Can traditional forest management protect and conserve ironwood (ulin) stands? An option and approach in East Kalimantan

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4 Management and sustainable utilisation strategies for ironwood: a case study in Paser district, East Kalimantan

4.1. Introduction

This chapter describes the traditional forest management and sustainable use of ironwood at the research sites. In addition, the chapter investigates the complex of activities which includes taking place in the research villages, including agriculture and forest management among swidden agriculturists. With a view to understanding how these different sets of activities relate to each other, I have also studied the traditional land use system and its impact on the management of ironwood trees. This topic must be examined prior to tackling issues of sustainable management and exploitation and the utilisation and trade of ironwood trees, which is covered by Chapter 6. I suggest that agricultural land use and forest management, if conceptualised as distinct economic activities, both compete for limited productive resources and, in the case of swidden farmers, mainly for land and labour. The degree of competition depends on the scarcity of each of these productive resources. These facts warrant a detailed understanding of the relation between swidden agriculture, ironwood timber use and procurement and traditional forest management, before strategies and approaches for improved management can be developed.

4.2. Methods, research area and objectives

4.2.1. Methods

This field research is based on interviews with 61 households, direct field observations, plot measurements and field visits to the nearest sawmills in two villages studied in the period 2005 to 2006. The methods of data collection have been elaborated upon in Chapter 2. Information about the terms of land use types at the research sites came from respondents. Generally, these terms are associated with the traditional knowledge

of local communities. The identification of traditional types of land uses as well as the associated traditional or local names of land use types, was undertaken with the help of field assistants, including the *adat* chief, a member of a local non-governmental organisation (NGO) PEMA (*Persatuan Masyarakat Adat*) in Paser, and local collectors who, were appointed based on their experience and their knowledge regarding the recognition of local plant names. Bahasa Indonesia was the language of the research activities, although sometimes it was mixed with the local dialect.

4.2.2. Research area

The two villages where the research took place, Muluy and Rantau Layung (see Chapters 2 and 3), are located in the western part of Gunung Lumut and in two sub-districts in the *kabupaten* (regency or district) of Paser, in the province of East Kalimantan, (see figure 3.1). Officially, Muluy is a *dusun* or hamlet of the sub-district of Muara Komam and Rantau Layung is a village of the sub-district of Batu Sopang (Anonymous 2002). These two sub-districts are located roughly, in middle of the southwestern corner of East Kalimantan and border South Kalimantan province. This region has also been the home of a number of some indigenous (*masyarakat adat*) and other local communities that have been practicing or used to practice traditional resource management systems. Muluy and Rantau Layung were selected as research villages because they have maintained 100 percent Paser Dayak ethnicity and are still using traditional customs to manage their natural resources.

4.2.3. Research objectives and questions

The main focus of this chapter is on the traditional forest management of ironwood. My research attempts to obtain a detailed, quantitative and qualitative body of data in order to make a contribution to improving the conservation effectiveness of traditional systems for the further management of ironwood. The main subject of the study is the Paser people, an indigenous ethnic group in the interior of Borneo. The research looked specifically at the landscape and land use patterns related to ironwood conservation, the ecological knowledge and traditional techniques for sustainable use strategies, as well as the current uses of ironwood and the socio-economic factors that affect ironwood stocks. It also identifies constraints and analysis the external influences on the traditional management of ironwood.

The research addressed the following research questions:

1. What differences exist in the traditional management systems related to ironwood, and what are the characteristics of these systems among two villages in the study area?

2. What are the external influences on towards the traditional management of ironwood?

4.3. Condition and history of the research area

The Gunung Lumut Protected Forest has several sites that were logged in the 1970s by commercial logging companies. These areas are officially classified as forest plantation or cultivation areas (*kawasan budidaya kehutanan*) by the Paser District government. There are fifteen villages surrounding the Gunung Lumut Protected Forest and Muluy is partly located inside the boundaries of the protected area. There are other areas of Gunung Lumut that are production forest. These are located in Rantau Layung and are the basis of these communities' livelihoods.

4.3.1. People and change

As previously described, the local people in the research area represent a multitude of cultures, languages, dialects and religions. During the last decade, organised and spontaneous migration of individuals, families and whole communities from outside and inside East Kalimantan have dramatically increased the population density and ethnic diversity in the region. The origin of the indigenous Paser people is not clear. Different stories are told, including that they were originally from Sulawesi or that they were a sub-tribe of the Dayak Benuaq in the upper Mahakam River. This last story is supported by the fact that there are a large number of words that are the same in the languages of both groups.

Paser indigenous people consist of several sub-ethnic groups: Paser Adang, Paser Semuntai, Paser Tikas, Paser Pematang, Paser Migi, Paser Tajur, Paser Lusan, Paser Labaei, Paser Laburan, Paser Semuntai, Paser Kodang, Paser Telakei, Paser Lembayut, Paser Bura Mato and Paser Balik (Anonymous 2005). Each community has an *adat* (customary) leader selected by the community. The head of the village has governmental responsibility while the *adat* leader carries out and develops the *adat* community (Debang, personal communication, August 2005). Four major groups can be distinguished: (1) Paser indigenous people, a collective term for the people with different cultures and languages but all indigenous to Borneo, who primarily practice swidden agriculture; (2) Banjar, also indigenous to Borneo but originally from the South Kalimantan Province; (3) Bugis, the third major group in the Paser District who mainly occupy the coastal area as fishermen and timber traders; (4) the immigrants from other provinces, the majority originating from the Muslim community in East Java, Central Java, West Timor, South Sulawesi and Sumatera, who work in the state-owned oil palm company; and (5) Finally, the Chinese descendants who have settled in the area for business reasons and who control the distribution of industrial and manufacturing goods in the town of Tanah Grogot.

Along with the Dayaks, the Paser people are considered to be the indigenous people of East Kalimantan. The *Orang Paser*, have a long, dynamic and violent history (Anonymous 2005). The Muluy and Rantau Layung people are communities of Paser Dayak and indigenous to the Paser District. In the past, villages often changed location because of land degradation or wars. In contemporary times relocation has occurred due to resettlement and because of logging and mining concessions. People depend heavily on forest and river resources for food and additional income. Collecting and trading forest products such as fruits, honey, rattan, live animals, and gold-bearing ore continue to be important means for generating money to buy manufactured goods (Murniati et al. 2006, 2008). Most of the people of the two villages are farmers who practice shifting cultivation using a system known locally as *gilir balik* where they plant rice only twice in the same area within a year. Then, with permission from the village chief, they move to an adjacent area in order to open up a new field in subsequent years.

Government processes such as granting concessions or logging permits have long ignored traditional land claims (Nanang & Inoue 2000). This tension between state tenure and traditional systems is one of the greatest challenges to sustainable forest management, and one that is found in many regions in East Kalimantan. The entire Paser region is divided by traditional claims. Nonetheless, the Indonesian government has allocated most of the area to timber concessions with little regard for these prior arrangements. Past government policies have favoured concessionary claims over traditional rights and most of the area is now officially classified as production forest estate. Some of the steeper land is designated as protected forest (*hutan lindung*). Much of the more accessible land has been logged or will be logged in the near future. However, many areas, which according to maps, 'have been logged' according to maps, appear to have been inaccessible, meaning that patches of primary forest vegetation occur in official 'post-logging areas' (Purnomo et al. 2002).

During my fieldwork and discussions with PEMA Paser members and the traditional leader Pak Debang (*kepala adat besar*), I also learned that a number of social problems have arisen as a result of provincial resettlement policies, which moved some previously remote communities into more accessible areas that, traditionally, have belonged to other villages. The Muluy community, which was last relocated in 1977, is an example of this policy. Nevertheless, the government has made special efforts to resettle the Muluy and other upriver peoples and encourage their agricultural development in the new location. Improved health care services and educational opportunities in Paser and some of the larger, neighbouring settlements have also attracted families from more remote sites. This has given rise to new local pressures and conflicts and has been a catalyst for traditional community land claims in areas far from their present location.

The majority of the Paser indigenous people now reside in a residential village area that has been established and given the administrative status of *desa,* a rural village; or, they live in smaller village sub-divisions called *dusun* or *kampung*, which can translated as hamlet. In Indonesia, villages with less smaller than 2000 inhabitants are not usually

independent, but have the status of *dusun* under a larger village unit (*desa*). *Dusun*s are represented in the *desa* government by their local leaders (*kepala dusun*). In general, most villages in the two sub-districts are accessible by motorbike. A few villages are accessible by car and truck. The most remote villages, such as the research site of Rantau Layung, can only be reached by boat; a trip that takes two hours from Rantau Buta or six hours from Batu Sopang (see map in fig.3.1).

4.3.2. History of study sites and forest resource

Muluy

During the research interviews I learned that the development of '*dusun*' Muluy has followed a process that was quite different from other villages in this study. The reason for this is that its population came from a single area, while in other villages the population usually originates from multiple areas. According to the traditional leader (*kepala adat besar,* Pak Debang), the early Muluy people were nomadic, forming a population group of Paser Muluy Bawo. There are several old settlement sites in the Kuaro River watersheds. In the past, settlements were frequently abandoned as part of the traditional swidden agricultural system. According to Pak Debang, the Muluy people have migrated four times in recent decades. Initially, they came from the old village in Gunung Berani (their ancestral home). In the 1940s, they moved to *Kampung Muluy Lama* in the watershed of the Muluy River in order to gain better access to water. In 1971, people were resettled by PT. Telaga Mas to make room for the logging companies. Then they moved to Muluy Baru on Mount Janas following family dispute (although a number of them remained in Muluy Lama). From this information, we can conclude that, in the past, the dynamic pattern of movement has been caused by family disputes, civil insurgency, transmigration, road construction and large-scale logging.

During fieldwork, I also learned that the P.T. Taman Daulat Wananusa company began its operations in the Paser District in 1992, having been granted a legal basis by the Ministry of Forestry Decree Nr. 254/Kpts-V/1992. It was a joint venture by P.T. Telaga Mas and P.T. Inhutani I. This company cooperated with the Ministry of Transmigration, managing forest plantations and a timber estate (HTI) through the transmigration programme and using transmigrant labour. At the start of the transmigration project and the forest plantation in 1993, about 300 families were settled in Suanslutung village. This programme introduced workers, mostly from outside East Kalimantan, to the plantation site. Since then, forty Muluy families have joined the HTI project, leaving 22 families (105 people) who refuse to do so (Gaharu 2000). In 1993, the 22 families were resettled again in Suanslutung. Following a conflict in this transmigration village, with the support of the Department of Social Affairs, the Muluy community moved to its current resettlement site within the PKMT (*Pembangunan Kesejahteraan Masyarakat Tertinggal*) structure of Paser District in 2001.

Figure 4.1. Resettlement of Muluy hamlet

The people of Muluy have always been dependent on the forest and have always used the forests around the protected area. Although they now live in a permanent settlement, they are still highly mobile. During my fieldwork, there were 18 households living in Muluy (121 people in 2006). Their livelihood activities include swidden farming, home gardening, rattan gardening and the collection of a variety of forest products for food such as fruits, honey, vegetables. In addition, they also collect agarwood (*gaharu*), rattan, firewood, medicinal plants and hunt wildlife, fish in the river and creeks, make handicrafts and pan for gold-bearing ore. Furthermore, the majority of people in Muluy are subsistence rice-hill farmers.

During my field research I learned that forest products (bush meat, birds, honey, wild fruits, etc.) from Muluy are mainly marketed in Simpang Pait (only accessible by a logging road that is maintained by the P.T. RKR = *Rizky Kacida Reana*) and in Muara Komam (accessible only by motorbike). Accessibility to the village is fairly good; a logging road crosses the village and cuts directly through the protected forest.

Kampung Muluy Baru or the current Muluy (01°26'21.5"south - 115°57'19.5" east) is located near the heart of the Gunung Lumut Protected Forest. There is P.T. Telaga Mas logging concession located nearby, about 59 km from the Kalimantan trans-highway of Long Ikis and 92 km from the district capital of Tanah Grogot. The current Muluy settlement has been designated a *dusun* or *kampung* or hamlet of Suanslutung village.

Officially, Suanslutung is a village in the Muara Komam sub-district. The villagers use the logging roads to go to the village of Simpang Lombok, 70 km away, and beyond to the cities of Balikpapan and Banjarmasin. The distance between the Muluy settlement and Suanslutung is about 18 km. *Dusun* Muluy covers 12,636 ha, most of which is located in the Gunung Lumut Protected Forest (Anonymous 2002). During my fieldwork, I also learned that Muluy is situated on top of a hill, which makes the availability of water problematic. Two rivers are located approximately two km from the settlement. These rivers are the main source of drinking water and are used for bathing and washing. The houses in Muluy have been built in a small settlement area and they are close to each other. A handful of households have built their small houses in the form of a field hut and stay there for the rice planting period. There is an elementary school (*sekolah dasar*) in the settlement with two temporary teachers. There is no health care in Muluy, but a health clinic or *Puskesmas* (*Pusat Kesehatan Masyarakat*, dispensary) is located in Suanslutung. Muluy also has a small mosque (*langgar* or *surau*).

Rantau Layung

According to the traditional leader (*kepala adat*) Pak Semok, the Rantau Layung people are a population group of Paser Kendilo. They were displaced during the civil insurgency in 1957 and took refuge in the forest for six months. In 1958, they fled and resettled in a village or *desa* called Kasungai (present day Temborong) following pressure from the Ibnu Hajar DI/TII gang. They stayed in Kasungai for ten years. After negotiations with the TNI (*Tentara Nasional Indonesia* or National Indonesian Military) the villagers founded Rantau Layung at a new location (see also CIFOR 2001). During my interviews in September 2006, I learned that the settlement of Rantau Layung people has developed since 1970, at the same time as the P.T. Telaga Mas forestry company was operating around the village. The name Rantau Layung means 'straight river' (*rantau*) with *lahung* or *layung* trees (a fruit tree like the durian).

Livelihoods in Rantau Layung are largely dependent on rattan, coffee and timber products. Other products include honey, latex, candle nuts and fruits trees (durian, rambutan, mangos). According to Purnomo et al. (2004), the total communal forest area in Rantau Layung is about 18,900 ha, whereas the extent protected forest within Rantau Layung is approximately 500 ha.

Administratively, this village is part of *Kecamatan* (sub-district) Batu Sopang (about 200 km from the city of Balikpapan). The village was established at its present site in 1981, although some of the areas around the present village were already cultivated before independence (1945). There are now 217 people living in Rantau Layung, divided among 52 households. There is a primary school, a small mosque (*langgar* or *surau*) and a village office, but no hospital facilities. People in Rantau Layung have large swiddens for rice cultivation, and have developed productive fruit gardens, durian is a

particularly important cash crop. Small-scale logging is another important source of income for local communities in Rantau Layung.

The timber concession company P.T. Telaga Mas has utilise the forest area surrounding the Gunung Lumut Protected Forest since 1970. This company operates in area of 130,000 ha, where two villages Rantau Layung and Rantau Buta are located (Purnomo et al. 2002). After the closure of the company, the logging road was no longer maintained, making accessibility to the villages increasingly difficult. As an alternative, villagers use the nearby Kasunge River to transport goods to Batu Sopang a six hour trip. The villagers' access to markets has historically been restricted by their isolation, with trade only possible when the rivers were high enough to allow transport by boat, or if the surplus goods could be easily carried – and then only in the dry season. The river flows through the village and is also used for drinking water, bathing and washing of clothes.

4.4. Description of resource and land use

In general, the Paser indigenous people have an extensively cultivated, rain-fed agricultural system, supported by semi-wild plants from the surrounding forest areas. The households maintain livestock as their main source of meat and income, along with wild animals and plants that are collected in the forest. The dependency of people in Muluy and Rantau Layung on the natural resources of the forest has influenced the special patterns of land use. Besides providing the basic needs for food and housing, the different land use types also provide increasing varieties of income. These people have combined swidden agriculture and the use of extracted and cultivated forest products as the basis for their livelihoods.

The management of forest resources by indigenous people is closely linked to the management of the village territory and the use of the forest within it based on each area's potential and the people's preferences. The land use of the Paser indigenous people means that the forest areas are in a state of flux transformed into swidden cultivations, then into forest gardens, and then finally, the area turns naturally into forest again. According to villagers from Muluy and Rantau Layung, the successive phases of regeneration, from swidden field to primary forest, may take from one to two hundred years. When the swidden plots reach regenerated secondary forest, local people open them back up again into the second swidden cycle. In Rantau Layung, Pak Semok reports that Paser people prefer to return to previous swidden sites in regenerated secondary forest rather than opening primary forest for their *ladangs*. The Muluy and Rantau Layung village territories are commonly divided into several designated areas. Table 4.1 below gives an overview of the local terminology (collected during field interviews in 2005 and 2006) for various landscape elements.

Table 4.1. Locally identified landscape types in Muluy and Rantau Layung

No.	Land use pattern & term	Landscape characteristics		Management and utilisation	Constraints
		topography	main vegetation		
1.	*Awa ngumo* (Swidden area) (ladang or rice field) or Umo in Muluy	Flat, gently sloping, steep	Paddy, maize, rubber, oil palm	Shifting cultivation, no tillage, no technology, used of herbicide, self seedlings	Wild pig attack, monkeys
2.	*Strat/awa ja* (Settlement area or village/ *kampong*)	Flat, undulating	Fruits trees, coconut	Settlement, village maintained by means of *gotong royong* (working together), managed by village head and *adat* head, structured organisation	Very limited transportation facilities to outside of settlement
3.	*Kebotn* (garden)	Flat to steep, undulating	Fruits, simple vegetables, medicinal plants	No tillage, directly planted from the seed and/or natural seedlings, and in a few cases nursery seedlings, herbicide application	Drop in coffee price, marketing products from garden is difficult (very limited transport facilities), pig attack and rats, no skill in sap tapping
4.	*Lati* (fallow) a. *Lati burok* b. *Lati tuo*	Flat to gently sloping	*Peronema, Vitex, Arthocarpus* trees and bamboo	Abandoned, shifting cultivation area (fallow), will be back after 10 years	None
5.	*Awa pengeramu* (village's open communal forest)	Flat, gently sloping steep	Fruits trees, timber trees, wild pioneer trees	No tillage, Kebotn (garden) directly planted from the seed and/or natural seedlings, and for few cases nursery seedlings, herbicide application	None

No.	Land use pattern & term	Landscape characteristics		Management and utilisation	Constraints
		topography	main vegetation		
6.	*Alas* (forest) a. *Alas adat* b. *Alas tuo* c. *Alas nareng* d. *Alas mori*	Sloping to steep and undulating	Mix of forest tress (*Dipterocarpaceae* dominant, etc)	Forest products can be gathered with permission and deliberation with customary leader, subsistence-way, selective cutting, contribution to the village	The government prohibits the cutting of trees; the regulation is not properly applied
7.	*Sunge* (river)	Gently sloping to steep	Ferns, *Ficus, Litsea* and *Kleinhovia* trees	Used for bathing, washing, toilet and drinking water, place to gather fish, transportation facilities, keeps the function as it is	The water becomes turbid after rain
8.	*Simpunk* (forest island)	Flat to steep	Fruit trees, ironwood trees and rattan	Former village or cultivation, private owner, traditional planting, the fruits, rattan or timber are free for the village community	None

Source: Interviews in 2005 and 2006 and Murniati et al. (2006)

Based on interviews conducted in August and September 2005 in Muluy and in Rantau Layung in February 2006, and also based on data from the NGO *Yayasan Padi Indonesia* (YPI), which has worked in Muluy and Rantau Layung since 1997, the following information can be summarised: There are a number of different forms of land use known by the people of Muluy and Rantau Layung.

1. *Awa ngumo* or *ladang* (Paddy, rice or annual crop field)
   Rantau Layung's primary activities are mainly at the *Awa ngumo*. *Awa ngumo* is an extensively cultivated, rain-fed agriculture system that is planted with semi-wild plants from the forest and surrounding areas. *Awa ngumo* is the first source of staple food for these people, producing items such as paddy and sticky rice (*beras ketan*), maize, cassava, various vegetables and sometimes fruits and fuel woods. The planting system has a typical cropping cycle of one year. The *Awa ngumo* is usually cultivated for two to three years and subsequently fallowed for about five years .

2. *Strat* or *awa ja* (Settlement area or village/*kampong*)
   This area is designed for houses and other facilities, such as a mosque and meeting hall (*balai adat*). It is also close to access to the street and river.

3. *Kebotn* (fruit garden around the house)
   Kebotn is the garden area located around the house planted with fruits, simple vegetables and medicinal plants. This area is an important source of food and additional income for the household, producing fruits and vegetables that can be sold at the local market.

4. *Lati* (former land)
   a. *Lati burok* (young fallow) is the former rice field and now fallow land that has to be swidden.
   b. *Lati tuo* (old fallow) is the land of the former settlement or old village, now given over to fruit trees

5. *Awa pengeramu* (village's open communal forest or production forest)
   Awa pengeramu is usually a former *Awa ngumo* area. This area is cultivated at the end of the *Awa ngumo* phase. The planting consists of fruit and timber trees and also wild pioneer trees that are useful for fuel woods. After its fallow time, the *Awa pengeramu* area will become a *Kebotn, Simpukng* or *Alas* area.

6. *Alas* (Forest)
   Alas is classified in different zones, each with its own set of rules and regulations. Ironwood is often found in this forest.
   a. *Alas adat* is a restricted forest area, which is located far from the village and here customary rules apply. For example, it is forbidden to convert these forests into swiddens (*ladang*)
   b. *Alas tuo* is forest located far from the settlement. In principle, this is an open access area with no specific *adat* regulations
   c. *Alas nareng* is forest that is reserved/assigned/planned for swidden cultivation (*ladang*). These areas are usually located relatively close to the village.
   d. *Alas mori* or sacred forest (*hutan keramat*) is forest that is believed to be a dangerous place (a haunted area); consequently this area can not be utilised.

7. *Sunge* (rivers)
   The *Sunge* or rivers are identified as a particularly important source for food (as are the fields, the forest and the gardens).

8. *Simpukng* (Forest island)
   The *Simpukng* is a reserved area forming a forest island. This may also be an important source of ironwood. It has many varied and useful trees and plants, such as fruit trees, rubber trees, rattans and also ironwood or other timber trees. The *Simpukng* is owned by an extended family. The access to the *simpukng* area is not limited to the owner and is open to people who come from out side the village.

They may take as much of the fruits or timber as they need, without permission, as long as they do not sell them. This area is designed for public services with certain limitations applied. Today, this charitable function has diminished because people tend to take more than they need in order to sell the fruits or timber. However, people from other villages still had access to the fruits or timber, with permission from the owners, during the research period.

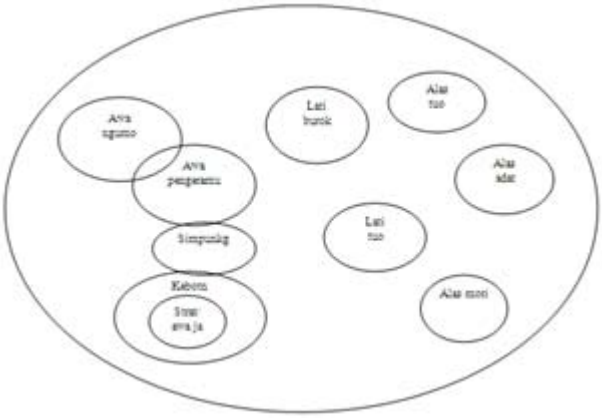


Figure 4.2. Land classification in Muluy and Rantau Layung

In both communities, most land close to the village or settlement is occupied by rice fields, fallowed rice fields (young secondary forests), rubber gardens and fruit gardens. However, mature forest where no farming has taken place for generations – if ever – can be found at less than one hour's walk from the settlement. There are several areas within both villages' territories where farming is not allowed, because they serve as timber and rattan reserves.

These people preserve other sites include groves of trees from felling by particular families. This is done in order to maintain sites of timber trees for cutting or rattan for collection at a later date. In addition, corridors of trees are preserved along the courses of major streams. There are also numerous smallholdings (*kebun*) of rubber trees and other tree crops such as coffee, often interspersed with fruit trees and sometimes overlapping with old longhouse sites.

Forest dependence

The fieldwork reveals that Rantau Layung and Muluy are geographically remote from the centre of power and the markets; consequently, the villagers remain dependent on

forest products and on the production of rice from their swiddening activities. The nature and extent of their direct forest dependence is one major difference between Muluy and Rantau Layung. While Rantau Layung villagers clearly still depend on trees, their landscape differs because it is dominated by intensively managed tree gardens. Muluy villagers cultivate a similar tree species mix – durian, other fruits and rubber – but their landscape is not dominated by intensively managed forest gardens. Rather, it is a mix of swidden fields and fallows, mixed tree gardens and old growth forest. The swidden fields are utilised by Muluy and Rantau Layung farmers for only a single crop of rain-fed rice, followed by a mixed crop of corn.

The major source of land used for swidden agriculture is old growth forest, although swiddens are also made in recent secondary forest. The villagers of both Muluy and Rantau Layung remain directly dependent on mature forest and depend on forest swiddens for most of the food they consume. However, in contrast to the people of Rantau Layung, the inhabitants of Muluy have no access to irrigable land to grow wet rice. The people of Muluy have not adopted the same agroforestry practices as those demonstrated by the people of Rantau Layung. There are several good reasons for this: First, they cannot afford the time or space to convert many of their swidden fallows into fruit or rubber production – they need their swiddens for rice production. Second, their access to markets is extremely limited and so their fruit has become a subsistence crop rather than a commercial crop. Third, useful supplementary income can be obtained from the harvesting of wild forest products, which do not perish easily.

4.5. Traditional management of natural ironwood by indigenous people

Interviews undertaken in August and September 2005 showed that every social group in the study area has its own techniques for managing natural resources in order to sustain and improve quality of life.

4.5.1. Role of adat law in arrangements for ironwood utilisation

The community is equipped with rules and regulations (part of what is called *adat*), which govern patterns of access to and exploitation of the forested environment for subsistence resources (see Eghenter & Sellato 1999; Eghenter et al. 2003). Among the Dayak swidden cultivators of Kalimantan, the customary law (*adat* law *or hukum adat*) has governed forest management for a long time, by regulating people's rights of access to forest products, the designation of forest land cleared for agriculture, and the planting or protection of trees in the forest. In Muluy and Rantau Layung, *adat* law (not merely a traditional legal system but also a moral guideline and the collective memory of the community defining the local institutions and rules of what is right) governs the daily

lives of people, especially the use, access and control over forest resources. The power of the system depends on both material sanctions and more subtle social pressures imposed on those who break the accepted rules of custom and action (Peluso 1992). Sanctions require the rule-breaker to pay predetermined fines to the wronged party and to sponsor a ritual meal between the parties concerned and the arbitrators or *adat* expert (Pak Semok, Jidan and Pak Debang, personal communication, 2005).

Rights over trees and permits

There are two bases for rights over trees. The first is ownership of land. A person who owns a piece of land is also the owner of the trees or crops that grow on the land. In this community, important proof ('living certificates') of land ownership is trees or crops. The second basis is a prior claim, known as a finder's right. During interviews, the indigenous people of the research villages explained that cutting permits for ironwood are regulated in the village (*desa*), and the requirements depend on the needs, i.e. whether the collection is for commercial purposes or for domestic use. The Muluy and Rantau Layung people do not sell ironwood for commercial purposes because it is too difficult and too heavy to transport by water.

Traditionally, the Muluy and Rantau Layung people have followed the practice of only excising fallen or crashed ironwood trees. A fallen tree without ownership marks may be claimed by the person who first found it. The finder must then clear the ground around the tree and place an ownership or prohibition mark, or a stick, across an ironwood trunk. The first person who finds the crashed ironwood tree can use it, but there is still the possibility of sharing it with other villager. Usually, a crashed ironwood is an uprooted, mature tree. Ironwood has a relatively short single root. Its branch roots are short and refined and superficial.

During interviews I learned that ironwood is a species considered sacred in many reserve forests of both communities. The villagers believe that one of the strongest spirits dwells inside these trees. For them, the forest is a public domain filled with a variety of beings, and thus a place in which one must observe the social norms characteristic of life in any public space. When local people need ironwood timber from the forest reserve or *alas adat* (communal forest), mature forest or from the perimeter forest, for example for the pole of a house, they must ask for a meeting with the *kepala adat* to obtain permission. Claims are marked by cutting a small piece of wood or bark and sticking it into the tree, by propping twigs around the trunk, or – more recently – by painting their names on trees. Before the Muluy and Rantau Layung people cut an ironwood tree, they have to conduct a special ritual. In terms of religion, these people are followers of Islam, though some traditions, based on the old religion, still exist, especially those dealing with the cutting of trees, cultivation and harvesting of rice or honey as well as in the making of medicines for various diseases. The traditional leader (*kepala adat*) performs the ritual. This ritual is also carried out before making a swidden

for rice planting or during the harvesting of honey. They call the ritual *besoyong besimong* (it means 'permission') and it involves praying (or *bemamang*) and cutters sing to ask permission from the spirit of the tree, and explain the need of the people to cut the tree. As Weinstock (1983) reported, a villager cutting down an ironwood tree 'may become ill' but will recover 'after he has propitiated the offended spirit through an offering of food' (Weinstock 1983). Knapen (2001) also reported that elsewhere on the island, some Dayak groups (Aoheng, Mahakam-Kayan, Kapus-Iban) did not prohibit the felling of ironwood, but rather its use (Rousseau 1990), which may have been more effective in protecting the species from overexploitation.

Muluy and Rantau Layung people consider it too difficult to plant ironwood, because survival rates of seedlings are quite low and the seed takes a year to germinate. In addition, the growth of ironwood is very slow compared to other tropical trees. There is also a lack of knowledge about cultivation techniques for ironwood. Ironwood is a crucial component of village forest subsistence supplies, this is why that these indigenous people realised that it was important to protect ironwood trees from destruction by maintaining their hereditary customary laws. For this reason, they only cut down ironwood trees for important uses. Ironwood trees are often well protected. During my first field visit in 2005, it was difficult obtaining permission to conduct an inventory of ironwood in the forests. It was only after I, together with one of the PEMA Paser members, explained the aim of the research activities, that the traditional (*adat*) leaders of both villages granted permission. This protective attitude is related to a local 'ethics of access'. Ironwood is perceived as being a highly valuable tree and local people realise that it is a difficult species to renew, like other nonrenewable resource, such as the traditional gold mining in both of the research villages (see box 4.1). They also perceive the forest as their common property and believe it should be managed according to their traditional rules. In principle, the logging companies are not allowed to cut ironwood trees. However, sometimes villagers ask the logging companies help them transport ironwood logs, for the construction of their houses or other infrastructure in the village.

Box 4.1. *Adat* gold mining

Gold mining areas are a communally owned resource secured by *adat* agreements handed down over generations. A person who discovers gold will inform the community so that the source can be collectively worked and the profits can be shared. The communities are divided into groups and share the results of their labour between group members. The gold is taken to markets at Long Ikis, Banjarmasin and Balikpapan, but only sold when there are pressing needs - for food, electronic goods or other items.

Box 4.1. (continued)

The traditional tools for mining gold include panning vessels, made from local wood and coconut shells, to separate the gold from the stones and mud. No chemicals are used. Several rituals must be carried out before panning can start. First, the community must go to the river and state their intention to pan for gold in the local language (*bemamang*), in order to secure the approval of the water spirits (*tondoi danum*) and the sacred figure, 'Nabi Haidir'. The Muluy then make an offering of red-coloured rice. This is placed on a palm leaf with an egg and is taken to the water by four or five elders, whilst chanting *bemamang*. The offering is then released into the river.

If, after floating a distance of about 4-5 metres, the offering sinks, this is a sign that the water spirits have granted the request to pan for gold. If it does not sink, permission has not been granted and, if people insist on panning, they will not be successful. There are several taboos related to mining. If these are broken, bad luck is brought to the whole community in their gold-panning activities. These include taboos against cursing or saying 'bad words', promiscuity, stealing from another group's area, saying the word 'gold' or 'stone', killing animals that come to the panning location and going to the toilet in the panning area.

Certain times are deemed best for panning. These are calculated according to the Dayak lunar calendar. The 'season' lasts for six months, after which an *adat* closing ceremony is performed.

Outsiders wishing to mine gold in the Muluy area must first apply to the *adat* leader. The decision of whether or not to give permission is usually taken in consultation with the community. If the application is unsuccessful, the person is asked to leave. If successful, the miner may go ahead within defined boundaries and on condition that they use traditional mining equipment. They must also inform the *adat* leader of the results of their mining efforts and give half of the gold to the Muluy community. These conditions usually act as a disincentive to miners from outside.

A similar traditional mining system prevailed in the Kelian area, East Kalimantan, where local Dayaks reached an *adat* agreement with outsiders coming in during the 1980s 'gold rush'. However, they were soon followed by Rio Tinto and the Dayaks were deprived of their resource. Indigenous mining rights to mining are not recognised by the Indonesian authorities, who favour large-scale commercial exploitation over small-scale mining.

Source: Jidan Muluy Community in Down to Earth 48, February 2001

4.5.2. Ecological knowledge of ironwood

During fieldwork in Muluy and Rantau Layung I learned that the village residents took ironwood either from the abundant mature forest on the outer perimeter of their village territory or from one of the two reserve forest areas encircled by more intensively managed land, converted to dry field agriculture, to early fallow, or mixed gardens. The traditional leaders informed me that generally information regarding candidate sites for new fields is reviewed before making a consensual decision by villagers. The advantages and disadvantages of each proposed site are discussed by household members and elders. Generally they discuss constraints including ecological suitability, potential productivity, logistical convenience, and potential conflicts among families and other groups. They also discuss proximity to the community, a river or water source and a road when making plot selections.

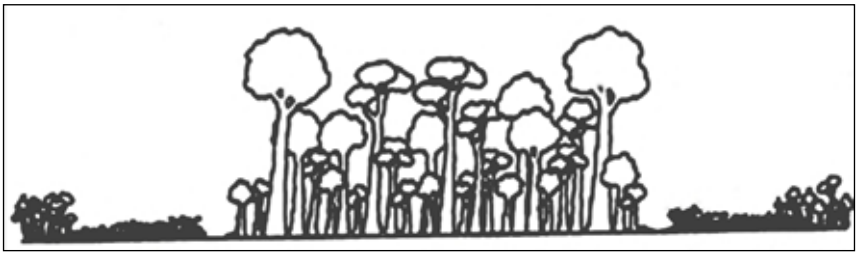
After a *ladang* site is selected, it is usually cleared by a group of men from the village using traditional cutlets (*parangs*). The environmental impacts resulting from the traditional cutting and felling methods practiced by these communities in their forests area appear to be limited, as they do not create gaps much larger than those made by natural tree-fall. The Muluy and Rantau Layung people practice directional felling, occasionally cutting lianas and smaller trees, which might disturb the way the tree will fall. On slopes, they try to fell the tree along the slope. This is done not so much for the protection of the forest, but rather as a way of facilitating on the spot processing of the trees into beams or posts and planks. Also, an improperly felled tree may be difficult and, at times, dangerous to work on. The gaps made by the felling of trees for 'consumption' are similar to natural tree fall gaps both in the terms of size and regeneration of seedlings, and in the amount of damage to the soil, undergrowth vegetation, etc. As no machinery is used apart from a chainsaw, the felling and extraction of timber causes little damage to the surrounding forest. However, as logging is selective, and because 'outsiders' now also invade the land to collect non-timber forest products (NTFP), especially *gaharu* and rattan, it is possible that some preferred species have been reduced locally in both distribution and abundance.

During fieldwork I also investigated how the Muluy and Rantau Layung people manage ironwood stands. The villagers did not plant seedlings of ironwood, but they did protect the trees during a swidden burn if it occurred within the area being cleared for agriculture. Before they make a swidden for rice planting (called shifting cultivation by outsiders), they first observe the forest location. If they find ironwood stands in the cluster, they avoid these stands by making 'forest islands or *simpunk*' (see also fig.4.3) and create a swidden around these ironwood stands. These 'forest islands' had not been converted to field agriculture or tree gardens because they were topographically unsuited to efficient swiddening, dotted with large boulders above and below ground. Like the perimeter forests, these reserves provide a range of forest products that are important to everyday life in both villages. Ironwood is only one of forest products from the perimeter

forests. However, if they find ironwood stands separately, they move to other locations. They also take in to consideration that after ironwood stumpage the soil usually has low fertility and is not good for planting rice. MacKinnon et al. (1996) confirm that soils carrying ironwood forests are not very fertile and contain a high sand or clay fraction.

Each tree of a certain species of trees are regarded as sacred or protected. These people conserve large trees in their forest. This is related to decomposition of mixed leaf litters, especially from large-diameter trees in areas that dominated by the *Dipterocarpaceae* family. The deep topsoil accumulation in the areas also indicates the presence of important trace minerals. Often these are (economically) useful trees such as 'honey trees', in which bees like to make their hives (often a *Koompassia excelsa*), the ipoh tree (*Antiaris toxicaria*), used to make dart poison, or illipe trees (*Shores spp.*) that have nuts that produce a butter-like oil. Such trees are commonly spared when villagers or farmers clear forest for swiddens. Beside ironwood, typically, large-diameter trees are left behind, such as valuable Borneo champor (kapur or *Dryobalanops spp.*), honey tree (banggeris or putih or pohon madu or *Koompassia excelsa*) and meranti (*Shorea sp.*).

By leaving these trees standing when a swidden is cleared, a resource is saved for future use. Joyal (1996) refers to this management practice as 'sparing'. Ironwood is sometimes spared because the stems have potential future cash value and it is time-consuming to cut them. Ironwood stands mainly occurred, associated, and distributed in old-growth forests (*alas tuo*). As previously mentioned, if important trees are found in cluster, forest islands or *simpukng* are created to protect tree stands or tree reserves. *Simpukng* comprises mixed tree species and play a role in the production, protection and culture functions of Muluy and Rantau Layung people. *Simpukng* are mostly protected and consist of both cultivated and wild floras that provide environmental and economic benefit. They also function as in-situ conservation areas for ironwood and other plants. For lists of plants found inside *simpunkg* that produce non-timber forest products at the plots in Muluy and Rantau Layung plots see Appendix 6, tables 1 and 2 respectively.



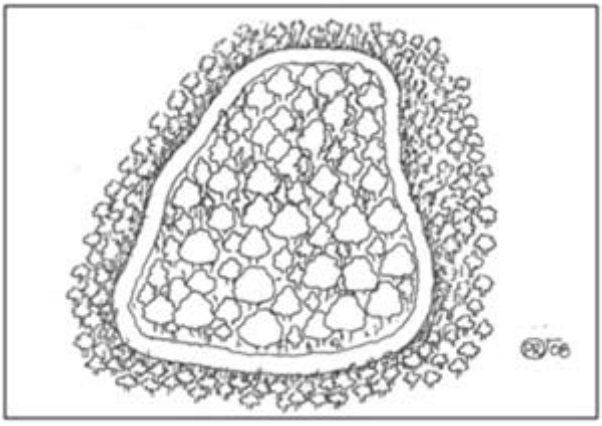


Figure 4.3. Forest islands or *simpukng* created to protect tree stands or tree reserves
Source: Field visits and interviews in 2005 and 2006

In addition to various categories of forest fallow, two further categories of specially preserved forest are recognised old longhouse sites and tree reserves (*pulau* or island). The former are prohibited from being farmed because of the valuable, long-lived fruit trees that people planted while they lived there. The latter cover a number of categories, including sacred sites, which are defined by their association with graves, sites of human death, and claims of spirit habitation.

Figure 4.4. Many plants are found inside the *simpukng*: ironwood, diverse of rattans, honey trees and other valuable plants

The traditional method of ironwood conservation can also be considered as one of the possibilities for improving the sustainability of the forest in this region. The Muluy and Rantau Layung people call 'reserved forest' with a diversity of trees '*alas nyelambang nté anaopo lai sori*', meaning 'reserved forest for future and next generations'. Ironwood trees grow in the reserved forest together with other plants.

Many authors have written on this subject (Elevitch & Wilkinson 2000; Donovan & Puri 2004). Subsistence resources include food (wild food resources), materials (timber for building houses and canoes, rattans and palms for tools and crafts), medicines, and other products. They also include land and water bodies: farming land, collecting areas, hunting grounds and fishing areas. Ironwood timber is also considered as part of their subsistence resources and an indispensable material for their traditional uses.

Although the people of both villages do not collect ironwood seeds, they have made attempts to transplant wild seedlings from the forest into abandoned swidden plots and home gardens, reportedly without much success. During the field visit to the villages, I observed no planted ironwood trees. The Muluy and Rantau Layung people recognise that ironwood trees tend to be located on the steep banks of usually dry streambeds, high in the headwaters of small streams.

Sometimes, a protected tree species may play an important role in the local ecosystem. Some fruit trees provide a strong catalytic function by attracting fruit dispersing vertebrates and enriching the local seed-rain (Guevara 1986; Hietz-Seifert et al. 1996). With reference to the importance of ironwood trees for faunal habitat requirements, local people confirmed that ironwood trees are ecologically important for certain mammals and birds. During my field observation, the large number of seeds found in the plots provided evidence of a very low seed predation. That said, I found that ironwood seeds are eaten by porcupine or *tetung* (local name) or *landak* (*Trichys fasciculata, Hystrix brachyura, Thercurus crassispinis*). Villagers value ironwood because its fruits attract animals that they can hunt. The Prevost's squirrel (*Callosciurus prevostti*) feeds, to some extent, on ironwood fruits and the trees are sometimes also damaged slightly by small beetles (MacKinnon et al. 1996). Leighton (1993) also noted that most of the ironwood trees in old-growth forests are used as food, accomodate bee nests (Eltz et al. 2003) and shelter or sleeping sites for orang utans (*Pongo pigmeus*). Indeed, the orang utans are highly dependent on ironwood trees for food and nesting, and they use them to move through the forest by vine and branch (Yaya Rayadin, personal communication, August 2007). For the bees, they serve as an effective shield against predator attacks. Additionally, ironwood has a tendency to form hollows that can be accessed by bees through crevices between living and dead parts of the trunk (Eltz et al. 2003). The importance of ironwood trees lies in the fact that they are a key species in the tropical forest ecosystem because of their carvenous stems and their regular and rich fruiting pattern. In sum, ironwood trees are especially important for wildlife because their stands provide fruits, opportunity for nesting, shelter and sleeping sites.

Figure 4.5. (A) Ironwood fruits as a food eaten by porcupine and (B) porcupine meat as a food for villagers

Manipulation of the forest composition has implications for herbivores. While the vegetation's chemistry is complex (for example, see Gartlan et al. 1980; Waterman 1983; Waterman et al. 1988 in Sheil & van Heist 2000), one rough generalisation is that slow-growing, dense timber species such as ironwood trees generally have better defences against browsers and provide fewer resources for vertebrates than faster growing, lighter species (see e.g. Gartlan et al. 1980; Janzen 1979; Loehle 1988; Sheil & van Heist 2000).

4.6. Traditional exploitation and utilisation pattern of ironwood

4.6.1. Utilisation

Both communities rely almost entirely on construction materials extracted from the surrounding forests. Ironwood has long been an important product of the old growth forest. Traditionally, the valued stock was used sparingly by villagers for local construction. Ironwood in particular, with its myriad of non substitutable subsistence uses, was rarely harvested for commercial purposes, although ironwood shingles could be sold for cash to buy food. According to the traditional leader (*kepala adat*) of Rantau Layung (Pak Semok), if local people need ironwood timber for construction, they only cut ironwood trees with a large diameter (more than 60 cm DBH). Stems from young trees are not good for house construction as, the poles or planks will be bent or crooked. Field observations at the research sites revealed some varieties of ironwood, namely *telien baning, telien sirap* or *jambu* (according to Rantau Layung people) and *telien jupe* (see table 4.2). According to Muluy people, the variety of *telien baning* is the most suitable *ulin* for construction. The Muluy and Rantau Layung people call *ulin sirap*

as *telien sirap* or *jambu* respectively. Interviews revealed that for house construction, the Muluy and Rantau Layung people only use ironwood to make the posts and poles (*tiang*) of the house. They do not use ironwood for flooring, because they consider the tree too valuable for this task.

Table 4.2. Summary of Paser indigenous knowledge of ironwood

Silvical characteristics and management aspects	**Indigenous knowledge**
Local names	*Telien baning** *Telien sirap or jambu* *Telien jupe*
Type of forest	Mixed lowland to hill dipterocarp forest within *adat* forests
Distribution pattern of *ulin*	In clusters, unevenly distributed
Regeneration from seed from wildings from coppice from cuttings	 observed, good observed attempt, but unsuccessful observed, good no reports
Exploitation	Naturally crashed old trees with customary law and communal use
Stands management	Forest island or *simpunk*
Uses	As subsistence resources

Cutting is usually done manually. The Muluy people still use a traditional axe or *wase* (local name) for cutting ironwood trees. This *wase* has a flexible handle that is made from rattan. The people of Rantau Layung have not used this *wase* since 2002, when they started to use chain saws. Formerly, all posts and beams were cut with an axe or *adze*.

The introduction of chainsaws has brought about a shift in the use of the species, as the exploitation of the forests has gradually accelerated since chainsaws greatly facilitate the cutting of trees. However, chainsaws also made it possible to use different types of wood for local construction. As mentioned earlier, livelihoods in Rantau Layung are dependent on timber products. The Rantau Layung people gather timber from species like meranti (*Shorea sp.*), kapur (*Dryobalanops sp.*) and bangkirai (*Shorea laevis*) for commercial purposes. They make rafts from these tree trunks during the night and transport them by water. They then sell these beams and planks in Batu Kajang (the capital of Batu Sopang sub-district). However, this is not possible with ironwood because

it is too dense and heavy to transport by water the wood sinks. In the social context of production, the cooperation among fellow villagers is sometimes needed because not all households possess the necessary equipment, i.e. a chainsaw, for felling trees and cutting wood, or a motor boat (*ketinting*) for transporting material.

To explore the diverse uses of ironwood, I conducted free listing with items such as household and construction tools. Local people use ironwood timber in the construction and traditional use of tools (see table 4.3), such as posts and beams (*tonggak* and *balok*), poles (*tiang*) in houses, stair dowels or steps (*pansek*) for honey trees, dibble sticks (*asok* or *tugal*) to make holes to bury seed plants, pound sticks (*alu*) to remove the skins of paddy, charcoal (*arang*), statues (*patong*) and blowpipes (*sumpit*). Timber wastes of ironwood are also good raw material for charcoal-making. Indeed, ironwood produces high quality charcoal that burns slowly and releases much heat.

Ironwood tools are important in all aspects of cultural life (see table 4.3). In former times, when the informant communities had only limited contact with the outside world, they were almost completely dependent on homemade tools. Today, when both communities are in regular contact with the outside world, some traditional tools made from plant materials have been substituted by modern replacements such as plastic containers and modern kitchen utensils. Other traditional tools have been made superfluous by modern development. However, there is a strong tradition of homemade tools and, as they are inexpensive and do not have to be carried all the way from town, many kinds of tools are still made by people themselves. Furthermore, some tools, such as dibble sticks, and stair dowels cannot be bought from town as they have no modern replacements, and they are specific to life in the interior. During the interviews I found that every household or family has its own dibble stick. These sticks are special as they are inherited from grandparents. In both communities, hill rice is the main product of the swidden fields. Rice planting activities, follow a gender division of labour. The men walk in a line making holes about one and a half inches deep in the ground with the dibble stick (see fig. 4.6 B); the women follow the men with small baskets of rice seeds, dropping three to seven grains into each hole, closing the hole with one foot. In former times, planting rice seeds was 'a gala occasion' when men and women dressed up in their best clothing and colourful traditional sun hats. The roles of men or women in rice planting are frequently interchanged but men are traditionally responsible for both collecting ironwood and making ironwood tools.

Table 4.3. Tools and equipment made from ironwood for traditional uses

No.	Local Term	Means	Uses
1.	*Tiang*	Pole	Pole of house
2.	*Tonggak or balok*	Post or beam	Foundation of house, bridge construction
3.	*Pansek*	Steps or stair dowels	Hammered in the honey trees and connected by poles to create stability. The poles have to be replaced every year; the steps generally last for more than ten years.
4.	*Asok or tugal*	Dibble sticks	Make hollows to sow rice seeds
5.	*Alu*		Remove the skin of paddy
6.	*Arang*	Charcoal	For burning iron in making process of *parang* or *kapak* (traditional axe) and other uses
7.	*Patong*	Statue	For ritual purpose in former times
8.	*Sumpit*	Blowpipe	For hunting animals, but in former times, it is used as weapon

Figure 4.6. Tools and material from ironwood (A) A blacksmith at work at the bellows, charcoal from ironwood waste for burning iron in the making of a *parang* (knife)*;* (B) *Asok* (dibble stick), make holes to sow rice seeds.

During my field research, I observed that there are many differences between the two villages in their use of ironwood for house construction. The development of Rantau Layung started earlier than the development Muluy, but houses in Rantau Layung look more modern than those in Muluy. The posts in the ground are all made from ironwood, which tolerates contact with the soil for a long time. The timbers used for indoor purposes are from species that do not last when exposed to rain. Today, most roofs are made of corrugated zinc, but, before this material was available, the roofing was made from wooden shingles made from the leaves of certain species of plants such as palm leaves (*Metroxylon sp.*). Nails and zinc roofs are, by and large, the only construction materials adopted from the outside.

Currently wooden planks are used for flooring, but these planks were not easily obtainable before villagers had chainsaws. Previously, floors were usually made from split bamboo or split *nibong* (*Oncosperma spp*) trunks. These materials are still used for the flooring of open galleries or temporary sheds. Today, the Muluy people also use ironwood for new infrastructure, such as poles for electricity cables. The local NGO *Yayasan Padi Indonesia* (YPI), with funding from international NGOs, has established a local hydro-electric power unit in Muluy.

The trunk of the ironwood is first cut to about 60 cm in length and divided into two or four blocks (depending on the size of the trunk). Then, from this block, wooden shingles of about 60 cm long by 10-20 cm wide are split into 2-3 cm in thickness. A small hole is made in the upper end of each shingle through which a rattan string is threaded, fastening each shingle to roof battens separately, so that the shingles cannot slip out if the string snaps at one point. A shingle-roof will last for between 20 and 30 years.

4.6.2. Ethics of access

The Paser, the focus group of this study, extract ironwood for household use, while other forest products, such as rattan, are extracted for commercial purposes, household use and consumption. Forest management by local groups for control and access over resources has long been in existence (Eghenter 2000a, Furze et al. 1996, Peluso 1992). Indigenous groups have long used extractive reserves to restrict access to resources for community members and outsiders who have encroached on traditional lands (Furze et al. 1996). Extractive forest reserves are areas where natural resource extraction is available to community members. There are often strict rules regarding the exploitation of resources within the reserve. Extractive reserves are often identified as a way of maintaining biodiversity, as well as of providing sustainable economic return to local people and governments (Crevello 2003). Indigenous communities often form extractive reserves in order to protect resources from outside encroachment and extraction.

Unlogged forest is consistently valued much more highly by local people than logged forest. If the forests were destroyed by logging this would seem unsurprising – yet commercial logging removes only a few stems per hectare and leaves tall species-rich rain forest behind. Explanations for the decline in value are various: a combination of diminished resources, reduced physical accessibility and reduced access rights.

Ironwood in particular, was subject to the traditional rule of access in both villages (see also box 4.1). When a product such as ironwood was important to every household in the community, groups of users were not allowed to monopolise the supply available. Such a monopoly would go against the social norms of rightful distribution, especially in an isolated village where substitutes were not available.

The ecological characteristics of a particular product are also affected by the nature of the access rules or by the expectation of product distribution within the community (see Oakerson 1986). Non-renewable or difficult-to-renew forest products, such as certain species of rattan (for example, *Calamus manan*), incense wood (*gaharu* or the diseased heartwood of *Aquilaria malaccensis*) and ironwood, can be subject to access controls that are different to those for more easily renewed species. Because they do not regenerate within a single human generation and their regrowth cannot be accurately predicted, future supplies for the villagers' descendants cannot be ensured once they are cut. Each traditional community has control over a given territory, a tract of forest around the settlement. Members of the community possess an in-depth knowledge of the inventory of extant resources within the territory.

4.7. **Discussion and conclusions**

My research documents the land use practices, traditional management and ecological knowledge and sustainable use of ironwood in the villages of Muluy and Rantau Layung, home to the Paser indigenous people of East Kalimantan. The Muluy and Rantau Layung village territories are commonly divided into several designated areas. Eight landscape types were identified by the inhabitants of both villages: (1) *awa ngumo* or *ladang* (paddy or rice or annual crop field); (2) *strat* or *awa ja* (settlement area or village/*kampong*); (3) *kebotn* (fruit garden around the house); (4) *lati* (former land); (5) *awa pengeramu* (village's open communal forest or production forest); (6) *alas* (forest: *alas adat, alas tuo, alas nareng, alas mori*); (7) *sunge* (rivers); (8) *simpukng* (forest island). My research shows that the mosaic of land management systems creates diversity in the landscape as well as the opportunity to benefit from the assorted diet and income generation activities facilitated by these systems.

Where trees are found in clusters, forest islands or *simpukng* are created to protect tree stands or tree reserves. *Simpukng* comprises mixed tree species and play a role in the production, protection and culture functions of these people. *Simpukng* are mostly protected and consist of both cultivated and wild floras that provide environmental

and economic benefits. The *simpukng* also functions as an in situ conservation area for ironwood and other plants. From a landuse system perspective, the *simpukng* systems offer an interesting challenge for ironwood conservation. They are genuine examples of '*kebun lindung*' (or 'protected forest gardens'), which provide not only valuable tree species like ironwood, but also have environmental and economic functions. Not only do these systems provide material output to individuals in the communities of Muluy and Rantau Layung, they also provide many environmental services that benefit the global community. Plant and animal biodiversity, carbon sequestration and hydrological functions are among the key services. Both the individually and community-owned *simpukng* have great potential for improvement. Enhancing tangible benefits for the people who manage these *simpukng*, while keeping their environmental functions intact, is a logical direction for research and development programmes. Documentation of the indigenous knowledge about these systems, their components, backed up with scientific investigation, will provide clarity on existing problems, future threats and opportunities for sustainable management of these resources. Participatory approaches to address the problems of declining resources and eroding indigenous knowledge need to be promoted.

I have only recorded a small fraction of the indigenous people's knowledge about the use and management of their natural resources, with a focus on their knowledge of the ironwood tree and its ecosystem. I investigated the traditional management practices of the ironwood tree in order to understand its role in the agricultural and forest diversification, which Alcorn (1990) considers the 'self-insurance' of indigenous management. These indigenous people have not only slashed and burned, hunted and harvested, but they have also manipulated and managed valuable tree species particularly ironwood often in subtle and complex ways that are invisible to the scientist's and traveller's eyes. Diversification works as an insurance to the extent that if one crop fails or the price of one crop is lower than expected, other products can help to reduce or compensate for financial losses. This approach is a hedging technique, analogous to investing in a mutual fund, spreading the risk among the natural resource assets in an agricultural and forestry-based portfolio.

Sustainable cutting implies a concern for the future of a resource; of an obligation to leave resources intact for future generations. For ironwood, the limited number of traditional uses and the difficulty of traditional harvesting make sustainability possible. At the same time, new uses for the species, improved transportation, and increased colonization with concomitant land clearing could remove ironwood from the landscape of the future.

A strong social basis for forest conservation exists among the communities in and around the Gunung Lumut Protected Forest. The majority of the people in Muluy and Rantau Layung acknowledge that most land in the Gunung Lumut area is unsuitable for agriculture. People depend heavily on forest resources, especially for food and as a source of income. From the communities' perspective, they use the forest mainly for fulfilling

their basic needs; that is, opening areas for shifting cultivation and gardening. They have managed forests sustainably for centuries and their farming management systems are adaptive. Unfortunately, the Paser way of management is difficult to explain in terms of contribution to professional forest management. The need to gain traditional knowledge is critical for the indigenous people's existence as it will help them to gain the respect of the government and other stakeholders related to natural resources management. Hopefully, this will lead to changes in policies that will allow the continuation of the Paser way of life.