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Environments and People of Sumatran Peat Swamp Forests II: Distribution of Villages and Interactions between People and Forests

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Abstract

I studied the distribution of villages and the interactions between people and forests in a lowland plains of Sumatra. I classified the villages there into four types. *Pangkalan* villages (river ports at the foot of hills) are located in flood zones. *Muara* villages (river ports at confluence points) are usually found in central zones. Migrant villages and fishing villages are settled in tidal zones. Different types of villages are found in different habitats, but they are connected by a network. The connections between pangkalan villages and muara villages are especially strong. In the central zone, the lands suitable for agriculture are limited to small areas covered by mixed peat swamp forests, and the other areas can be used only as forests. As a result, people in the central zone (villagers of muara villages) have the closest relationships with forests. In this paper I describe the agricultural, fishing, and hunting practices, the dietary taboos, the logging methods, and the plant usage that I observed in the muara villages of Riau, in the Kampar region. I conclude that the most important reason to conserve peat swamp forests is to secure the survival of the people who live among them, (especially those who lack capital). I also point out that the network connecting the different kinds of villages plays important roles in enabling villagers to adapt quickly to changes in the environment and to avoid overexploitation. Taboos in diets are considered to contribute greatly to the villagers' sense of belonging to the network at the level of everyday life. Since the recent political crisis in Indonesia, the government's protection of the forests has been unreliable. The reason why forests still remain is that the Malays, an influential group, have prevented newcomers from devastating their lives, which are founded on close interaction with the forest.

Keywords: fishing, hunting, logging, medicinal plant, migrant, *muara*, paddy, *pangkalan*

I Introduction

Furukawa [1992] divided lowland plains into three zones: flood, central, and tidal. The authors who studied villages in peat swamp forests [*ibid.*; Sumawinata 1992; 1999; Abe 1993; 1997] focused mainly on migrant villages in tidal zones. Meanwhile, the fact that

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different types of villages are distributed in different kinds of environments has been overlooked. The diversity of environments within lowland plains has been described in previous reports, through vegetation studies. In this paper, I first clarify the relationships between environments and the distribution of villages. Next, I describe the relationships between forests and the people who live in them. It is sometimes emphasized that the exploitation of lowland plains is destructive. However, in this study close relationships between forests and people were sometimes observed. What I aim at is not just to praise local traditions, but to consider how people can adapt to environments, how the wise ways to live in tropical peat swamps were born, and how overexploitation is avoided.

II Distribution of Villages in Lowland Plains of the Sumatran East Coast

The largest peat swamps are found on the Sumatran east coast. The Kampar River flows from the central Barisan Mountains, and flows into the Malacca Straits (Fig. 1). The reaches lower than Kurinci, a town ca. 160 km inland flow through a lowland plains covered mainly by peat swamp forests. Seventeen villages are found within the lowland plains along the main and branch streams of the Kampar River. These villages are

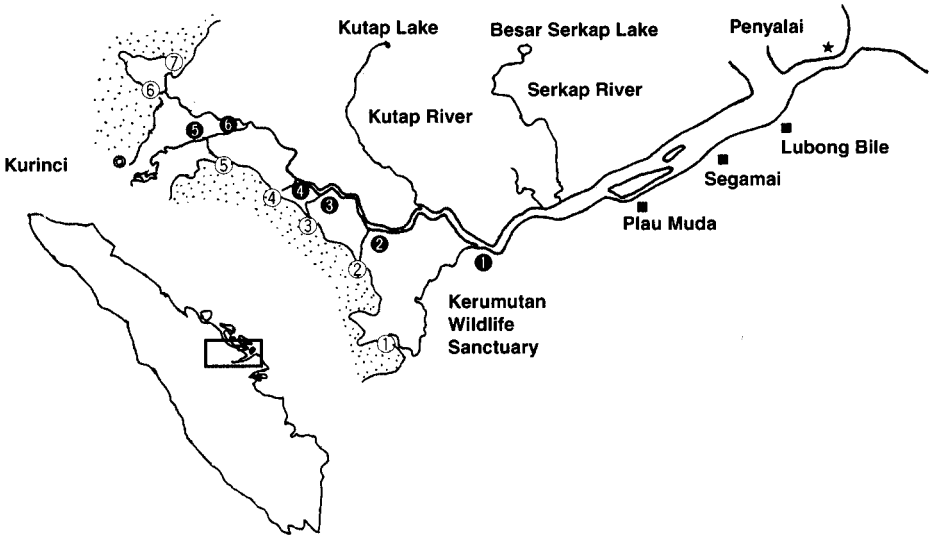

Fig. 1 Distribution of Villages within a Lowland Plains along the Kampar River, Riau, Sumatra

Notes: Dotted areas are hills, and areas without dots are plains. Numbers in white circles indicate small *pangkalan* villages along branch streams: ① Kapau, ② Pangkalan Panduk, ③ Merbau, ④ Pangkalan Bunut, ⑤ Talayap, ⑥ Pangkalan Dolik, ⑦ Pangkalan Balai. Outlined numbers in black circles indicate muara villages: ❶ Tuluk Meranti, ❷ Muara Panduk, ❸ Sungai Ara, ❹ Muara Tolam, ❺ Séren, ❻ Pelalawan. Squares indicate migrant villages (*sepontan*). The star indicates a fishing village (*bagan*). Names of migrant villages and fishing villages appear on the map.

categorized into four types: 1. *pangkalan* villages, 2. *muara* villages, 3. migrant villages, and 4. fishing villages.

Pangkalan villages are river ports settled by the Malay people at the foot of hills. Thus, pangkalan villages are located in flood zones. Of the 17 villages in the plain studied, 7 are in this category: Talayap, Pangkalan Dolik, Pangkalan Balai, Pangkalan Bunut, Merbau, Pangkalan Panduk, and Kapau (Fig. 1). The word "pangkalan" is of Minangkabau origin and is used in Riau to describe river ports at the foot of hills. Although in North Sumatra seaports are also sometimes called pangkalan, in this paper I follow the Riau use of the term.

For several centuries, the rivers of East Sumatra have been important trading routes that connect inland agricultural societies (the Minangkabau highlands, for example) and the world beyond the Malacca Straits. Pangkalan villages are located at landing points where roads cross rivers. These villages are not restricted to main streams; a number of small villages are found at points where branch streams emerge from the hills to flow into the lowland plains (Fig. 1). In fact, all seven of the pangkalan villages listed above are small and are located along branch streams.

Villagers are engaged in trading, fishing, growing rice on the plains, and cultivating rubber on the hillsides. Before the 1920s, when the number of rubber plantations expanded, the hills were used for shifting cultivation [Marsden 1811]. From the 1980s to the present, more and more villagers have been employed in oil palm plantations, replacing rubber plantations in the hills.

Small pangkalan villages on branch rivers once served as ports for trading products from plantations and forests in hill areas. These forest products included *kapur baros, gharu, julton,* rattans, and woods. In Pangkalan Panduk along the Panduk River, a small branch stream of the Kampar River, *gharu* and *julton* were traded until the 1980s, villagers say. Today, products of the hills are usually transported by road rather than river, and the small pangkalan villages have lost their significance as ports, except as tiny fishing ports.

Muara villages are river ports settled at the confluence of rivers by the Malay people. They are often found in the central zones of peat swamps. The six muara villages along the lower Kampar River are Séren, Pelalawan, Muara Tolam, Sungai Ara, Muara Panduk, and Tuluk Méranti.

The muara villages, located at confluence points of branch and main rivers, are closely connected to pangkalan villages, which are located along the upper streams of branch rivers. For example, Pangkalan Panduk is located on the upper stream of the Panduk River, and Muara Panduk is located at the confluence of the Panduk and Kampar Rivers (more examples are shown in Fig. 1). There are six muara villages and seven pangkalan villages in the lower Kampar region. This is because there are two pangkalan villages along the upper streams of the Pelalawan River. The role of muara villages in the transit trade was to connect plangkalan villages to the main trading routes along the

main streams. However, in addition to the transit trade, Pelalawan had historically different characteristics from other muara villages. There was a king's palace in Pelalawan, and tax collectors were based in this village to collect from ships transporting goods along the main stream.

Muara villages are not found at some confluence points. If a branch stream flows from a lake located within a peat swamp instead of flowing out of the hills, no pangkalan villages will be located upstream; this situation occurs along the Kutap River and the Serkap River, which are rather large but rise from lakes within lowland plains. There are no muara villages at their confluence points with the Kampar River.

Today, the products of the hills are usually carried by road rather than river, so the connections between pangkalan villages and muara villages are weakened. Instead, trade in woods and freshwater fishes from peat swamps has developed greatly. Thus, the function of muara villages has shifted to the export of forest products from peat swamps.

Muara villages in central zones are still surrounded by peat swamp forests, and close relationships between the people and the forests are observed; these relationships are the main topic of the remaining paper in this series. Agriculture is possible in areas covered by mixed peat swamp forests near rivers, but such locations are very limited, and in any case sufficient incomes are not gained from agriculture. Villagers are engaged in trading, fishing, hunting, and collecting forest products.

Migrant villages are categorized into two types: *sepontan* and *pélita*. *Sepontan* villages were settled by autonomous migrants of the Banjar people from Central and South Kalimantan (Banjar is regarded as a sub-tribe of Malay) and of the Bugis people from Sulawesi, as well as Malay from pangkalan, muara, and fishing villages of neighboring areas, since the 1880s. Plau Muda, Segamai, and Lubong Bile are *sepontan* villages along the Kampar River. The exploitation of the Kampar River began later than in other peat swamp regions, and the villages listed above were established in the 1960s or 1970s. Banjar, Bugis, and Kampar Malay people reside in these villages, but they are separated along different drainage channels within the same villages.

The *sepontan* villagers transform mixed peat swamp forests of the tidal zone into coconut plantations or rice fields after draining water through channels. As Furukawa [1992] and Sumawinata [1992; 1999] stated, *sepontan* villagers' methods of development are often very adaptive to changes in ecological conditions of the peat swamps in the tidal zone.

Pélita villages were settled by government-run projects called Transmigrasi, by which migrants (mainly from Java) have been introduced to undeveloped areas since the 1960s. No examples of *pélita* villages are found along the Kampar River. Furukawa [1992] introduced the situation of *pélita* villages in a Batan Hari region in Jambi province. Because the areas most suitable for agriculture had already been opened by *sepontan* migrants, in many cases areas unsuitable for agriculture were developed by government-run projects. The reason why the agricultural development of areas distanced from

Table 1 Habitats and Land Use of Four Types of Villages

Village Type	Zone	Original Vegetation	Land Use
Pangkalan	Flood	Freshwater swamp f.	Rice fields
		Hill dipterocarp f.	Plantations, shifting cultivation
Muara	Central	Mixed peat swamp f.	Rice fields, plantations
		Meranti paya f.	Hunting and logging
		Padang suntai f.	Hunting and logging
Migrant	Tidal	Mangrove f.	
		Mixed peat swamp f.	Rice fields, plantations
Fishing	Tidal	Mangrove f.	Fishery
		Mixed peat swamp f.	

rivers is destined to fail was explained by Furukawa and was noted in the previous section. As a result, a considerable number of *pélita* villages have been abandoned.

Fishing villages of Malay and Orang Laut people are located in mangrove areas, which are on the outer edges of peat swamps in the tidal zone. Penyalai is a fishing village near the mouth of the Kampar River. Aquatic products are usually traded with Chinese [*ibid.*]. According to the term used in Riau, such fishing settlements can be called *bagan* villages.

Orang Laut people in Penyalai are fishermen, but they also hunt wild boars in the peat swamp forests. Because no primary forests remain in the tidal zone, these hunters go to the central zone to find game (it takes one day by boat). The boars are also sold to Chinese traders. The population of wild boars is very high in the peat swamp forests (there are no exact estimates, but flocks and footprints can be seen there much more frequently than in other types of tropical vegetation). Because all other residents of the lowland plains are Muslim, these non-Muslim hunters can monopolize the rich population of wild boars.

Although Penyalai began as a fishing village, migrants have expanded it. Mangrove forests remain, but the mixed peat swamp forests behind the mangrove forests have been changed into coconut plantations, just like the situation in migrant villages. Thus, today, the composition of the ethnic groups of Penyalai is similar to that of migrant villages, except for the presence of Orang Laut fishermen.

Patterns of land use are summarized in Table 1.

III Characteristics of Muara Villages

Abe [1993; 1997] stated that peat swamp forests showed no trace of long-past human activity, but rather they were populated suddenly by migrants in modern times during rapid development. I cannot agree to all of his opinions. Abe considered that only migrant villages would exist in peat swamp forests, and thereby overlooked the existence of

Table 2　Prices for Which Collecters Sell Peat Swamp Products at Muara Villages of Kampar Region

Products	Unit	Price (1,000 Rp.)
Alive large catfish	kg	30
Smoked fish (*gymnotus*)	kg	50
Deer	kg	25
Peranduk (small mouse deer)	individual	25
Napuh (large mouse deer)	individual	55
Square timbers of *puna* and *kmpas*[1)]	ton	700
Logs of *suntai* and *ramin*	m^3	200
Other timbers (logs)	m^3	130

Note: In 2000, the retail price of rice was 1,500–3,000 Rp. per kg (1 US$= 8,000–9,000 Rp.).
[1)]Two hundred feet of square timbers (6 × 4 inches) are calculated as one ton (0.93 cubic meter).

pangkalan villages and muara villages. Different types of villages are found in different habitats, but are connected by a network. The connections between pangkalan villages and muara villages are especially strong. In the central zone, where clear sequential forest zonation is observed, lands suitable for agriculture are limited to small areas covered by mixed peat swamp forests; the other areas can be used only as forests. Thus, people in the central zone (muara villagers) have the closest relationships with the forests.

The agriculture of migrants is intensive, especially labor-intensive and capital-intensive in the process of development, as Furukawa [1992] reported. In contrast, the land use of Malay people in muara villages is extensive in the sense that it is labor-saving and capital-saving. Although the capacity of the land to support the human population is limited in extensive ways the impact on nature is much smaller than with the intensive practices of the migrants. In my opinion, as shown later, such labor- and capital-saving ways with minimum impact on nature require the work of individuals to be highly knowledge-intensive. Here, we can observe and compare two different ways to live in peat swamps. The labor- and capital-intensive ways of migrants have been reported in detail [*ibid.*; Sumawinata 1992; Abe 1993; 1997]. I shall deal with the knowledge-intensive ways of muara villagers.

As is usually the case in trade-based societies, the disparity in wealth is very large in these villages. In the case of Tuluk Méranti, which is at the confluence point of the Kampar and Kerumutan Rivers in Riau, Sumatra, 18 of the approximately 1,500 households belong to the richest class, and the heads of those households are also respected as haji. On the other hand, a large number of people have no savings, and their only estates are houses they built themselves on small lots. Some villagers who have no capital are day laborers (sawmill workers, porters, sailors, shop assistants, etc.), but others are engaged in fishing, hunting, or collecting forest products.

In the following, I describe agriculture, fishing, hunting, dietary taboos, plant usage,

and logging methods that I observed in Tuluk Méranti, in order to elucidate the relationships between the people and the forests. Table 2 shows the prices of some products in the peat swamp forests in the Kampar region in 2000.

IV Agriculture

The traditional agriculture of the muara villages is very simple: the planting of sago on the riverbanks. Once planted, sago palms regenerate from rhizomes. In the Kampar region, sago was a long-established staple food until the 1950s. Thereafter, rice became the staple, and sago is seldom eaten today.

This shift in staple foods occurred at the same time that rubber plantations arrived and the exploitation of forests began. This is explained by the fact that rice cultivation is part of the process by which plantations are established (noted below). As remarked in the first report in this series, there is a limited supply of land suitable for exploitation and the periods of exploitation were not long — only a decade — so today, few additional plantations can be opened. Rice cultivation continues in the most fertile habitats (Fig. 2) in ways that differ slightly from the process of forest exploitation (noted below). In the central zone, such habitats are so small (Fig. 2) that the supply of rice today is mostly imported.

Rice is cultivated in back swamps beyond riverbanks. Rice fields in the central zone are called *ladang*, and the same term is applied to upland rice fields where shifting cultivation is practiced. Villagers say that the rice fields of muara villages are not *sawah* (wet rice fields). As described below, the tools and techniques used in cultivating *ladang* are similar to those used in upland shifting cultivation.

Mixed peat swamp forests are cut using chain saws, axes (*kapak*), and long hatchets (*parang*) in the driest season, July to August. This work is called *tobé*. One month after they are cleared, cut trees are burnt. Rice seeds are broadcast as soon as the fire is extinguished. The process of seeding the rice is called *manyambang*. The villagers have no more farm work until harvest time (*manuai*) five months after seeding. Ears of rice are harvested by *tuwa*, ear cutters. Ears with grains are placed on a *bidai pengil padi*, which consists of a sieve, 2–3 m square. A frame made of wood and bamboo supports the sieve, keeping it ca. 3 m above ground. The sieve is made from cut wood of *linau* palm trees (*Cyrtostachys renda*, Palmae) stitched together with rattans (*Korthalthia paucijuga*, Palmae) at equal intervals through slits 3 mm wide. A woman stands on the *bidai pengil padi* and rubs the rice ears with her feet so that rice grains drop through the slits to the ground 3 m below the sieve. As that is happening the chaff blows away in the natural wind. This footwork for threshing and screening on the *bidai pengil padi* is called *iyik*. Rice grows under non-flooding or temporarily flooding conditions. The rice varieties are the same as those cultivated in the upland shifting cultivation of pangkalan villages, or

Fig. 2　Distribution of Rice Fields and Rubber Plantations around Tuluk Méranti

Notes: Back swamps inside the riverbanks of the winding river, where clay and silt accumulate, are used as rice fields ("C" in the aerial photograph). Back swamps of other habitats are peaty and mineral-poor. Such habitats are transferred to rubber plantations ("P" in the aerial photograph). However, for two years after forests were opened, rice was cultivated in a manner similar to shifting cultivation in both kinds of lands. Straight lines running from riverbanks into forests are *ongka* rails (Fig. 4) to carry timber.

they are the same as those grown both in dry and wet conditions in pangkalan villages. Two factors enable broadcasting without soil coverage. One is that the ground surface is wet. The other is that sparrows or other cereal-eating birds are seldom found in the

central zone of peat swamps.

In the second year after a forest is opened, bushes and grasses are cut by *parang* in August (this work is also *tobé*). Cut grasses are burnt two weeks later, and immediately seeds are broadcasted. The other tasks are the same in the second year as in the first.

In the third year, if the soil is peaty, drainage channels are dug and rubber or coconut trees are planted. If the soil is clayey, rice cultivation continues. Small drainage channels are dug in rice fields only when land levels have fallen as a result of peat disappearing through repeated burning. Because the amount of weeds increases, rice seedlings are transplanted only after they have grown enough to compete with the weeds. Nurseries are made in a portion of the main fields in July. Three weeks after seeding, the main fields are cleared (*tobé*). Forty days after seeding, the main fields are burnt, and seedlings (ca. 30 cm long) are transplanted (*ubah*). As part of this process, seedlings are removed from the nurseries, and their leaf tips and root tips are cut off. Holes 5–10 cm deep (deeper in dry habitats) are dug using sticks called *tugal*, which is also the name used in upland fields for seeding rice. The roots of these young plants are placed in the holes and pushed into the mud or muddy peat by hand. The methods and seasons of harvesting are the same as above. Rice is cultivated in the same fields every year.

In pangkalan villages, both shifting cultivation in upland fields and wet rice cultivation in flooding areas are observed, although shifting cultivation is rare today. In the following, I point out both the common and the different ways in which rice is cultivated between pangkalan and muara villages. In upland shifting cultivation, fallow periods are necessary, because the amount of weeds increases if cultivation continues yearly in the same fields. On the other hand, in swamps of the central zone, rice can be cultivated in the same fields every year, because the muddy habitats enable transplanting. Transplanting is the standard method found in *sawah* (wet rice fields) in flood zones, where pangkalan villages are located. However, in these zones, rice is cultivated from the end of the rainy season, when water levels start dropping. Rice seedlings are transplanted to the re-emerging fields. As Furukawa [1992] introduced, multiple transplanting periods are commonly observed, because water levels continue to drop for a few months. In muara villages, where the fluctuation of water levels is much smaller than in pangkalan villages, such a connection between transplanting and changes in water levels has disappeared, leaving competition with weeds as the only reason for transplanting instead of direct seeding.

V Fishing

The boundary between a flood zone and the central zone is where seasonal lakes appear. This is the best place to catch freshwater fish. In the case of the Kerumutan River, a branch stream of the Kampar River, a small settlement of fishermen, Sungai Boba, is

Table 3　Fishing Gears Observed in Tuluk Méranti, Sumatra

Name	Type	Materials	Caught Fishes	Methods
embatan lintan	fishnet with a folding flame lens shape: ca. 6 × 3 m with sensor strings	*aur* bamboo (*Bambura vulgaris*)	*tapa* (catfish)	ambush fish going down small streams after spawning
amboi	fishnet with a folding flame lens shape: ca. 4 × 2 m	*sowik* bamboo (*Gigantochloa rostrata*)	various	scoop fish at small streams or along riverbanks
langian	like *amboi* but smaller ca. 2 × 1 m	*sowik* bamboo	small fishes for baits	like *amboi*
jaring (1)	oblong gill net, large mesh		*patin* (*Pangasius*)	set across the river, sunken to river bed
jaring (2)	oblong gill net, fine mesh		*teakan* (*Helostoma*) *lais* (*Kryptopterus*)	set along flooding forests of *Syzigium*, where fish lay eggs in rainy season
pukat	oblong net		various	both ends are held by two persons fish are driven to riverbanks
jala	cast net		various	cast from canoes, the net does not reach the bed the net must be twisted on pulling up
serampang	spear	*sowik* bamboo	*tapa, toman* (snake-head fish)	in nighttime, used with a torchlight (*suluh*)
juli	harpoon, the arrowhead is released from the rod	*sowik* bamboo	*patin, belido* (carp)	same as *serampang* but larger fish are caught
pangile	trap, made from fish net and rectangular wood flames		various	put in small streams or along riverbanks with the mouth downstream, without baits
pangile tumbang	same as *pangile*		various	set with cut coconut fruits inside as baits
campiai	trap, fig-shaped	*buluh jaleh* bamboo (*Schizostachyum gracile*)	various	set with cut coconut fruits inside as baits
luka	trap, cylindrical	*buluh jaleh* bamboo, rattans (*Korthalsia flagellaris, K. paucijuga*)	various	set with cut coconut fruits inside as baits
taju	fishing line		*toman*	young catfish or snake-head are used as living bait
awai	consists of many *taju* connected to a horizontal rope		*toman*	same as *taju*
kail	fishing rod, ca. 3 m long with a sinker	*buluh cino* bamboo (*Bambusa multiplex*)	various	boiled casaba roots, earthworms, or small fishes are used as baits
smbuang	fishing rod, ca. 3 m long with a float	*buluh cino* bamboo	*buju* (snake-head fish, smaller than *toman*)	living fishes are used as baits
popa	fishing rod, ca. 1.5 m long without sinkers and floats	*buluh cino* bamboo	various	same as *kail*

located at the boundary separating the flood zone from the central zone. The residents of Sungai Boba usually have their main houses in Tuluk Méranti (a muara village on the Kerumutan River) or Kapau (a pangkalan village on the Kerumutan River). Otherwise, newly married couples live in Sungai Boba until their children enter school, and then they move to one of the main villages. They try to save money by living in fishermen's settlements; they use their savings to start a business after moving to a main village. Fishes are sold in Tuluk Méranti or Kapau, which is visited every week by Chinese or Minankabau traders from Pekambaru, the capital of the province.

Fishing tools and techniques are summarized in Table 3. There are no taboos about which fishes to eat or not to eat, but it is taboo to eat tortoises (*kura kura*) and soft-shelled turtles (*labi labi*) that have been caught in fish traps. These creatures are released or sold to Chinese.

VI Hunting

The most exciting game that these villagers hunt may be deer (*rusa*: *Cerbus unicolor*). The dry season is better for deer hunting, because deer are found near rivers. There are three methods in deer hunting: *bulu, jérat* and *témbak*.

Bulu is hunting using dogs. First, the hunters cast a spell on the dogs for good luck. Two hunters take four dogs into the forest to look for deer, and three people wait in three canoes on the river. The dogs drive the deer to the river, and the hunters in the canoes row to where they hear the dogs barking. When the deer runs into the water, those in the canoes spear it. In combination with *bulu*, devices called *siding*, neck-hanging traps, are sometimes used. Neck-hanging ropes are set at the height of the deer's head at different points along a deer trail. The dogs drive the deer into these traps.

Jérat means traps. Hunters look for hoof prints and set traps there. A spell must be cast on the traps. The traps are made from branches and lianas of forest plants, and each part has a name (Fig. 3). The left and right sides of the trap are blocked with fences called *popa*, and a *pelangkahan* (guide) leads the deer into the trap. When the deer steps on the *lantai* (floor), a *comotik* (pin) is released from a *sulut* (stopper), which is settled by a *bongku* (pile), and the bent *bau* (rod acting as a spring) snaps back. Tied to the *bau* is a *mata* (lasso that has already been set on the *lantai*. So, when the *bau* snaps) back, the *mata* constricts around the legs of the deer and pulls the animal up. The selection of tree poles for the *bau* is important, and they are selected from *kelat* trees (*Syzygium incarnatum* or other *Syzygium* species) in the forests. In the dry season, animal trails leading to rivers are good trap sites. Although it is very difficult for Malay hunters to avoid the paths of wild boars, it is important for them to do so. This is because they consider it an abomination to trap wild boars in traps meant for deer. Caught boars are left untouched.

Témbak refers to hunting with guns. Shotguns are often hand-made from iron pipes

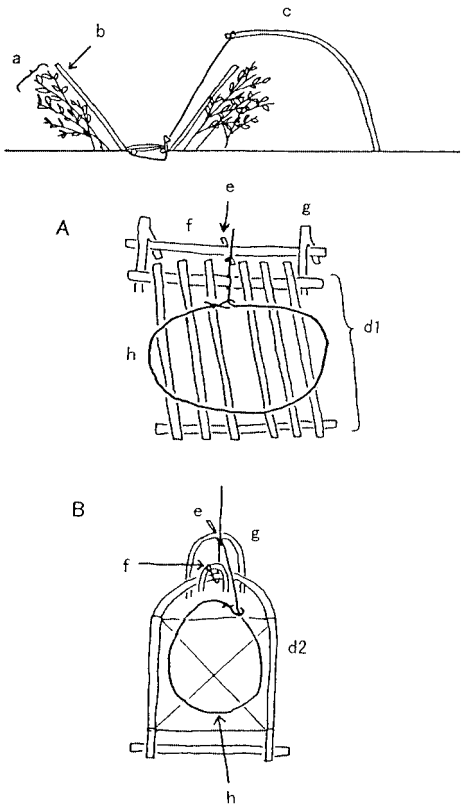

Fig. 3　Traps (*jérat*) to Catch Deer (A) and Mouse Deer (B)

Note: Their parts are named as follows; a: *popa*; b: *pelangkahan*; c: *bau*; d1: *lantai*; d2: *pelapin*; e: *comotik*; f: *sulut*; g: *bongku*; h: *mata*.

and *cempedak* wood (*Artocarpus* integer), so only cartridges are bought. By night, hunters ambush deer along animal trails and shoot them.

If a hunter catches one big deer, he can sell it for 2 million Rp, on which his family can easily live for several months unless he loses it by gambling.

The hunting of mouse deer (*perandok*: *Tragulus javanicus*; and *napuh*: *T. napu*) is less exciting, but this game is more reliably found. Traps for mouse deer are much smaller than those for deer, but their structures are similar. Because the smaller traps must react to the steps of smaller animals, light *pelapin* is used instead of heavy *lantai*. The *sulut* and *bongku* have different shapes than they do in the larger traps, as these smaller ones are designed for greater sensitivity (Fig. 3). Trap sites are selected by proximity to the various foods that mouse deer eat. Mouse deer are especially attracted to wild ginger, *Elettariopsis smithiae* (*keinsisip*, Zingiberaceae), creeping ferns, *Stenochlaena palustris* (*paku*, Blechnaceae), and fallen fruits, especially that of *Tetrameristа glabra* (*puna*, Tetrameristaceae), which are found throughout years.

The populations of gibbons (*ungko*: *Hylobates syndactylus*), macaques (*kera*: *Macaca fascicularis, boök*: *Macaca nemestrina*), and wild boars (*babi*: *Sus scrofa*) are very high, and are potential sources of food for the villagers. However, it is taboo for Malay people to eat these and other mammals (Table 4), reptiles, and amphibians, although medicinal uses of these animals are noted below.

The scales of pangolins (*tenggiling*: *Manis javanica*) are used as an antidote. When someone suddenly falls ill, the villagers usually consider that he or she has been poisoned by somebody, so they administer one of their various antidotes. In the case of pangolins, their scales are boiled and the broth is taken as the antidote. The roasted hearts of flying lemurs (*kubung lumut*: *Cynocephalus variegatus*) are also believed to be an antidote.

Birds are hunted also, and they are usually eaten by the hunters themselves. Some

Table 4 List of Birds and Mammals Found in KWS

Vernacular Names	Scientific Names
Edible birds caught with river side traps	
buung ule	*Ardea purpurea*
buung kompil	*Bubulcus ibis*
bangau	*Egretta eulophotes*
buung pucung	*Butorides striatus*
bibikit	*Ciconia stormi*
bajubolang	*Ciconia episcopus*
uak uak	*Amaurornis phoenicurus*
bobokik	*Numenius madagascariensis*
Edible birds caught with forest floor traps	
menkout	*Rhizothera longirostris*
pengior	*Rollulus rouloul*
puyu	*Turnix suscitator*
ambang	*Lophura erythrophthalma*
Edible birds caught with birdlime	
punai beruke	*Teron curvirostra*
punai tasi	*Teron fulvicollis*
punai utong	*Teron griseicauda*
punai jambu	*Ptilinopus jambu*
pagam	*Ducula aenea*
baram jambi	*Streptopelia bitorquata*
ketitian	*Geopelia striata*
limbuan	*Chalcophaps indica*
cawai	*Dicrurus aeneus, D. remifer, D. sumatranus, D. paradiseus*
bibiik	*Merops viridis*
pinatau	*Aegithina viridissima*
buron daun	*Chloropis cochonchinensis*
sapoca	*Pycnonotus melanoleucos*
ketilang	*Pycnonotus aurigaster*
boba	*Pycnonotus tympanistrigus*
mulai batu	*Copsychus malabaricus*
sangkarak	*Acrocephalus orientalis*
bungosam	*Orthomus sutorius*
cincilak	*Prinia inorata*
injik taik	*Motachilla cinerea*
incit baldu	*Nectarina calcostetha*
coce	*Arachnothera longilostra*
bung incit	*Prionochilus thoracius, P. maculatus, P. percussus, Diceaeum agile, D. trigonostigma*
incit api api	*Zosterops chloris*
pipit pinang	*Lonchura striata*
pipit puntung	*Lonchura leucogastroides*
pipit uban	*Lonchura maja*
tempuo	*Ploceus hypoxanthus*

Vernacular Names	Scientific Names
Birds of taboo to eat	
elang	eagles (species list incomplete)
bayang	*Psittacula longicauda*
saindit	*Loriculus pusillus*
mompoling	*Eudynamys scolopacea*
punai ondu	*Phaenicophaeus sumatranus*
pokup	*Centropus sinensis*
elang kucing	*Ketupa ketupa*
pungguk	*Ninox scutulata*
binti	*Alecedo meninting, Ceyx rufidosa*
mangkako	*Pelargopsis capensis, Lacedo pulchella*
rankong	*Buceros vigil*
ongangboguk	*Aceros corrugatus*
tauda	*Mealaima chrysopogon*
dundun	*Mealaima rafflesii*
papiye	*Colorhamphus fuliginosus*
pelatu	*Picus miniaceus*
palanau	*Eurylaimus ochromalus*
tanau	*Calyptomena viridus*
tiung tana	*Pitta moluccensis*
mulai tabu	*Pitta venusta*
layang layang	*Delichon daypus*
ompak ompak	*Rhipidura javanica*
tiung	*Gracula religiosa*
Mammals hunted for diets	
rusa	*Cervus unicolor*
napuh	*Tragulus napu*
pelanduk	*Tragulus javanicus*
Mammals used as medicine	
tenggiling	*Manis javanica*
kubung lumut	*Cynocephalus variegatus*
Mammals of taboo to eat	
kukui	*Echinosorex gymnurus*
tupai	all treeshrews and squirrels (species list incomplete)
tupai jonjang	*Callosciurus prevostii*
kubung ati	*Petaurista petaurista*
moncit	all rats (species list incomplete)
landak	*Hystrix javanica*
keluang	*Pteropus vampyrus*
kalilawar	all bats except keluang (species list incomplete)
kukang	*Nycticebus coucang*
kera	*Macaca facilicularis*
book	*Macaca nemestrina*
koka	*Trachypithecus cristatus*
ungko	*Hylobates syndactylus*
beruang	*Ursus malayanus*
musang	*Martes flagula, Priondon linsang*
musang air	*Lutra perpicillata*
omui	*Artonyx collaris*
kucing utan	*Viverra tangalunga, Paradoxurus hermaphroditus, Hemigalus derbyanus*
imau	*Panthera tigris*
imau daan	*Prionaliurus bengalensis*
Mammals of taboo to eat and touch	
babi	*Sus scrofa*

birds are caught using traps of the same structure as the ones used for mouse deer. Marshes that dry up during the dry season are good sites for trapping herons, storks, and water hens (Table 4). If nests of terrestrial birds (Table 4) are found on the forest floor, traps are set near the nests to catch adult birds. Smaller birds (Table 4) are caught using birdlime. The sap of *Artocarpus scortechinii* (*töwap*, Moraceae) is collected by cutting the bark. The sap is boiled and plastered onto the tips of rods, which are then placed where birds seem to perch. It is taboo to eat certain birds (Table 4).

The taboos against eating mammals are rather simple: only deer and mouse deer may be eaten. In contrast, the taboos against eating certain species of birds are many, and the criteria to distinguish taboo species from non-taboo species are complex. This difference in complexity between taboos on mammals and those on birds is paralleled by naming systems: the system by which mammals are named is rather simple (for example, all tree shrews and squirrels are *tupai*), whereas that by which birds are named is much more specific and is at the species level (Table 4).

VII　Plant Use

Full descriptions of flora, along with their vernacular names and a complete list of useful plants, are presented in the third paper in this series. The present paper presents only a summary (Table 5). Among 254 plant species collected 41% were used by the villagers as timber, non-wood materials, food, medicine, or indicators of trap sites.

Villagers who have an especially strong knowledge of forest plants are respected as medical doctors. The daily works of rural doctors are fishing, hunting, collecting woods or rattans, and agriculture. A patient coming in for a visit brings a gift such as sweets. The doctor does not charge a fee, unless the treatment requires a drug that includes rare materials that are difficult to get. After the patient gets well, he or she returns to present the doctor with a gift of fowl in return for the successful medical services.

There is not a clear separation between medical treatments and enchantments. Plants taken from deep forests are believed to have mysterious powers. As mentioned above, if a person suddenly falls ill, villagers consider that somebody has poisoned or cursed him. Especially in such cases, the villagers rely on the mysterious powers of forest plants, through the knowledge of rural doctors. For example, when somebody experiences strong chest pain, the affliction is called *tuju* and is thought to have been caused by a curse that someone has placed on the victim. To counter *tuju*, the mysterious power of *misio* (*Ilex cymosa* and *I. pleiobrachiata*, Aquifoliaceae) collected from forests is helpful. Leaves and bark are boiled and applied to the chest.

On the other hand, spirits of the forests often cause diseases. If a person becomes ill after working in the forest, certain plants found near villages are thought to be effective antidotes (for example, *kedudu*: *Melastoma malabathricum*, Melastomataceae; and *debuk*:

Table 5 List of Useful Vascular Plants Collected in KWS

Used for timbers

Alstonia angastiloba Miq.
Arcidendron bubalinum (Jack) Nielsen
Calophyllum rigidum Miq.
Campnosperma coriacea (Jack) Hall. f.
Durio lowianus Scort. ex King
Evodia aromatica Bl.
Gardenia pterocalyx Valeton
Gonystylus bankanus (Miq.) Kurz
Koompasia malaccensis Maing.
Memecyron acuminatum Sm.
Neoscortechinia kingii (Hk.f.) Pax et K. Hoffm.
Palaquim burckii H. J. Lam
Parartocarpus forbesii (King) FM Jarrett
Parastemon urophyllum A. DC.
Polyalthis glauca (Hassk.) Boerl.
Pternandra galeata Ridl.
Shorea macrantha Brandis
Shorea platycarpa Heim
Shorea teysmanniana Dyer ex Brandis
Shorea uliginosa Foxw.
Swintonia glauca Engl.
Syzygium acuminatissimum (Bl.) Merr. et Perry
Syzygium claviflorum (Roxb.) Wall. ex AM et JM Cowan
Syzygium cymosum (Lam.) DC.
Syzygium decipens (K. et V.) Amsh.
Syzygium dyeanum (Bl.) Merr. et Perry
Syzygium fastigiatum (Bl.) Merr. et Perry
Syzygium incarnatum (DC.) Merr. et Perry
Syzygium lineatum (DC.) Merr. et Perry
Syzygium magnoliaefolium (Bl.) DC.
Syzygium operculatum (Roxb.) Merr. et Perry
Syzygium rhyzophorum Boerage. et Kds.
Syzygium sexangulatum (Miq.) Amsh.
Syzygium stenosum King
Tetramerista glabra Miq.
Tristania sub-auriculata King
Vatica pauciflora (Korth.) Bl.

Used for non timber materials

Alstonia angastiloba Miq.
Areca catechu L.
Artocarpus scortechinii King
Bambusa multiplex (Lour.) Raeuschel ex JA & JH Schultes
Bambusa vulgaris Schrad ex Wendl.
Carallia brachiata (Lour.) Merr.
Cyrtostachys renda Bl.
Daemonoropus angustifolius (Griff.) Mart.
Dracaena gracilis Wall.
Etlingera elatior (Jack) R.M.Sm.
Gigantochola aff. *rostrata* K. M. Wang
Hornstedtia caryphera (Koenig) Steud
Hypolytrum nemorum (Vahl) Spreng
Korthalthia flagellaris Miq.
Korthalthia paucijuga Becc.
Pandanus atrocarpus Griff.
Pandanus helicopus Kurz
Polyalthia hypoleuca Hk. f. et Th.
Schizostachyum gracile (Munro) Holttum
Tracostachyum sumatranum (Miq.) Kurtz
Xylopia malayana Hk. f. et Th.

Used for foods, including seasonings and nonessential grocery items

Areca catechu L.
Artocarpus dadah Miq.
Bambusa vulgaris Schrad ex Wendl.
Barringtonia racemosa Roxb.
Barringtonia reticulata (Bl.) Miq.
Campnosperma coriaceum (Jack) Hall. f.
Campnosperma squamatum Ridl.
Chisocheton patens Bl.
Cyrtostachys renda Bl.
Curculigo capitulata (Lour.) Kuntze
Daemonoropus angustifolius (Griff.) Mart.
Dendrocalamus asper Backer
Eleiodoxa conferta (Griff.) Burret.
Etlingera elatior (Jack) R. M. Sm.
Evodia aromatica Bl.
Ganua mottleyana Pierre ex Dub.
Garcinia balica Miq.
Garcinia bancana Miq.
Garcinia tetrandra Pierre
Glochidion borneense (Muell Arg.) Boerl.
Hornstedtia caryphera (Koenig) Steud
Korthalthia flagellaris Miq.
Korthalthia paucijuga Becc.
Litsea gracilipes Hk. f.
Mangifera foetida Lour.
Mangifera macrocarpa Bl.
Medinila hasseltii Bl.
Microcos riparia (B. et Kds.) Burr.
Palaquim burckii H. J. Lam
Parkia timoriana Merr.
Physalis minima L. var. *indica* Clarke
Stenochlaena palustris (Burm. f.) Bedd.
Sterculia javanica Br.
Uncaria glabra DC.
Willughbeia angustifolia (Miq.) Markgarf
Zingiber griffithii Baker

Used for medicine

Alstonia angastiloba Miq.
Canthium didymum Gaerm. f.
Curculigo capitulata (Lour.) Kuntze
Dianella ensifolia (L.) DC.
Dillenia suffruticosa Wall.
Entada phaseoloides (L.) Merr.
Eurycoma longifolia Jack
Ficus aurata Miq.
Ficus fistulosa Reinw. ex Bl.
Hibiscus macrophyllus Roxb.
Ilex cymosa Bl.
Ilex pleiobrachiata Loes.
Jackia ornata Wall.
Knema intermedia (Bl.) Warb.
Melastoma malabathricum L.
Nepentes ampullaria Jack
Nepentes mirabilis Durce
Parastemon urophyllum A. DC.
Peronema canescens Jack
Psycotria obovata Wall.
Psycotria ridleyi King
Quassia borneensis Nooteboom
Syzygium fastigiatum (Bl.) Merr. et Perry
Syzygium lepidocarpum Wall.
Syzygium zeylanicum (L.) DC.
Timonius flavescens Baker

Used for indicators of trap sites

Elettariopsis smithiae Y. K. Kam
Stenochlaena palustris (Burm. f.) Bedd.
Tetramerista glabra Miq.

Ficus fistulosa, Moraceae), as are certain cultivated medical plants (*suntat*: *Peronima canescens*, Verbenaceae; and *pintu ali*: *Eurycoma longifolia*, Simaroubaceae). Villagers pay special attention to the balance between human activities and the powers of nature, and plants found near villages or those found in forests are often helpful in balancing such powers.

Until the early 1990s, rattans were the most important forest products in terms of commercial value, but wild rattans are no longer traded because the cultivation of rattans has increased in Kalimantan. Among the three rattan species commonly found in forests, only *Korthalthia paucijuga* (*rotan*, Palmae) had commercial value. Unlike the other two rattan species found in mixed swamp forests (*danan, Korthalthia flagellaris* and *rotan guta, Daemonoropus angustifolius*), this species is found in *méranti paya* and *padang suntai* forests, so rattan collectors had to go far inside the forest, away from the rivers.

Recently, timber has become the most important commercial product, replacing rattans. The *ongka* method (a method of logging using wood rails and sleighs) is widely spread in Indonesian peat swamp forests. In the Kampar region, Chinese (Fuchenese) wood traders introduced this method in 1991. Today, not only Malay villagers but many people from outside of Riau Province (people from Java, Lombok, North Sumatra, Aceh, Nias, etc.) are also engaged in logging.

The instruments for logging have been borrowed from wood traders. Large trees (usually over 40 cm in diameter) are cut by chain saws. The felled trees are divided into 4–7 m lengths so that they can be carried (thick and heavy trees are cut into shorter timbers, and the rest are cut into longer timbers). Thick bark, like that of *mëranti* (*Shorea*, Dipterocarpaceae), is removed by axe. Wood rails (Fig. 4) are constructed from the site of the felled trees to the riverbank. These rails are made with the wood of several common understory tree species: *kelat* (*Syzygium*, Myrtaceae), *tembasa* (*Stemonuros secundiflorus* and S. *scorpioides*, Icacinaceae), and *boangku* (*Ganua mottleyana*, Sapotaceae). A sleigh (called an *ongka*, ca. 2 m long) made from the wood of *kömpas* (*Koompasia malaccensis*, Leguminosae) is placed on the rails. Timber is raised onto the *ongka* using levers (*wacai*) made from *kelat* and hooks (*locat*). The handles on the levers are made from *bintangor* (*Calliphyllum rigidum*, Guttiferae) trees. It takes six people to pull the timber and sleigh to the riverbank. After the timber is kept there for more than one month to dry up, the

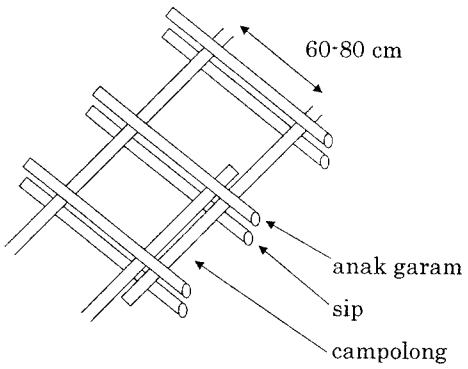

Fig. 4 Names of the Parts of a Wood Rail for the Sleigh That Carries Timber from Peat Swamps to Riverbanks

Note: The central parts of *anak garam* are coated with soap, and the sleigh, *ongka*, is placed on the *anak garam*.

logs are tied into rafts. The rafts are pulled by diesel-powered boats to sawmills near muara villages.

Puna (*Tetramerista grabla*, Tetrameristaceae) and *kömpas* are sawed in the forests into square timbers of 6 × 4 inches, because these woods are too heavy to be carried as logs. If only *puna* or *kömpas* is cut, the sawed wood is carried piece by piece on the shoulders to the river, rather than via the sleigh. This is because these woods are distributed sparsely in the forests and are not found in groups. On the other hand, if they are cut together with other species, the sawed pieces are carried by *ongka*.

Logging is hard work, but knowledge of trees and forests may greatly contribute to the efficiency of the labor. For example, woodcutters climb trees to observe the types of trees around them and thereby decide where the timbers should be gathered and where to place the *ongka* rails. The expensive *suntai* (*Palaquium burckii*, Sapotaceae) and *ramin* (*Gonystylus bankanus*, Thymalaeaceae) trees are found in groups in deep peat, but if the peat is too deep, the forest is poor. In order to find the shortest route to forests dominated by large *suntai* and *ramin* trees, the woodcutters must be able to read the trends in the changing of forest types as a reflection of peat depth. Thus, even non-Malay newcomers learn a lot of plant names and their ecological characteristics.

VIII Impacts of Logging

The *ongka* method has much less of an impact on forests than do the modern logging methods using bulldozers in hill forests. In order to quantify the impacts of logging, I compared total basal areas, the species diversity index (N') calculated from individual numbers, and N' calculated from basal areas among seven plots of primary peat swamp forests (including mixed peat swamp forests, *méranti paya* forests, and *padang suntai* forests) in the Kerumutan Wildlife Sanctuary and in one plot of a logged *padang suntai* forest near this sanctuary. Trees over 10 cm in dbh (diameter at breast height) found in 40 × 60 m plots were identified, and these dbh were measured. Trees over 1 cm in dbh found in 20 × 20 m subplots were identified. Total basal areas were calculated by summing up the basal areas (dbh 2 ×3. 14/ 4) for trees over 10 cm in dbh. N' for individual numbers was calculated as $N' = \Sigma_i (n_i/N) \ln (n_i/N)$, where N is the total number of individuals over 1 cm in dbh found in subplots, and n_i is the number of individuals of species i. N' for basal areas is obtained by replacing the "number of individuals over 1 cm in dbh found in subplots" with the "basal areas of individuals over 10 cm in dbh found in plots."

The basal area was reduced from 134 m^2/ha of primary forests (average) to 89 m^2/ha in a logged forest. The species diversity index (N') calculated from individual numbers decreased slightly, from 3.26 in primary forests (average) to 3.05 in a logged forest. If we consider only *padang suntai* forests (plots D–G in Table 6), the value of N' is smaller than

Table 6 Species Diversity Indices of Seven Primary Forests and One Logged *Padang Suntai* Forest

Forest Type Plots	Mixed Peat Swamp f.	*Méranti Paya* f.		*Padang Suntai* f.					Primary f.	Logged Forest
	A	B	C	D	E	F	G	mean(D–G)	mean(A–G)	H
N' (individual numbers)	3.67	3.41	3.10	2.98	3.26	3.24	3.18	3.17	3.26	3.05
N' (basal areas)	3.32	3.12	2.48	2.40	2.67	2.58	2.63	2.57	2.74	2.44

in plots E, F, and G, but higher than in plot D. The species diversity index (N') calculated from the basal areas fell slightly, from 2.74 (average) in primary forests to 2.44 in a logged forest. If we consider only *padang suntai* forests, the value of N' is smaller than in plots E, F, and G, but higher than in plot D. It is remarkable that the reductions in the species diversity indexes were very small.

In order to learn how many years it takes for a forest to recover, I should continue to observe the logged forests as well as the primary forests. Rough estimations could be made from the first re-census, which should be carried out in 2002. When we consider the forest regeneration process after logging, the following points are essential. If only timber trees are logged, species composition changes, and the concentrations of these timber species may become less and less as logging is repeated. However, with the *ongka* method, the most dominant understory trees (*kelat, tembasa*, and *boangku*,) are selectively used as the materials for the wood rails. These trees compete with juveniles of the timber species. Thus, it is possible that the *ongka* method would prevent the exhaustion of timber species through changes in species composition resulting from repeated logging. Of course, this is just a hypothesis, but it can be tested through continued observations of logged and primary forests.

IX　Concluding Remarks

1. *Forest Conservation*

Close relationships between people and peat swamp forests are observed in muara villages. These villages are trader societies rather than self-sufficient hunter-gatherer societies. As is often found in trader societies, the disparity of wealth in muara villages is very large. The most important point, however, is that the forests maintain the lives of the villagers who are without capital. In other words, property in the form of money is not essential for earning a living in the forests. Instead, collective knowledge and experience is the vital property on which these communities depend.

Why must forests be conserved? They have ecological functions (exchanging gases,

conditioning the climate, supplying water, avoiding erosion, etc.). They are valuable as a form of biological heritage. They are important as genetic resources. These three claims are all true. A fourth reason to conserve forests — to secure nomadic hunter-gatherers' right to live — has also been emphasized (Manser [1997] had a great impact, for example). However, the population of nomadic hunter-gatherers is shrinking, and almost all might become settled sooner or later. If they do, will there still be a reason to conserve forests? Clearly the answer is Yes. It isn't only the very rare hunter-gatherers who rely on the forests, but also the majority of capital-less people, whose only property is knowledge of the forests and experience in them. As long as the disparity in the distribution of wealth continues to grow, then securing people's right to live is the most important reason to conserve the forests.

If we consider only the first three forest-conservation reasons presented above, then an effective way to protect forests is to enclose them in order to prohibit human activities. According to Abe [1993], peat swamp forests are nothing more than obstacles to the proliferation of developments for migrants. However, the relationship that Abe supposed between people and peat swamp forests is not an exclusive one that rules out others. Because securing people's right to live is an important reason to conserve the peat swamp forests, it follows that human activities should not be excluded in them.

Today, no visitors come to Kerumutan, because there are neither roads nor accommodations. However, within the next five years, roads will be built and Kerumutan may become a sightseeing destination. These visitors may wake up in the morning to the sounds of gibbons, and they may enjoy watching colorful kingfishers, hornbills, storks, monkeys and apes, as well as beautiful flowers. Plants listed in this paper and some rare plants still unlisted may be saved from extinction. Forests may be explored as sightseeing resources and conserved as a biological heritage and a treasury of genetic resources. However, it must be noted that in addition to these advantages, forests have different kinds of material and spiritual significance to the everyday life of local people. Seeking ways to conserve such significance for local people is an important subject for ethnobiologists and area studies researchers.

In protected areas like the Kerumutan Wildlife Sanctuary, commercial logging is prohibited but everyday use is permitted. However, because of political crises, government protection of the forests today is unreliable. Nevertheless, forests still remain. Why? My answer is that the Malay people are an influential group that does not allow newcomers to devastate the Malay way of life, in which people interact closely with the forests. If protection by governments is not reliable, then protection by local communities that utilize the forests is.

The next question is why the Malays are influential. In my opinion, the disparity of wealth contributes to this influence. Whereas the poorer villagers depend on the forests, the very rich members of the same community have economic and political powers that they are obliged to use in order to help the poorer members. For example, hunters or

foresters who know forest plants well are often respected as rural medical doctors. But if all community members were hunters or foresters, none would be wealthy, and thus the group as a whole could not be influential against newcomers. Therefore, an important point may be that people with very different economic fortunes are nonetheless connected into the same community.

2. *Adaptation to Environments*

How can people adapt to changes in their environments? No doubt in many cases adaptation is the result of trial and error repeated through a long history. This is the reason why tradition is respected. However, it also must be noted that a long history is not always required. For example, the rice cultivation system of muara villages in the Kampar region became established within a single decade, the 1950s. How were these villagers able to adapt so quickly to the change in their environment? In my opinion, the network of trading, marriage, and migration plays great roles in quick adaptation.

Through trading, muara villages are closely connected with pangkalan villages at the foot of hills. Malay society is matrilineal, and lots of husbands come from pangkalan villages to find brides in muara villages. Pangkalan villages have traditions of upland shifting cultivation (Fig. 5). Thus, it is understandable that rice cultivation in the swamps of muara villages is modified from upland shifting cultivation. The transplanting methods used in rice fields of mineral soils were brought from the cultivation of *sawah* practiced by the pangkalan villages, and were adapted to the conditions in muara villages. Fruitful and quick adaptations are a result of a spontaneous process mediated through the network connecting the different types of villages.

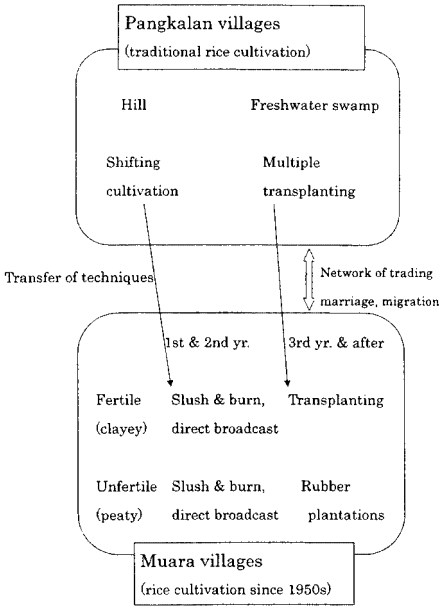

Fig. 5 Techniques of Rice Cultivation in Muara Villages in Relation to Those of Pangkalan Villages

3. *Taboos in Diet and the Network*

Here, I do not ask why taboos were born (there are lots of theories, such as those of Marett [1967], Steiner [1970], and Leach [1981], but to test them is beyond the scope of this paper), but I consider what kinds of significance taboos have for villagers.

When Malay people talk about taboos in their diets, they are strongly conscious of ethnic identity: We do not eat that, unlike Orang Laut fishermen or Javanese

migrants. Muara villages are located in the Malay network of trading, marriage, and migration. Not only traders, but also hunters and fishermen depend on this network for their survival. Orang Laut have their own network. They trade with Chinese. Thus, their ethnic identity is, at the same time, derived from a sense of belonging to a network. Of course, various trading networks converge into one common network, but people interacting with forests represent nodes within each network.

Religion is no doubt an important factor in the formation of this sense of belonging to a network. However, at the levels of everyday life, some (not all) villagers, especially hunters and fishermen, do not obey Islamic doctrine strictly (e. g., they don't fast during Ramadan, they drink alcohol, they engage in rather free sex before marriage). Even so, they are still members of the Malay network because they remember the long list of taboo foods and obey those taboos as Malay customs that rule their everyday life. Except for the prohibition against eating wild boars, the taboos in diets recorded in a muara village are not Islamic customs. These dietary taboos contribute to the formation of a sense of belonging to a network, and sometimes replace Islamic doctrine.

4. *Avoiding Overexploitation and the Malay Network Today*

How is overexploitation avoided? The network may also be a key to this issue. Muara villagers open only those forests that are suitable for agriculture. After the mixed peat swamp forests in the central zone were exploited, some Malay people moved to the tidal zone, relying on relatives in fishing villages. Upon their arrival, they found that wide areas of the tidal zone were covered with mixed peat swamp forests, and so they were able to use the knowledge of forest exploitation that they had developed in the central zone. Of course, they had to adjust their practices to accommodate their close interactions with the original residents of the tidal zone. The muara villagers did not have to develop lands that were unsuitable for agriculture, because they had the network and were therefore able to find better lands.

This use of the network to find better lands can last only as long as frontiers remain. Once these frontiers have disappeared through development, what will these villagers do? There may be two solutions. Today, the Malay network is spreading to cities. The growth of the network, whose capital strength is far less than that of the Chinese network, depends in part on timber money. If the Malay network can survive in the cities, portions of its population might be absorbed there. On the other hand, the Malay people in the tidal zone are now familiar with the intensive agriculture developed by Banjar and Bugis migrants. Thus, considerable numbers of Malay people will be engaged in intensive agriculture in the tidal zone.

The Malay network today includes diverse ways to live: 1) the knowledge-intensive ways of hunters, fishermen and foresters in the central zone; 2) labor-intensive ways of farmers in the tidal zone; and 3) capital-intensive ways of traders in the cities. Because Malay society is matrilineal, boys seldom inherit their fathers' jobs, but seek suitable jobs

by themselves. Most Malay boys go through a number of different jobs or lifestyles, as mentioned above, until they find their niche. In this process of deciding what line of work they want to be in, they usually find wives who are compatible with their abilities, careers, and experiences. This is an important process in forming the Malay network. In addition, they do not hesitate to change jobs when social or environmental conditions change. Thus, before their living conditions decline through overexploitation, they will be able to find other ways to live, as long as the Malay network is sound.

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