Importance of a Mosaic of Vegetations to the Iban of Sarawak, Malaysia

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Introduction

Human disturbance has been creating habitat mosaics (Smith and Wishnie 2000), and swidden agriculture is one kind of human disturbance. In swidden agriculture, a piece of forest is cut and burned, and the land is used for farming for one year or for a few years (or more), then left fallow until forest grows again (e.g., Conklin 1957; Chin 1985). A mosaic of farming land, young to old fallows, and primary forest are usually found around swidden farmers' settlements (e.g., Colfer 1997; Wadley, Colfer, and Hood 1997). The land can regain nutrients during the fallow period (Szott, Palm, and Buresh 1999), and weed seed banks are reduced (De Rouw 1995). Furthermore, fallows are actually abundant in useful plants for local people and are actively used by them (Balée 1994, Colfer 1997; Chazdon and Coe 1999; see also Voeks 2004). In addition, early successional species are adopted to open environments created by disturbance (Bazzaz and Pickett 1980). This implies that they are less likely to become extinct by use pressure. Overexploitation of primary forest may be avoided by effective use of secondary vegetation (see also Momose 2005). The traditional swidden agriculture is not a destructive practice, nor are swidden fallows themselves a threat to biodiversity.

This study examines use and classification of plants in primary and secondary environments by the Iban living near the Lambir Hills National Park in Sarawak, Malaysia. The Iban is the largest indigenous group of swidden farmers in Sarawak (Ichikawa 2004). Around an Iban village, a mosaic of swidden fields, young to old fallows, rubber and pepper gardens, orchards, and fragmented primary forests is found (Ichikawa 2004). According to ecological studies conducted in Lambir Hills National Park and the area surrounding it, primary forest has higher diversity of plant species than secondary forest (Momose et al. in this report). Primary forest, however, is decreasing, and secondary forest after logging and farming as well as oil-palm plantations are increasing around Lambir Hills National Park and in Sarawak (Ichikawa 2007). We have to understand the importance of primary and secondary forests for local people as well as their biodiversity to consider the consequence of the land use change. By examining the use and recognition of plants and forests by the Iban, we will show differences in importance of primary and secondary vegetation to the local people who are creating and using the mosaic environment.

Methods

Fieldwork was conducted in the territory of an Iban village Rumah Chabu (4°10′ N, 114°01′E) near Lambir

Hills National Park, Sarawak, Malaysia in 2003. A vegetation survey in 0.1 ha (10 × 100 m) plots in various environments was conducted as part of a larger ecological project. For our purpose, the vegetation of trees and vegetation on the forest floor was investigated. The vegetation of trees was surveyed in 11 plots: three in fragmented primary forests, two in old fallows (more than 20 years after abandonment), three in young fallows (5 years after abandonment), and three in rubber gardens. All trees ≥ 10 cm dbh (diameter at breast height) were tagged, mapped, measured, and identified. Vernacular names were identified by two Iban informants, who were men about 60 years old.

The vegetation of the forest floor was surveyed in 16 plots: three in fragmented primary forests, five in young fallows, four in new fallows (1 year after abandonment), and four in rubber gardens. Within each plot, small woody and herbaceous plants on the forest floor were identified in forty 1 × 1 m subplots. Vernacular names were identified by the Iban informants.

For an ethnobotanical survey, we collected specimens with the Iban informants and asked them about vernacular names, uses, and places to collect the plants during the vegetation survey and other occasions. We also asked about classification of vegetation types and about traditional belief and stories about forests and plants. Voucher specimens collected in the vegetation and ethnobotanical survey were stored in the Herbarium of the Forest Research Center, Sarawak.

To evaluate the abundance of useful trees ≥ 10 cm dbh, basal area (m^2/ha) and density of individual trees (number of individuals/0.1 ha) of all useful species for each use category (Fig. 1) in each vegetation type were calculated. Species that were used for two (or more) categories were included for both of the categories.

For plants of the forest floor, the number of subplots (n_i) where a useful species i for a certain use category (Fig. 2) appeared was counted. The sum total of n_i (N) for all useful species for each use category in each vegetation type was then calculated. The density of useful plants was expressed as N per 40 subplots. One plot was counted twice (or more times) for a certain use category when the plot had two (or more) useful species for the category. Species that were used for two (or more) categories were also included in both of the categories.

For analysis of vernacular names (Iban names), primary and secondary names were distinguished. A primary name is a single expression to indicate a taxon, and a secondary name is formed from a primary name by adding a modifier (Martin 1995, 210). Three name types were distinguished (Fig. 3), and the number of species and percentage of individual trees (as found in the vegetation survey of tree ≥ 10 cm dbh) having each name type in each vegetation type were calculated.

Results

(1) Useful trees ≥ 10 cm dbh

Figure 1 shows basal area and density of useful trees ≥ 10 cm dbh. The fragmented primary forests showed much higher basal area of timber species than plots of other vegetation types (Fig. 1A). More timber species were found in the fragmented primary forests (25 species in three plots) than in the old fallows (10 species in two plots), the young fallows (6 species in three plots), and the rubber gardens (4 species in three plots). The Dipterocarpaceae (13 species) contributed 82.7% of basal area of timber species in the fragmented primary forests.

The old fallows showed the second highest basal area and density of food species, while the rubber gardens showed the highest values (Fig. 1). In the rubber gardens, however, rubber trees (*Hevea brasiliensis* Müll Arg.), whose seeds and leaves can be (but were only occasionally) eaten as vegetables, comprised 75.5% of basal area or 77% of individuals of food species. If this species is excluded, food plants were most abundant in the old fallows. There were nine species of food plants found in the old fallows, and five of them were *Artocarpus* spp. These *Artocarpus* spp. produce edible fruits and accounted for 72.3% of basal area or 55% of individuals of food species in the old fallows. *Artocarpus* spp. were also abundant in the rubber gardens and the young fallows. In the old fallows, *Shorea amplexicaulis* Ashton, from whose seeds cooking oil is processed, was also commonly found (13.8% of basal area or 20% of individuals of food species in old fallows).

One of the most common *Artocarpus* spp. in the old and new fallows and the rubber gardens was *A. elasticus* Reinw. The species contributed the most to basal area and density of species used for crafts in these vegetation types. Strong fiber can be obtained from the inner bark of the species and is used for rope. The latex was also often used for birdlime.

The people most often used *Vitex pinnata* L. for firewood. The plant was a dominant species in the new fallows and also abundant in the old fallows and the rubber gardens.

Larger basal area of plants for religious and magic purposes in fragmented primary forests and old fallows than other vegetations were mainly due to *Xylopia* spp. and *Euodia malayana* Ridl., respectively. Branches of *Xylopia* spp. may be burned with *Goniothalamus* spp. (see the fifth subsection of the results) to keep the fire burning longer. *Dillenia suffruticosa* (Griff.) Mart. was also found in old fallows. Branches of *D. suffruticosa* were cut and stuck in rice fields to drive rats and mice away.

(2) Plants of the forest floor

The vegetation survey of the forest floor included ferns, herbaceous seed plants, rattans, and shrubs as well as saplings of many tree species. Many more species were recorded than in the survey of trees $\geq$ 10 cm dbh. Many of the species, however, were not used by the Iban. The density of the useless species was excluded from Figure 2.

Vegetable species were most abundant in the young fallows (Fig. 2). Most commonly found vegetable species in the young fallows were *Nephrolepis biserrata* (Sw.) Scott, a fern species especially favored after giving birth, and *Stenochlaena palustris* (Burm.) Bedd., the most favored fern species in the study village. *Gnetum gnemon* L. (leaves as well as fruit and seeds were eaten) and rattans (shoots were eaten) were also common. In the new fallows, *N. biserrata* was similarly abundant, but rattans were rare and *G. gnemon* was not recorded. Vegetable species found in the rubber gardens were similar to those of the young fallows, but their density was lower. *N. biserrata* and *S. palustris* were not recorded in fragmented primary forests, though rattans were common and *Gnetum* spp. were not rare.

The density of medicinal species[1] was similar among the plot types (Fig. 2), but species composition was different. *Lygodium* spp., for example, were very common in the young fallows and also found in the new fallows and the rubber gardens, but not in the fragmented primary forests. The plant was believed to cure a headache in the morning by tying the stem around the head. *Merremia* spp.[1] were abundant in the new

fallows, but not recorded in other vegetation types. The plant was used to cure sexually transmitted disease by shamans. *Spatholobus* spp. were found in all vegetation types, but the density was relatively high in the fragmented primary forests and the rubber gardens and rare in the new fallows. When people get injured, they may cut the stem and drink the sap so that the bleeding would stop (but larger stems were used).

In the use category of crafts (Fig. 2), *Dicranopteris linearis* Und., *Melastoma malabathricum* L., rattans, and some other plants were included. *D. linearis*, a fern species, has fiber used for crafts. The species was most common in the rubber gardens and not recorded in the new fallows. *M. malabathricum*, a weedy shrub species, was abundant in the new fallows, but not found in the fragmented primary forests. The fruit was used as a black dye. Rattans were commonly found except in the new fallows. *Archidendron clypearia* (Jack) I. C. Nielsen, whose leaves were used as a blue dye, was commonly found in the rubber gardens (but the leaves were usually collected from lager trees).

The higher density of species of the religious & magic category in the young and new fallows than in the other vegetation types (Fig. 2) was due to high density of *Dillenia suffruticosa* and *Merremia* spp.[1], respectively.

Saplings of timber species showed high density in the new fallows and the fragmented primary forests (Fig. 2). Species composition, however, was different. In the new fallows two pioneer species *Alphitonia excelsa* (Fenzl) Reiss. and *Macaranga gigantea* Müll Arg. contributed 85% of the density value, while five species of the Dipterocarpaceae contributed 51% of the value in the fragmented primary forest.

(3) Classification of plants

Three types of names can be distinguished among Iban names of plants. They are defined as follows: (1) a primary name including one scientific species (type 1 name; e.g., **tekalong** for *Artocarpus elasticus*, **selangking** for *A. nitidus* Trécul), (2) a secondary name including one (or rarely two) scientific species (type 2 name; e.g., **resak kerubong** for *Dipterocarpus geniculatus* Vesque, **resak ensulai** for *D. palembanicus* Slooten), and (3) a primary name including two or more species, but with no secondary name to distinguish them (type 3 name; e.g., **seladah** for *Dacryodes rostrata* (Blume) H. J. Lam, *Santiria laevigata* Blume, and *Scutinanthe brunnea* Thwaites).

The number of species appearing in the survey of trees ≥ 10 cm dbh greatly varied according to plot type, but the number of species which were labeled by type 1 names was almost the same (Fig. 3A). These species accounted for many of individuals in the young fallows (79%) and the rubber gardens (88%) (Fig. 3B).

Type 1 and 2 names distinguish plants to the scientific species level. Most individuals in the young fallows (92%) and the rubber gardens (91%) had type 1 or 2 names (Fig. 3B). This means that most individuals in these vegetation types were linguistically recognized with the same distinctions as scientific species. (We have to add, however, that *Vitex pinnata* and *Hevea brasiliensis*, both of which had a type 1 name, accounted for 42% of individuals in the young fallows and 58% in the rubber gardens, respectively.) In the fragmented primary forests and the old fallows, the percentage of individuals having type 1 or 2 names were only 49% and 53%, respectively.

(4) Management and use of the vegetations

Fragmented primary forests were called **pulau,** and were secured to conserve timber for house construction or to protect graves by the study people (timber reserves and cemetery forests are given different names by the Iban of other areas [e.g., Wadley, Pierce, and Hood 1997]). Timber may be logged from cemetery forest when needed. The people did not go to **pulau;** probably because the places were somewhat far from the longhouse. Although not included in the vegetation survey, the people called large primary forest outside their living area (in Lambir Hills National Park) **kampong**. They rarely entered **kampong** because they believed there were lots of spirits, though shamans sometimes went to **kampong** to obtain magical power. An exception was made in the fruit seasons, when other people also went (but not often) to **kampong** to collect fruits and hunt bearded pigs.

The people did not consciously manage fallow vegetations, but usually went to fallows for collecting vegetables, firewood, materials for crafts, and offerings for annual events as well as for hunting. They called fallows one to three years after abandonment **jérami'**, about five years after abandonment **temuda'**, and after many years and with large trees **pangérang**. To collect vegetables, **temuda'** near the longhouse were most often used.

Rubber has not been tapped in the last 20 or 30 years because of low selling price of the latex. When the rubber was tapped, the undergrowth was cut to make the tapping work easier for the villagers, but today there are lots of small trees and grasses covering the rubber gardens. Some fruit trees were planted at edges of rubber gardens.

(5) Beliefs and stories about forest and plants

Although not appearing in the vegetation survey, **Ara** (large strangling *Ficus* trees, such as *F. kerkhovenii* Koord. & Valeton) was believed to host spirits and was feared by the people. Some men, however, were said to communicate with spirits on **Ara** to get strong magical power that can absorb other people's vitality and provide an ability like that of **Ara** strangling other trees. The plant was found in (fragmented) primary forest. An Iban story about **Ara** goes like this: A man lost his way in forest. Someone called him, and he followed the voice and found a longhouse. He entered and stayed at the longhouse. In the morning, he found himself on **Ara** and could not get down.

The people used **Selokai** (*Goniothalamus* spp.) for protection from spirits in the forest and the longhouse. The plants were abundant on the forest floor of primary forest (in Lambir Hills National Park). The people believed that lots of evils would come if it rains while the sun is shining. They would put leaves on their ears or burn leaves and branches so that spirits could not see them. They also burned the bark in the longhouse to protect pregnant women and babies from evils. There was a story about **Selokai**: A man went out to hunt bearded pigs. He met a man carrying a bearded pig. They made a fire to bake the pig to eat together, but the man who had been carrying it suffered from the smoke and ran away. The pig turned into a man. There was **Selokai** in the firewood. The man was a spirit and had tried to have the first man eat a human. For another example of a talisman, the people planted **Kemali** (*Leea indica* Merr.) at the border of a cemetery forest after they buried a dead person there so that the ghost of the person would not come out of the forest.

There was a story about **Kuang-Kapong** (Indian Cuckoo, *Cuculus micropterus*; Aihara 2007) and **Kemunting** (*Melastoma malabathricum*). **Kuang-Kapong** made trees fruit in the past. One day, however, **Kemunting** said, "I am the king from today. Plants other than me should not fruit very often." Plants in forest thus do not fruit very often. On the other hand, **Kemunting** likes rice, so rice fruits well.

Discussion and conclusion

Fragmented primary forests were conserved by the study people, and the people were getting timber for house construction from there. Actually, the vegetation type had a large basal area of timber species, and they were regenerating well. At the same time, (fragmented) primary forests were not safe places for the Iban because there were lots of spirits. Some plants were used to control or drive away spirits.

In contrast, secondary vegetations were used in everyday life. The young fallows, where the people usually collected vegetables, had rich vegetable flora both in terms of the number of species and their density. A good firewood species was also abundant in the young fallows. There were more fruit trees in the old fallows and the rubber gardens. Plants producing materials for crafts were also abundant in secondary vegetations. For the study people, secondary vegetations were places for humans and their livelihood. **Kemunting** was one of the symbolic plants of the human area, and it helps rice to crop.

The abundance of useful plants in secondary vegetations is probably the result of both natural and cultural factors. The vegetations compared here had different species composition, and thus it is natural that they had different importance to the people. Different cultures, however, may recognize different useful plants in the same vegetation (Voeks 2007). In general, there were more useful plants used in everyday life by the study people in secondary vegetations than in primary forest. This implies that the people have developed more knowledge about plant use of secondary vegetations than of primary forest. By using plants near their settlement, people can save effort to collect plants. The knowledge or use pattern may also be ecologically reasonable. For example, collection of vegetables and firewood from early successional, fast growing species would not seriously threaten the species.

Land use is changing around the study village, and primary forest is decreasing. If primary forest disappears, it will become difficult for people to find large timber for construction. The disappearance of primary forest also means, to the Iban, the disappearance of the place of spirits. Conversely, the secondary forests are now increasing. But if they disappear because of plantation development, people will become unable to find necessities that were once abundant around the village and will have to buy them. As long as the people depend on natural products they collect by themselves, they will conserve primary and secondary forests to the extent that fulfill their needs.

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Endnote

1. The distinction between medicinal plants and religious and magic plants was not always clear, but the study people distinguished between plants used to cure disease and plants used in religious or magic ceremonies. The former plants were included in the use category of medicine. *Merremia* spp., however, was used to cure disease only by shamans and was included both in the medicinal category and the religious and magic category.

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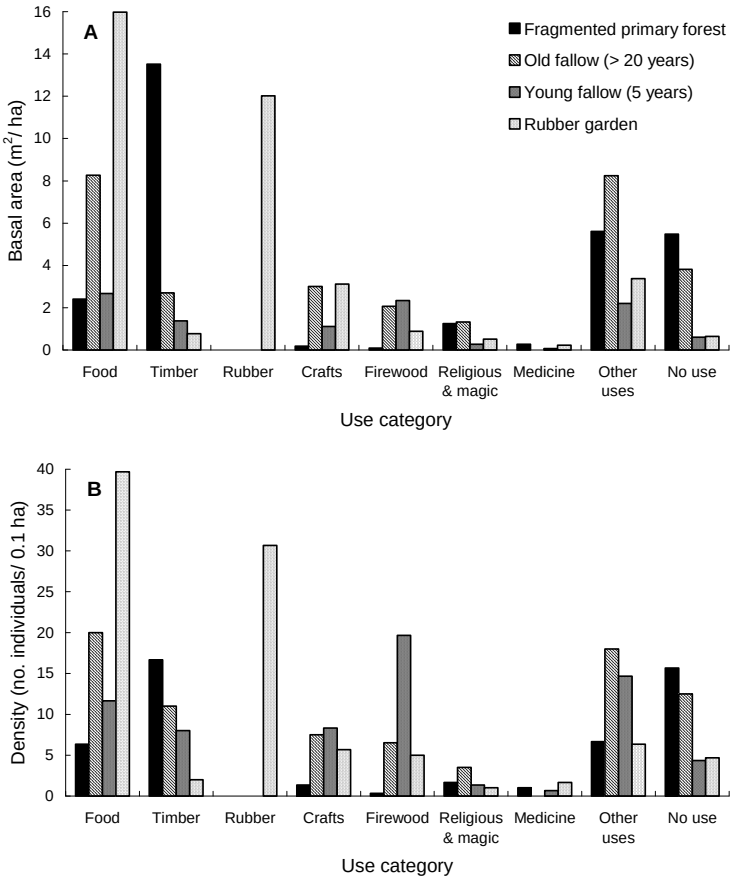

Fig. 1 (A) basal area (m^2/ha) and (B) density (number of individuals/0.1 ha) of useful and useless trees ≥ 10 cm dbh in four types of vegetations.

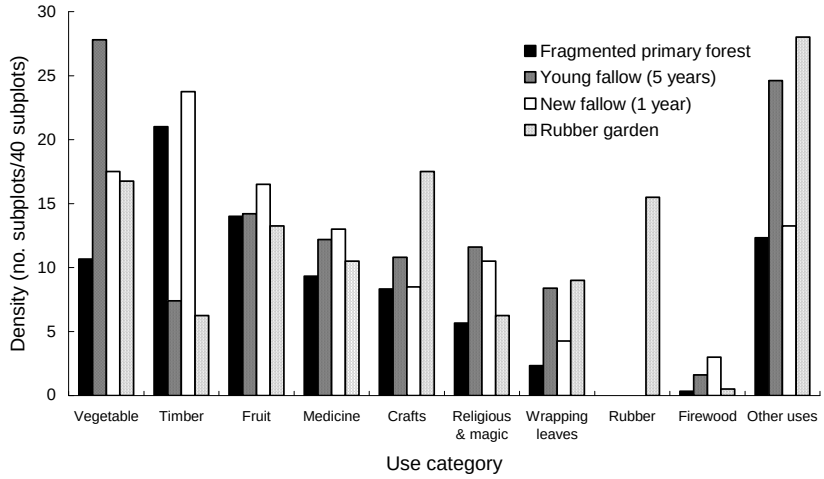

Fig. 2 Density (number of subplots/40 subplots) of useful plants on the forest floor in four types of vegetations.

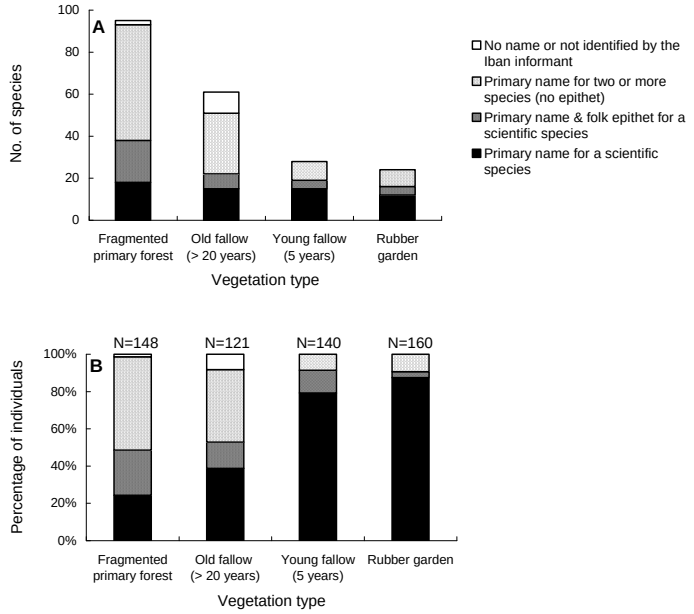

Fig. 3 (A) Number of species and (B) percentage of individuals (appeared in the survey of trees ≥ 10 cm dbh) having different types of names in the four vegetation types. Data from three 0.1-ha plots are compiled for each of fragmented primary forests, young fallows, and rubber gardens. Data from two 0.1-ha plots are compiled for old fallows.