	0.52	0.68
27	Asam Tewu	<i>Mangifera</i> sp.	0.51	0.67
28	Asam Kasturi	<i>Mangifera casturi</i> Kosterm.	0.43	0.65
29	Pangi	<i>Pangium edule</i> Reinw.	0.41	0.29
30	Sangalang	<i>Nephelium</i> sp.	0.23	-
31	Payang	<i>Artocarpus</i> sp.	0.16	0.29
33	Asam Jawa	<i>Tamarindus indica</i> L.	-	0.11
34	Kedelai	<i>Glycine max</i> (L.) Merr.	-	0.06

***Nephelium lappaceum* L. (Sapindaceae):** The species grows wild in Kaleka. Consumed, the fruits are harvested and sold in traditional markets. The wood is used as the material for fuel wood and civil construction. Some cultivars are found in Kaleka and represent its species diversity. Such cultivar are often differentiated by the fruits' taste.

The Implication for Kalimantan's Flora Conservations: Until about 30 years ago, the majority of tropical forests in Gunung Mas were reported to less disturbed. Starting in 1980's, outsiders became interested to harvest timber and opened many forests to become rubber plantations¹⁰. As in many parts in

Kalimantan Island, the rate of forest degradation in Gunung Mas Regency varies depending upon the accessibility, facility and equipment, timber tree species and the government's policy. The recent deforestation rates, however, tends to increase and comprehensive conservation actions by promoting local people's participation are needed.

Kaleka is one of the traditional agroforestry systems which is important in Kalimantan's biodiversity preservation. This local people's management to enhance their sustainability seems to be adaptive in the recent global changes. The old and undisturbed Kaleka with numerous giant and tall tree species is the result of

collective preservation actions by local people over generations. The mature Kaleka is habitat for giant trees in significant number (Table 2) and therefore represent the success of conservation program. Some tall trees are home to numerous liana and epiphytes.

As far, Kaleka is able to conserve many endemic and native plant trees species to Malesian regions, encompassing *S. koetjape* (native to Indonesia, Sabah-Sarawak (Malaysia), the Philippines and Papua New Guinea), *M. casturi* (native and probably endemic to Kalimantan), *D. kutejensis* (native and probably endemic to Kalimantan), *B. motleyana* (native to Java, Sumatra, Kalimantan), *P. canescens* (native to Malaysian peninsula, Thailand, Java, Kalimantan, Sumatra). Recently, these species are rarely found in western Indonesia. The growth of such rare plants in Kaleka, therefore, opens new opportunities to promote Kaleka as the landscapes' component for biodiversity conservation. Native agroforestry systems are considered by conservationist to provide benefits to enhance biodiversity conservation^{10,19,30}.

The high level of biodiversity in Kaleka represents such sites' potential to be developed as natural sanctuary. The maintenance of species diversity in Kaleka is key to such agroforestry system sustainability. Intensive planting is absent in Kaleka. Many plants seem to be spontaneously regenerated. There are no fertilizers and chemical applications in Kaleka. This fact is similar with the studies on the plant regeneration agroforestry system in Saparua, Central Maluku³¹.

Indonesia is rich in terms of agroforestry praxis. The recent studies on Kaleka systems in Dayak Ngaju show that such praxis present in Central Kalimantan as the local people's strategy to live in harmony with their environment. The similar practices of such agroforestry have been developed in Dayak Tunjung and Dayak Benuang in East Kalimantan. There are *Munan* in Dayak Tunjung, *Sinpunkng* in Dayak Benuang and *Lebo* system in Kutainese³². Facilitating local people to conserve traditional land management will allow the central

government to reduce forest cover in Kalimantan island significantly. In such a case, however, strengthening local people is needed. It is particularly important due to massive and rapid monoculture practices, such as oil palm plantation which potentially reduces forest and agroforestry area.

Conclusion

The study of agroforestry has been undertaken intensively as a part of the solution exploration to countermeasure global problems. There are, however, many forms of agroforestry in remote areas in developing countries which are less explored and studied. Kaleka is one of the agroforestry systems which is practiced and preserved over generations in Kapuas, Central Kalimantan. The socio-cultural aspect of Dayak Ngaju contributes significantly to the Kaleka's establishment and preservation. Dayak Ngaju believes that human prosperity is determined by the environment quality in which people live. Kaleka is the symbol of recent generation's respect to their ancestors and its cultural attributes. Kaleka provides benefits to social, cultural and economical value for the local people. The principles of resources value distribution used in Kaleka are equal among family members and sustainable in harvest practices. Kaleka contains numerous plant species and its multi-strata represents secondary to climax tropical forest status. Many plant species grow and regenerate spontaneously with less intensive management. Many species of Kaleka are native to Malesian region and many of them are endemic to Kalimantan island. This data principally shows the importance of Kaleka in Kalimantan's biodiversity conservation.

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Table-2
Steam diameter (d in cm) of some trees species in 10 by 10 m plot observations

No	Species	Tumbang Danau		Dahian Tambuk	
		No. of ind.	d (cm) (sd)	No. of ind.	d (cm) (sd)
1	<i>Tamarindus indica</i> L.	12	38.23 (±26.82)	7	37.59 (± 17.14)
2	<i>Durio zibethinus</i> L.	52	31.29 (±21.02)	19	38.33 (± 22.27)
3	<i>Peronema canescens</i> Jack	2	22.27 (±4.50)	1	6.36
4	<i>Garcinia mangostana</i> L.	17	18.51 (±15.99)	6	10.23 (± 3.49)
5	<i>Artocarpus heterophyllus</i> Lam.	14	13.77 (± 5.28)	7	11.45 (± 4.79)
6	<i>Hevea brasiliensis</i> (Willd. ex A. Juss.) Müll. Arg.	26	17.65 (± 12.07)	10	13.14 (± 11.43)
7	<i>Artocarpus champeden</i> (Lour.) Stokes	15	17.58 (± 10.52)	7	22.95 (± 16.22)
9	<i>Lansium domesticum</i> Corrêa	27	16.43 (± 11.37)	8	15.91 (± 5.17)
10	<i>Dimocarpus longan</i> Lour.	14	15.98 (± 11.31)	6	13.15 (± 4.34)
11	<i>Baccaurea motleyana</i> (Müll. Arg.) Müll. Arg.	12	14.34 (± 9.03)	7	24.77 (± 19.70)
12	Ramonia	14	18.27 (±15.14)	5	14.51 (± 6.73)
13	Kayu Tubulus	12	17.45 (± 6.45)	5	21.06 (± 5.35)

References

1. Torquebiau E., Are tropical agroforestry home gardens sustainable? *Agriculture, ecosystems & environment*, **41(2)**, 189-207 (1992)
2. McNeely J.A. and Schroth G., Agroforestry and biodiversity conservation—traditional practices, present dynamics, and lessons for the future, *Biodiversity & Conservation*, **15(2)**, 549-554 (2006)
3. Harvey C.A., Komar O., Chazdon R., Ferguson B.G., Finegan B., Griffith D.M.M., Martínez-ramos H., Morales R., Nigh L., Soto-pinto M., Van Breugel and Wishnie M., Integrating agricultural landscapes with biodiversity conservation in the Mesoamerican hotspot, *Conservation Biology*, **22(1)**, 8-15 (2008)
4. Thapa B., Sinclair F.L. and Walker D.H., Incorporation of indigenous knowledge and perspectives in agroforestry development, In *Agroforestry: Science, Policy and Practice* (249-261), Springer Netherlands (1995)
5. Michon G., Mary F and Bompard J.M., Multistoried agroforestry garden system in West Sumatra, Indonesia, *Agroforestry Systems*, **4**, 315-338 (1986)
6. Wilkie P., Argent G., Cambell E. and Saridan A., The diversity of 15 ha of lowland mixed dipterocarp forest, Central Kalimantan, *Biodiversity & Conservation*, **13(4)**, 695-708 (2004)
7. Jepson P., Momberg F. and van Noord H.V., A review of the efficacy of the protected area system of East Kalimantan Province, Indonesia, *Natural Areas Journal*, **22(1)**, 28-42 (2002)
8. Curran L.M., Trigg S.N., McDonald A.K., Astiani D., Hardiono Y.M., Siregar P., Caniogo I. and Kasischke E., Lowland forest loss in protected areas of Indonesian Borneo, *Science*, **303(5660)**, 1000-1003 (2004)
9. Lontaan, *Masyarakat Dayak Kalimantan*, Monograf Perpustakaan Kalimantan Tengah, Palangkaraya (1975)
10. Mackinnon K., Mangalik A. and Hatta G., The Ecology of Kalimantan, The Ecology of Indonesia Series Vol II. Periplus, Singapore (1997)
11. Kabupaten Gunung Mas, Statistik Kabupaten Gunung Mas Tahun 2012, Penerbit Badan Pusat Statistik Kabupaten Gunung Mas, Propinsi Kalimantan Tengah (2012)
12. Tardío J. and Pardo-de-Santayana M., Cultural Importance Indices: A Comparative Analysis Based on the Useful Wild Plants of Southern Cantabria (Northern Spain) I, *Economic Botany*, **62(1)**, 24-39 (2008)
13. Byers B.A., Cunliffe R.N. and Hudak A.T., Linking the conservation of culture and nature: a case study of sacred forests in Zimbabwe, *Human Ecology*, **29(2)**, 187-218 (2001)
14. Colding J. and Folke C., Social taboos: “invisible” systems of local resource management and biological conservation, *Ecological Applications*, **11(2)**, 584-600 (2001)
15. Mgumia F.H. and Oba G., Potential role of sacred groves in biodiversity conservation in Tanzania, *Environmental Conservation*, **30(3)**, 259-265 (2003)
16. Bhagwat S.A. and Rutte C., Sacred groves: potential for biodiversity management, *Frontiers in Ecology and the Environment*, **4(10)**, 519-524 (2006)
17. Higgins-Zogib L., Dudley N., Mallarach J.M. and Mansourian S., *Beyond belief: Linking faiths and protected areas to support biodiversity conservation*, Arguments for Protected Areas: Multiple Benefits for Conservation and Use (2010)
18. Cranbrook E. and Edwards D.S., *Belong: A Tropical Rainforest*, The Royal Geographic Society and Sun Tree Publishing, Singapore (1994)
19. Whitten T., Soeriaatmadja R.E. and Afif S.A., *The Ecology of Java and Bali*, The Ecology of Indonesia Series Vol II. PErilupus, Singapore (1997)
20. Monk K., de Fretes Y. and Reksodiharjo-lilley G., *The Ecology of Nusa Tenggara and Maluku*, The Ecology of Indonesia Series Vol V. Periplus, Singapore (1997)
21. Sodhi N.S., Koh L.P., Clements R., Wanger T.C., Hill J.K., Hamer K.C., Clough Y., Tschardtke T., Posa M.R.C and Lee T.M., Conserving Southeast Asian forest biodiversity in human-modified landscapes, *Biological Conservation*, **143(10)**, 2375-2384 (2010)
22. Lee J.S., Garcia-Ulloa J., and Koh L.P., Impacts of Biofuel Expansion in Biodiversity Hotspots, In *Biodiversity Hotspots* (277-293) Springer Berlin Heidelberg (2011)
23. Soengeng-Reksodihardjo W., The species of Durio with edible fruits, *Economic Botany*, **16(4)**, 270-282 (1962)
24. Siregar M., Review: Species Diversity of Local Fruit Trees in Kalimantan: Problems of Conservation and Its Development, *Biodiversitas*, **7(1)**, 94-99 (2006)
25. Mulyoutami E., Rismawan R. and Joshi L., Local knowledge and management of *simpukng* (forest gardens) among the Dayak people in East Kalimantan, Indonesia, *Forest Ecology and Management*, **257(10)**, 2054-2061 (2009)
26. Ginoga K., Cacho O., Erwidodo L.M. and Djaenudin D., Economic performance of common agroforestry systems in southern Sumatra: implications for carbon sequestration services, Working paper ACIAR project ASEM (2002)
27. Lim T.K., Durio kutejensis, In *Edible Medicinal and Non-Medicinal Plants* (559-562), Springer Netherlands (2012)
28. Elevitch C.E. and Manner H.I., *Artocarpus heterophyllus* (jackfruit), Species Profiles for Pacific Island Agroforestry (2006)

29. Omar S., Zhang J., MacKinnon S.A., Leaman D., Durst T., Philogene B.J.R., Arnason J.T., Sanchez-Vindas P.E., Poveda L., Tamez P.A and Pezzuto J.M., Traditionally-used antimalarials from the Meliaceae, *Current topics in medicinal chemistry*, **3(2)**, 133-139 (2003)
30. McNeely J.A. and Schroth G., Agroforestry and biodiversity conservation—traditional practices, present dynamics, and lessons for the future. *Biodiversity & Conservation*, **15(2)**, 549-554 (2006)
31. Kaya M., Kammesheidt L. and Weidelt H.J., The forest garden system of Saparua island Central Maluku, Indonesia, and its role in maintaining tree species diversity, *Agroforestry Systems*, **54(3)**, 225-234 (2002)
32. Sardjono M.A., The lembo system: A model for agroforestry in dipterocarp forest ecosystems of East Kalimantan, *Dipterocarp forest ecosystems: towards sustainable management*. World Scientific, Singapore, 354-368 (1996)