Indigenous systems and ecological knowledge among Dayak people in Kutai Barat, East Kalimantan – a preliminary report

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Contents

Executive Summary

Sustainable forest management and conservation initiatives are becoming increasingly important in the tropics as the alarming rate of deforestation continues. The almost completed deforestation in East Kalimantan, one of the most ecologically diverse rainforests in the world, provides an undisputed example. The indigenous management systems along with communal conservation of forest resources as well as the indigenous knowledge of biodiversity are on the verge of disappearance due to a number of factors – uncontrolled logging, gold and coal mining, village conflicts and rampant corruption – all for personal short-term economic benefits. The indigenous systems and participatory approaches to conservation, documentation and promotion of indigenous knowledge with due respect of intellectual property rights of these indigenous people require immediate attention. This is a report of a rather quick and preliminary investigation through farmer consultation and field visits to Kutai Barat district in East Kalimantan supplemented with some literature review.

The Dayak were traditionally forest dwellers. The environment has shaped their complex cultures and beliefs. The vice versa is equally true. The Dayak people created a mosaic of land use systems including swidden agriculture, mixed fruit orchards, rubber and rattan plots and woodlots. Customary laws shaped the landscape and dictated extraction of forest products from common properties; while household owned resources were also managed in which conservation, diversity and sustainability are clearly seen important. Indigenous value and knowledge of biodiversity is understandably rich among the Dayak people. Numerous indigenous landuse systems have potential for in-depth knowledge investigation. The *umaq* (non-irrigated paddy fields) remains at the heart of landuse change and their management. Natural vegetation is an important aspect of fertility replenishment of the soil. Indigenous knowledge about natural plant species, their functional (use and ecological) values is key aspects of Dayak indigenous communities. The use of certain plants as indicators of soil fertility is well reported in the literature, but in-depth knowledge about these plants and other useful plants are still inadequately studied.

The *umaq* plots, normally after a year of rice cultivation, are later allowed, with enrichment planting of fruit trees, rattan, to develop into *simpukng* (forest gardens) that are an important resource for the Dayak Benuaq for collecting fruits, medicines, timber, firewood, rattan, wildlife. A range of *simpukng* serve a myriad of functions - ecological, economic, religious and cultural. *Bengkar* (forest reserves) are largely community controlled but currently under pressure from extensive logging activities and large-scale plantations. There is much ecological knowledge among the Dayak people about valuable and use plant species and wildlife, their habitats in these *simpukng* and *bengkar* systems that are invaluable for resource management. Quick action is required from development agencies to understand and document indigenous knowledge and find ways to promote participatory community action to preserve. The weakening community cohesion necessary for effective participatory resource management, largely related to the on-going quick-buck strategy in logging and mining activities will require some serious thoughts. Also the issue of policy on land tenure is likely to remain influential in natural resource management in Kutai Barat.

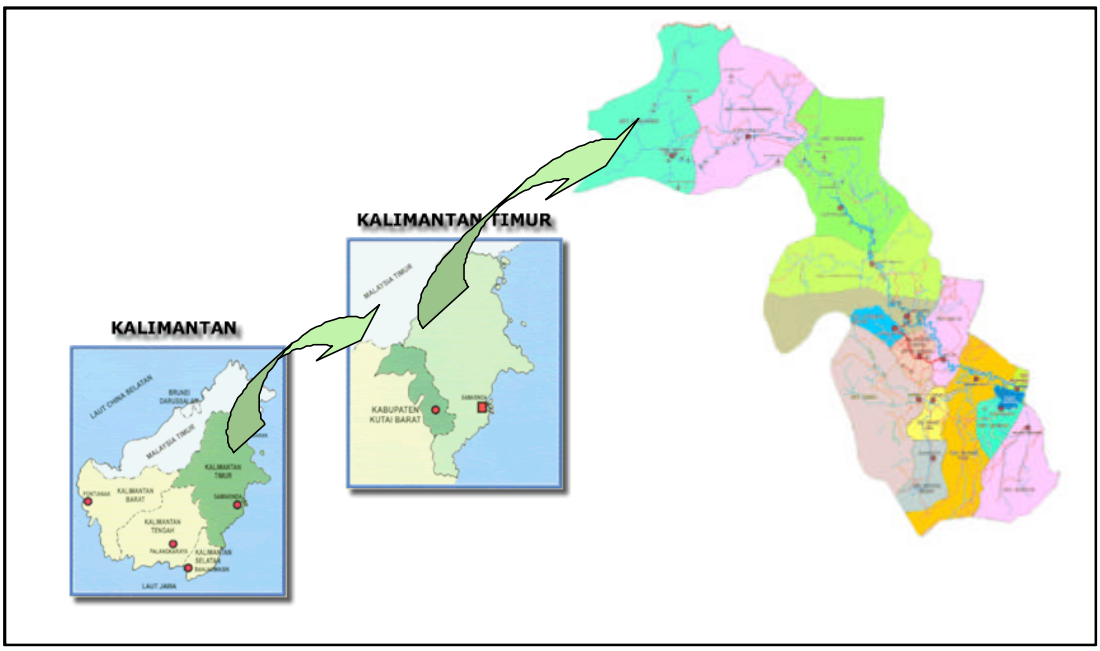
East Kalimantan's - Natural resources

Indonesia has the second most ecologically diverse rainforests in the world (Barber 1998) – occupying 10% of the world's rainforests and 40% of Asia's rainforests. In many places these forests house the indigenous cultures and people who also hold knowledge of forest ecosystems and common and unique plants and animals. East Kalimantan province in Borneo is one of the richest provinces in Indonesia with natural resources such as dense rainforests, large deposits of gold, coal, petroleum products and natural gas. This province has played a key role in the country's development with revenues from exploitation of natural forests, gold and coal, oil and natural gas deposits.

The province East Kalimantan is located 113° 44' – 119° 00' East (longitude) and 4° 24' North – 2° 25' South (latitude) along the equator on the island of Borneo. The province covers a land area of 21,193,000 hectares (11 percent of the entire country) with only 2.3 million or 1 percent of the total population. The topography of the region varies from lowland forests to mountainous areas in the north. Annual temperature ranges from 16.4°C to 35.4°C, with a wider diurnal temperature fluctuation than the annual fluctuation. The main rainy season falls in November to April while May through October is relatively dry. Annual rainfall ranges from 1500 mm to 4500 mm.

Soils in East Kalimantan are poor in fertility and heavily leached. It has been estimated that only 13 percent of the land in the province is suitable for agricultural crop cultivation (Solichin, 1999). Other land types are only suitable for perennial crops or forest activities. Forestland conversion to plantation forests or agriculture has been rapid. Rubber, coconut and oil palm are the three main estate crops. Large-scale logging continues in the region with dire consequences on the environment and forest functions. Illegal logging activities by timber companies and small-scale loggers has been a big problem. Estimates suggest that the province contributed 40 percent of the national log production in the seventies (Potter, 1990). The Mahakam River meandering through the province remains the main medium for transporting both legal and illegal goods. Most of the natural resources of timber, coal, and gold are carried down river to the provincial capital, Samarinda. The Mahakam River has made exploitation of natural resources possible where access would have been difficult otherwise. No primary forests remain along the Mahakam River.

Coal and gold mining, now a major source of income for the government and the people, is contributing to the environmental degradation. Kelian Equatorial Mining (PT KEM), established in 1992 and one of the largest gold mines in the world is also located in the area but is now being closed due to depleted sources and increasing public condemnation.



The Indigenous Dayak people

Dayak, meaning ‘people of the upstream’, are the indigenous non-Malay people in Borneo (Kalimantan in Indonesia, and in Sabah dan Sarawak in Malaysian Borneo). These indigenous inhabitants prefer to be identified by Dayak term with their specific tribal names such as Kayan, Kenyah, Benuaq, Merab, Lun Dayeh, and Punan.

Traditionally, Dayak communities lived in communal longhouses, called lamen in which several families with the same descent lived together. A lamen is essentially houses the whole community under a single roof. Longhouses were built above the ground and wooden walls separate the each family section. A longhouse grows as new sections are added to accommodate new families. Many traditional longhouses have housed 200 or more families. Every longhouse has a customary chief who would manage and regulate community owned resources including Bengkar (forest reserves) and the Simpukng (forest gardens). However the longhouse system is now becoming obsolete as families these days prefer to live in single houses for various, including political, reasons. Dayak groups had complex social structures and strata (as among the Punan group). However, in the modern era these social structures have more or less disappeared due to socio-political interventions, trading and development activities.

Originally, Dayak Benuaq people are hunters and natural forests have been an inseparable component of Benuaq livelihood. Recently, most Dayak practice swidden agriculture, traditionally involving long and complex rotations of crops and trees on various patches of land. Variation in cropping systems existed among different groups with the Dayak people. Some groups like the Kenyah historically inhabited swampy sites where they grew taro and non-irrigated rice. The logging and mining industry has brought over a rapid and irreversible change in the traditional landuse systems in the Dayak land. Dayak have remained active in hunting, collecting honey, wax, scented woods, nuts and bird’s nests. Even in the present days, gathering of non-timber forest products (NTFP) has an important role in many areas.

Indigenous innovations and knowledge

Farmers, by nature, are experimenters and indigenous innovations are common (see Veldhuizen et al., 1997 for examples of farmer innovations). The Dayak systems of upland rice cultivation (*umaq* or ladang), site selection for *umaq* establishment, fertility indicator plant species, and cultivation of a wide range of upland rice varieties indicate a clearly sophisticated knowledge system at work. Most indigenous communities, including the Dayak, see themselves as a part of the natural world and learn to respect and protect nature and environment from which they derive their livelihood. Cases of indigenous communities causing destruction of forests are exceptional. Even in these cases, the damage caused by indigenous groups is far less than those caused by large scale logging and mining with beneficiaries always from outside (Cravello, 2003). In other cases, deforestation by local people is due to policy changes where local people lost their tenure rights over the resources they have been managing for centuries. Improved security of land can lead to better management of even state forestland as shown by Suyanto et al. (in press).

Over the last several decades, there is a growing awareness of the rights of indigenous people and access to natural resources. It is now acknowledged that these indigenous people have their own effective knowledge that has been effective in sustainable exploitation of natural resources. Local management by those who are familiar with the ecosystem and depend on effective functioning of the ecosystem is likely to be more effective for conservation and sustainable development. It is in the interest of the local people to conserve and manage forest resources well. The swidden agriculture, the forest gardens, the community forest reserves (*bengkar*) and their management are other examples of innovations and underlying knowledge of cleverly exploiting natural resources without causing a detriment to these resources. Again as exemplified by the Dayak communities, indigenous people have a wealth of knowledge on plant usage, function, and regeneration. Their knowledge and involvement are crucial in sustainable development of these natural resources.

The terminology surrounding the study of indigenous knowledge is rich, although people's choice of language often reflects the disciplinary context within which their work is grounded. The distinction between indigenous knowledge and indigenous practices also warrants attention. In order to be explicit, Joshi et al. (2004) see knowledge as “an output of learning, reasoning and perception and a basis for predictions of future events; it is people’s understanding and interpretation based on some explainable logic of supposedly general validity”. This is most notable with respect to the body of work on ITK (Indigenous Technical Knowledge), which often describes people’s actions rather than the underlying rationale driving them.

Knowledge alone does not lead to action; conditions and constraints due to cultural norms, religious obligations, and economic and policy circumstances can all influence farmers’ decisions, forcing them to act in an ecologically irrational manner. Moreover, agricultural practice generally unfolds over time (during a season, or over several years in the case of perennial crops), so that farmers may make many separate decisions about the cultivation, tending and harvesting of crops, each of which would be contingent upon the circumstances extant at the time that it is made. These build up a complex agricultural practice, in which it is difficult to disentangle ecological knowledge from other social and economic constraints by simply observing the result (Richards, 1989).

Many proponents of the importance of local knowledge have promoted its use both in combination with scientific investigation and as a means of enhancing our overall ecological understanding. However, for some time, wide application of what local ecological knowledge had been acquired remained elusive, partly because of the difficulty associated with accessing much of the knowledge

contained in reports, articles and theses. The development of formal methods for making explicit records of local ecological knowledge on computer (in a form that allows them to be flexibly accessed, evaluated and used), have made it easier to incorporate local knowledge in natural resource management (Box 1).

Box 1. Formal methods for knowledge acquisition

Much of the understanding about local ecological knowledge investigated and documented (refs) has been developed through the use of a knowledge-based-systems methodology for acquiring and evaluating local knowledge (Walker *et al*., 1995). The methodology comprises of two major phases: the first involves gathering knowledge from people and recording it in an easily accessible form; the second investigates how widely this acquired knowledge is held in the community of interest (Walker and Sinclair, 1998).

In the first phase, ecological knowledge is collected from a small sample of deliberately chosen individuals thought to be knowledgeable about the domain of interest and willing to co-operate. The knowledge is collected through repeated, focused interviews with these key informants. Between successive interviews, knowledge is abstracted from records of the discussions with key informants and expressed as a series of unitary statements (written in simple, formal grammar) and terms. These are stored on computer in the form of a knowledge base, so that the knowledge is accessible and can be evaluated using tools for handling qualitative data, including automated reasoning procedures (Kendon *et al*., 1995). Contextual information about who articulated the knowledge and the conditions under which each statement is valid are also stored (Sinclair and Walker, 1998). A customizable software package (AKT5 - the Agroecological Knowledge Toolkit, freely downloadable from www.bangor.ac.uk/afforum) provides the facilities necessary to explicitly record, access and evaluate local ecological knowledge. It has built-in features for representing hierarchical information, displaying synonyms and exploring cause–effect relationships.

In the latter phase, involving a test of generality (or distribution) of knowledge across multiple communities, a large randomized sample of people is drawn from the target community (as in Joshi and Sinclair, 1997) to explore how representative the knowledge base is. For details, including the rationale of the approach and a manual for the AKT5 software, see Dixon *et al*. (2001).

Land types

Recent land type data (Table 1) indicate that Kutai Barat still has over half of its area covered with forest (nature reserves, protection and production forests combined) although the quality of these forests is unclear. These figures can be misleading due the *umaq*-forest cycle and it is not clear whether such fallow land is included in agriculture category or production forest category. Nonetheless, the land under agriculture is substantial, presumably large proportion of this coming from *umaq*.

Table 1. Land Use Allocation of West Kutai Regency, East Kalimantan

Landuse type	Area (ha)	%
Uncultivated		
1. Nature Reserve	5,500	0.17
2. Protection Forest	699,453	22.11
3. Swamps (Depth > 3 Meter)	38,423	1.22
Cultivated		
1. Agriculture	845,843	26.81
2. Fishery	20,486	0.65
3. Production Forest	1,055,614	33.46
4. Community Business Development	237,727	7.54
5. Settlements	228,445	7.24
6. Trade	482	0.02
7. Industry	654	0.02
8. PT. Lonsum Plantation	5,371	0.17
9. PT. GBPC Coal Mining	14,094	0.45
10. PT. KEM Gold Mining	2,303	0.07
TOTAL	**3,154,394**	**100.00**

Source: Pemerintah Daerah Kutai Barat, 2002

Annual swidden agriculture for upland rice combined with extraction of forest products form the core of Dayak subsistence strategies in Borneo. The establishment of swidden or *Umaq* (or *ladang* in Indonesian) in either old or fallow forest is the base for most forest gardens and fallow types. This leads to either fallow, to be reused after a certain period, or to permanent forest gardens enriched with rubber, rattan or fruit trees (Figure 2). Growth of natural vegetation in these gardens leads to ecological dynamics that resemble natural succession. The swidden system is mostly 'cyclical cultivation' rather than 'shifting cultivation' as different cultivated landuse systems are interrelated (Gonner, 2002). Forests (*bengkar*) that appear pristine may be an advanced stage of forest garden or fallow.

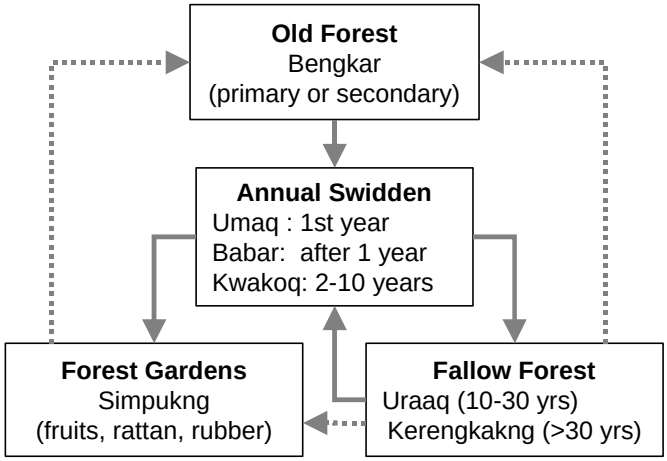


Figure 2. Swidden-garden-forest transition in landuse cycle. Dotted arrows represent rare but possible pathways. (Adapted from Gonner 2002)

In general six types of landuse systems are distinguishable. Detailed description of important landuse types are given in latter sections.

1. Bengkar (Community forest reserves)

All Dayak villages possess *Bengkar* from which timber, medicinal herbs, honey, wild vegetables and animals are extracted. Most *Bengkar* are mixed dipterocarp forests and provide wild game and forest resources such as rattan, wood and medicinal plants. These *Bengkar* serve as communal reserves used primarily for hunting and small-scale extraction for villagers' personal and household use but generally no commercial logging or exploitation is allowed. Usually Kepala Desa (village head) gives permission to villagers for resource extraction. Although most *Bengkar* are primary forests, secondary forests following swidden fallow or forest gardens after many years may be included in this group.

2. Umaq (swidden)

Dayak Benuaq cultivate rain-fed upland rice on annual swidden (umaq or ladang). Usually the annual cycle of rice cultivation dominates village activities. Rice cultivation takes a central role in traditional Benuaq agriculture. Along with rice, vegetables, banana, cassava, parsnip, nanas and agricultural crops may also be grown. Cultural rituals are commonly associated with rice cultivation activities; however these rituals are not always followed in the modern era. Generally harvest from *umaq* is primarily to meet household daily needs and not for sale. Sharing of rice by surplus households with rice-deficit families also exists.

3. Simpukng (forest gardens)

Simpukng or lembo are family-owned forest gardens that are a traditional and important part of Benuaq resource system. *Simpukng* consist of fruit trees, *Tanyut* ("honey trees") and other useful plants. *Simpukng* look like the surrounding forest and the useful trees form an indistinct island with dynamic borders within the fallow forest. *Simpukng* are most commonly established from *umaq* (ladang) where a farmer or community has planted fruit and/or other useful plants. Most families own between one and 30 family *Simpukng* with each with a size of 0.1-20 ha (Crevello, 2003). *Simpukng* may also be owned by community (often families living in a longhouse). Private *simpukng* are inherited by children and until recently, *Simpukng* were hardly ever sold and *simpukng* established by forefathers are generally not converted to swidden. The typology of *simpukng* is discussed later in the paper. Most *Simpukng* are mainly used in mast fruiting years, when they become a kind of open access area with usufruct for anyone who wants to eat fruit although it is not allowed to collect fruit in someone else's garden in order to sell them.

4. Uraat-Batenkng (Uratn, advanced fallow)

Uraat-Batekng is the fallow stage of *umaq* following upland rice cultivation. Resources continue to be extracted for household use. Compared to soil in *bengkar*, soil under uraat is less fertile as these soils haven't had much time to recover the lost nutrition and vegetation cover is still much less than in a *bengkar*. Uraat may have been planted with various fruits, rubber and rattan plants. Depending on the planted tree species, uraat develop into different types of *simpukng* of left fallow.

5. Kebotn (Garden)

Kebotn refer to more intensively managed plots often for a commodity for sale. In Kutai Barat rattan and rubber are the key marketable products from *kebotn rotan* (rattan garden) and *kebotn karet* (rubber garden). Although the term *simpukng* may be used to cover these intensively managed gardens, there is a clear distinction between these cash oriented gardens with more self-consumption and conservation oriented *simpukng*.

6. Settlements

Settlement represent location where community of Dayak Benuaq tribe build their houses, either separate small houses or traditional longhouses (called Lou or Lamin). *Simpukng* lamin (longhouse forest gardens) are usually close to sites where longhouses were built in the past. Dayak community

rarely settle more than eight to ten years in any one area, primarily as the fertility of the area declines with cultivation and also because of the belief that it is important to move after family members dies (Sardjono, 1990). This mobility of Dayak communities results in establishing new settlements around which *Simpukng* are readily developed.

Landuse systems - description

Umaq-forest continuum

The Benuaq people see their *umaq*-fallow-forest landuse as “cyclical cultivation”. They separate forest regeneration into five phases: young scrub, old scrub, young secondary forest, old secondary forest, and primary forest. The time required for a complete forest regeneration depends on soil fertility and microclimatic conditions in the area, as well as the effects and extent of disturbances experienced earlier during the cropping period and the recovery. The successive phases of regeneration from swidden field to primary forest, as defined by Dayak Benuaq, may take one to two hundred years (see Figure 3). Regrowth is understandably influenced by such factors as soil conditions, moisture levels, rainfall, temperature, and slope. Where soils are poor due to leaching, erosion, compaction, or other problems, each phase of regeneration requires a longer period.

The appearance of dense young scrub growth (*kurat uraq*) usually occurs during the first 1-3 years of the fallow period. Light-demanding grasses, perennial shrubs, herbs, and pioneering tree species dominate this phase, generally reaching heights of 3-4 meters, while canopy closure is usually under 20 percent. Second-phase old scrub conditions (*kurat tuha*) occur 2-5 years after fields are fallowed. Emergent saplings with an average 5 cm DBH (Diameter at Breast Height). Lianas, dense shrubs, and herb undergrowth are common, attaining heights of 5-6 meters.

In the third phase of regeneration, young secondary forest (*kurat batang muda*) succeeds into medium-size pioneering tree saplings of 10-15 centimeters in diameter. This takes 3-10 years after fallowing, but where soil conditions are poor -- due to fires, exceptional erosion, or otherwise depleted nutrient status -- the third phase may not be reached for 15 years. As the upper canopy closes to over 50 percent cover, reducing the light below, the grass and herb layers thin out.

The fourth successional phase, old secondary forest (*kurat batang tuha*), is characterized by significant canopy closure (over 80 percent) and a higher proportion of larger trees over 10 centimeters in diameter. Under good to moderate soil conditions, abandoned swidden plots will begin to generate old secondary growth after 9-15 years and will continue to be classified as such for one hundred years or more until the forest may once again be considered primary (*hutan bengkar*).

Dayak consider the old swidden plot to have reached the fourth stage when the more valuable hardwood species (*meranti, kayu ulin, putih*, and *kapur*) begin dominating the earlier pioneers. The Benuaq Dayaks prefer to wait until the swidden plots reach this fourth successional phase before they open them again (Abdoellah et al., 1993).

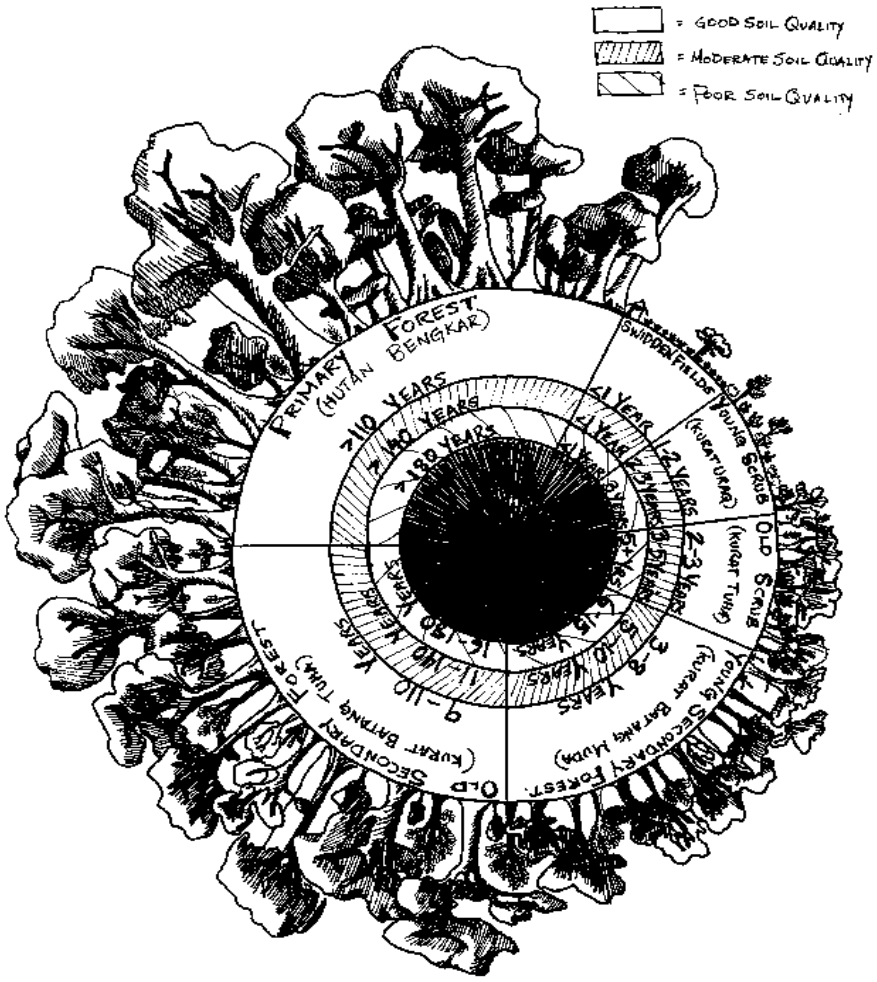


Figure 3. Dayak Benuaq people's identification of various phases in forest regeneration following forest clearance and rice cultivation. (Source : Abdoellah et al, 1993).

Table 1. Dayak people's perception of forest regeneration phases - relationships with light intensity and vegetative composition.

Regeneration Phase	Average Light Intensity (>=1m above ground) (*percent*)	Vegeta-tive Cover (>=1m) (*percent*)	Vegetative Composition (30m. x30m. plots) (Frequency in percent)				
			Grass (Include *Imperata*)	Seedlings (<1meter height)	Saplings (<1.5 meter height; <5cm DBH)	Poles (5-10 cm DBH)	Trees
1. Young scrub (0-3 yrs)	>80%	20%	3.40%	2.50%	11.70%	2.20%	0.20 %
2. Old scrub (2-4 yrs)	70	30	2.4	5.5	15	5.9	1.2
3. Young secondary forest (3-15 yrs)	45	55	0	17.6	20.9	10.5	6.1
4. Old secondary forest (7-180 yrs)	20	80	0	21.6	20.8	17.6	20
5. Primary forest (110-180+ yrs)	<10	90	0	27	14.4	18	30.6

Source : Abdoellah et al, 1993

The above classification system reflects the Benuaq Dayak understanding of forest succession, so that they cannot promiscuously open an area especially for the farm. System of this classification also depicts how society manages ecosystem so that remain to can be used by sustainable to maximize agricultural produce and forest product.

The Dayak culture in East Kalimantan is influenced by the environment they have modified for many centuries. People have to meet their daily needs but also to ensure that the resource base they depend on are not destructed. The surrounding forest resources in Kutai Barat are managed by the indigenous people both as common property resources as well as household properties. From a land ownership perspective, various forms of landuse types can be distinguished that serve various need fulfilling as well as conservation functions. Individually or privately controlled landuse systems include *umaq*, the fallows, different types of forest gardens (*simpukng*) and *kebotn* or gardens (rattan and rubber in particular) (Figure 4). *Bengkar* (forest reserves), settlements and different types of gardens (*simpukng*) may be controlled and managed by communities and longhouse families. Descriptions of the major landuse types are provided in the following sections.

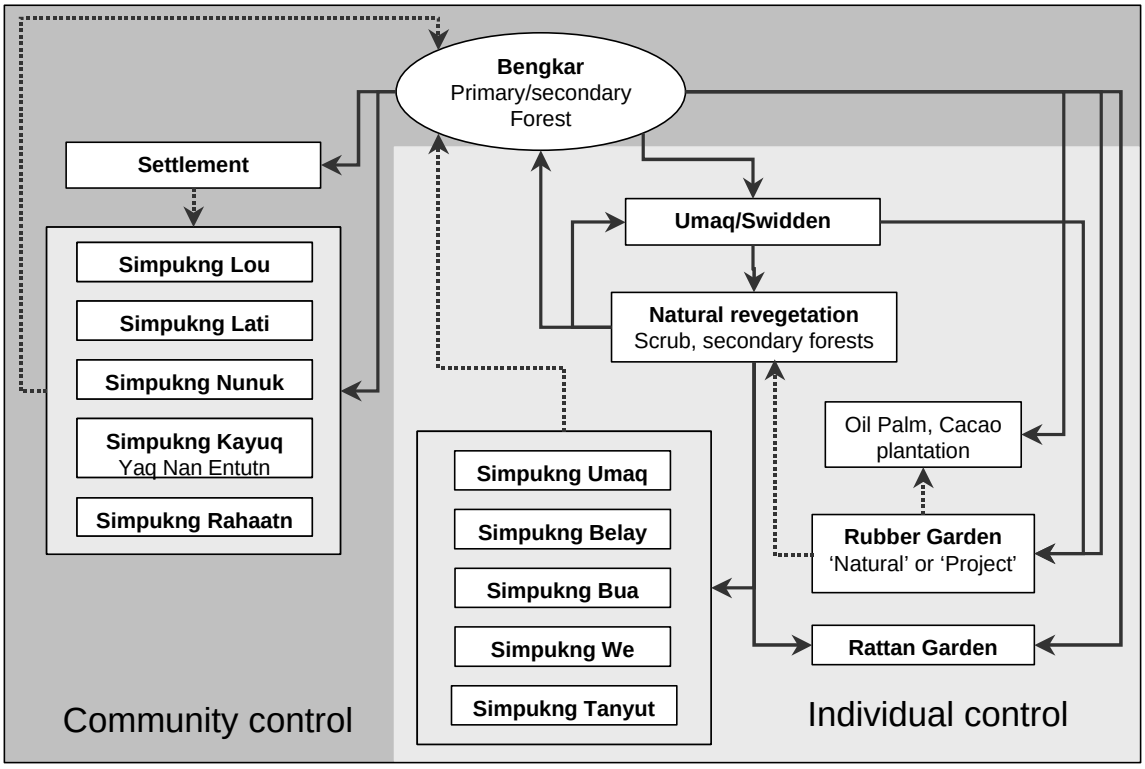


Figure 4. Cyclical transition and evolution of landuse systems in Kutai Barat. Dotted arrows represent infrequent pathways.

Individual controlled land use systems

Umaq

Dayak Benuaq call swidden cultivation plots *Umaq* that plays the central role in evolution of major landuse systems in Kutai Barat. The *Umaq* are used to grow upland rice that may be intercropped with cassava, vegetables and fruits. All harvest is primarily for household consumption. The upland rice *(beras gunun*g) is a highly prized commodity and most villagers prefer not to sell their paddy even when it fetches a good prices while they may distribute their surplus harvest to rice-deficit relatives and friends On average an *Umaq* plot is between 1 to 1.5 hectares and most Benuaq households normally establish one *umaq* plot every year by clearing fallow land (separate names for different stages, see Table 1) or *bengkar*, mainly secondary forest plots. The selection of a suitable site to establish *umaq* is carried out with extreme care and involves consultation and careful observation. Certain Dayak rituals are performed in the process at each stage of land preparation, planting and harvesting (Box 2).

Box 2. Dayak Benuaq Steps for rice cultivation

1. The area selected for planting rice is slashed around June-July. Although men also help, Dayak women mainly carry out this activity. The slashed vegetations are allowed to dry under the sun for a few days for drying.
2. Large trees (over 15 cm dbh) are cut down (called *Noang)*. Mostly men do the cutting and carrying of trees as this is a heavy job.
3. The felled trees are debranched (referred to as *Nutu*) to allow faster drying.
4. The plot is then left to dry (this activity called *Oikng Joa*) for a period of 4-6 weeks, depending on the 'wetness' of the plot. Plots with larger trees and bigger branches require longer time for drying.
5. Once the vegetation is dry, it is burnt. Ceremonial rituals such as making human picture (*Kerongoq*); placing it above *tampian* (or winnowing basket for rice) and hanging it in house yard are performed.
6. Any leftover branches and logs are collected in piles and a second burning is arranged (this activity called *Mongkaakng)* in which both men and women get involved.
7. Before sowing paddy (called *Tugal/Ngasak)* in holes in the soil made using dibble (a pointed stick), another ritual is performed in which paddy seeds are kept in a special place called *Pokaatn Bini*. Seed is always sown with the help of other members in the community; hence the fields are planted in sequence. Men and women and even children participate in this activity that takes place around August and September.
8. After *Tugal/Ngasak*, the plot is left for a week, when family members can attend extra activities like making carpets from *Kajang* leaves in preparation for ritual associated with other activities.
9. About a week after planting, farmers, mainly women, visit the plot and weed. In the meantime men prepare rice barn called *Lumbung*.
10. Around January or February, mature paddy is harvested and other families assist this activity. The tools called *Gamak* (small *lanjung*) and *Gentiq* (ani-ani) are used. The harvested paddy plants are piled above a mat placed in a clear area in the *ladang*.
11. Paddy is then collected into *amoq* (basket case) that is later stored in *lumbung*. Every community member assisting in different activities is rewarded with one *amoq* of paddy, except in cases where the assistant is an owner of another *ladang* and requires help of the first farmer.
12. Paddy is threshed usually by women; the straw is usually fed to livestock.

Source: Documentasi Proses Sistim Perladangan (Umaq Tautn). SHK Kaltim. 1996.

The rice farming season is about six month long that begins in August or September at the end of the dry season with land clearing. Ground vegetation is slashed and burnt while. Large trees (more than 15 cm dbh) are extracted for firewood prior to burning. The soil is hand tilled to remove remaining roots and to loosen the soil. Rice is hand planted soon after, normally around end of September. Cassava, banana, chili, sweet potato and other perennial crops are planted when the rice plants reach knee height. The plots are weeded regularly.

Rice is harvested around March while other crops are left to mature. Small scythes are used for cutting rice plants, the grains are separated and sun dried under the sun. The rice *(bera*s) is stored and later milled either by hand or machine.

Figure 5. Old Natural Rubber (*Karet Alam*) converted back to swidden (*Umaq*).

Simpukng

Simpukng are for number types and forms and referred by various names reflecting the history of the plots. The *Simpukng* is a very important land management unit in Benuaq Dayak communities as it provides food for families and income generation (Nuripto and Panthorn). A variety of fruits are mostly found grown in the *Simpukng*, many of which include *Nangka* (Jackfruit*), Langsat, Rambutan*, Durian, *Kapur, Mangga* (Mango), *Kelapa* (Coconut), *Kemiri* (candlenut, a commonly used spice), and Coffee.

Simoukng can be differentiate form the forming process and the function (Arifin M). The following section provides some description of individually owned *Simpukng* among the Dayak Benuaq in Kutai Barat area.

Simpukng Umaq

Regularly when forest plot is cleared in preparation for umaq, valuable trees, especially fruit trees are maintained and protected from fire. The owner may plant additional valuable trees. A characteristic of simpukng umaq is the remnants of a hut or shelter used by the farmer while paddy is growing.

Simpukng Belay

When Dayak Benuaq clear land for building houses, again useful standing trees are preserved and more may be planted around the house along with ginger, chili, etc. Simpukng Belay is similar home gardens in Java but their products are usually only for household consumption.

Simpukng Bua

Simpukng Bua is established as Simpukng belay, but these become more like fruit orchards with trees like Rambutan, Durian, Langsat and Cempedak. Harvests from these trees have market value and normally provide some cash to the owner.

Simpukng We

These forests consist of rattan that grow either spontaneously or planted deliberately by the farmers. Rattan forests are not intensively managed. Although Sokaq or Sega and Jahab dominate, in Kutai Barat area, 30 different types of rattan have been recorded (Table 2).

Table 2. Types of Rattan usually found in *Simpukng We*

Local Name	Common Name	Latin Name
Boyung	Seletup	*Calamus optimus*
Danan Daktum	Danan	*Calamus blumei*
Jahab	Jahab	*Calamus trachycolous*
Kehes		*Calamus sp*.
Ngono (T)	Manau	*Calamus manan*
Merangkui		*Calamus sp*.
Peles		*Calamus sp.*
Peles Belaakng	Pulut Putih	*Calamus fibelatus*
Peles lalung tulukng	Pulut putih	*Calamus sp*.
Peles panpakng	Pulut	*Calamus sp.*
Peles Jengah	Pulut	*Calamus sp.*
Sokaq	Sega	*Calamus caesius*
Siit baluq (T)	Sega batu	*Calamus sordicus*
Tu'u	Semambu	*Calamus scipionum*
Uwe pakuq		*Calamus sarawakensis*
Biungan/Jungan	Rotan sabut	*Daemonorops sabut*
Jepukng	Pulut Merah	*Daemonorops crinita*
Kotok	Kotok	*Daemonorops spesiflora*
Siit Iguyanki	Sega	*Daemonorops sp.*
Siit Jengpe	Sega	*Daemonorops ruptilis*
Siit Pantukng	Sega	*Daemonorops garnis*
Sidong	Jelayan	*Calamus ornatus*
Danan	Rotan semut	*Korthalsis rigida*
Uwe Lalukng	Botet	*Korthalsis scaphigera*
Uwe Meaq	Rotan Merah	*Korthalsis scinometra*
Uwe Ohot	Rotan Merah	*Korthalsis robusta*
Iya	Rotan Sotong	*Plectocomipsis geminiflora*
Peles Batuq		
Sokaq Lemiang		*Calamus sp.*
Sokaq Liwea/Bop		*Calamus sp.*

Source : Lembaga Ekolabel Indonesia, 2003

Simpukng Tanyut

'Honey' trees (or Tanyut) are a group of tall and dominant species in the forest that are preferred by wild honey bees to build their combs. The trees are prized by all Dayak and are legally protection.

Unclaimed land with natural Tanyut trees can be claimed by anyone. More tanyut trees can be planted in any simpukng. The plots with tanyut trees are known as simpukng tanyut.

Rattan gardens

Rattan as a non-timber forest product has been harvested and managed by the Dayak Benuaq for centuries (Box 3). Rattan is major source of income for many Benuaq families these days. In the family rattan is used for house construction, for making various household items (mats, baskets) and for ritual offerings as in traditional birth ceremonies (Sadikin and Nyongka, 2001). In the past rattan was exchanged with other items of use and the commercial sale of started in 1814, rattan when traders from *Banjar* and *Bugis* area took rattan from this area to China and elsewhere.

Box 3. Rattan Cultivation

Many rattan species (mainly *Calamus* species) are indigenous to East Kalimantan. It is an important non-timber forest commodity that is contributing significantly to the household income among Dayak households in Kutai Barat. These days nearly 70 percent of harvested rattan come from cultivated sources.

The indigenous Dayak Benuaq incorporate rattan in their traditional swidden system and see this as a useful strategy to restore soil fertility during the fallow period. The land preparation activities for rattan cultivation are same as for rice-based swidden system – slashing, gathering and burning of surface vegetation. Usually two weeks before burning standing trees and felled, branches and cut and leaves are left to dry. A fire line, 1-2 meter wide, is around the plot to stop fire from accidentally spreading out. Occasionally, Dayak people establish rattan gardens inside existing forests without clearing the vegetation. This is done through enrichment planting of rattan plants.

In the field, either seeds or seedlings of rattan can be planted. However, most of the Dayak people prefer to plant seeds, as it is more practical and require less effort and resources. Seeds are usually collected from mature rattan fruits, normally around 6 months. The fruits are peeled and placed in a rattan basket and soaked in water. The seeds are then separated from the soaked fruits and sun dried. Dry seeds can be planted immediately or stored for later use. Wild seedlings (or wildlings) can be collected from a rattan gardens or forests. Seedlings are carefully uprooted without damaging the roots.

There is an indigenous technique of preparing seedlings for planting. The seedlings are loosely bundled with rattan rope to a stick. Then the bundle is placed in soil close to a water source to ensure that the roots are well soaked. After the leaves on the seedlings wither and fall off, new leaves begin to sprout. The seedlings with 2 or 3 new leaves are planted in the field. This indigenous innovation increases seedling survival and growth significantly.

Rattan is planted in the rainy season. Planting rattan seed is more flexible than planting seedlings. Seed can be sown either before or after burning the field, or before or after harvesting rice. When seeds are planted before burning, the vegetation above are near the planting hole must be cleared to avoid burning the seed underneath. Planting of seedlings should be done only after burning the field. Dayak farmers believe that the burnt vegetation provides nutrients to the growing seedlings.

Regular weeding and cleaning of vegetation is required in rattan gardens. Ground and canopy vegetation need to be managed according to rattan species. Large trees around rattan clusters are not felled to avoid damaging the creeping, climbing rattan plants. If required, unwanted large standing trees can be ring-barked to kill them.

Source: Rattan for Life: The Rattan Cultivation Practices of the Dayak Benuaq of Kalimantan, Indonesia, An Information Manual. SHK Kaltim, NTFP-Exchange Programme, and Studio Driya Media-Bandung. 2001

According to data of Statistic Center Bureau (BPS), the majority of Kedang Pahu watershed is Dayak Benuaq and disperse at 57 villages with 30,337 people of population, and estimated that 90 % of them are rattan producers. A survey carried out in the year 2000, showed that approximately 70 % of the total volume of rattan traded in Kedang Pahu Watershed came from cultivated rattan (Cahyat, 2001).

Among 30 or so rattan species in Kutai Barat, 20 species are wild while two species (Sega or *Calamus caesius,* Jepukng or *Daemonorops crinita*) are the most commonly planted species. As these have different ecological requirements, only one species can be cultivated at a time. Sega has stronger stems that are also easier to process than other species hence has a higher value (Sadikin and Nyongka, 2001). *Calamus trachycoleus* is also encountered frequently. A fourth species Manau (*Calamus manan*) is only occasionally planted within *Simpukng* gardens (Gönner, 2000).

Rattan harvesting technique has received much attention lately. The conventional harvesting technique is quite destructive and does not allow regeneration of the plant. However, new methods are being promoted that allows continued harvest from same plant every few years without damaging the mother plants (Sadikin and Nyongka, 2001).

Figure 6. Rattan *Sega* (*Calamus caesius*)

Rubber gardens

Natural latex from Para rubber trees is another major product in the region. The rubber trees in Kalimantan originally came from seedlings that the British collected in Brazil in 1876 and planted in Singapore. The first seedlings from Singapore reached Sarawak in 1882, and from here, they were dispersed to other parts of Borneo. According to *Tetua Adat* of Dayak Benuaq, Haji traders first introduced rubber to Dayak Benuaq community in the year 1919 from banjar. Initially their objective of planting rubber in the field was to control weeds in *Umaq* cultivation. Earlier rubber was planted as

companion plant with other fruit trees. However, after 1950's, farmers planted rubber as a monoculture probably due to the awareness of high price of natural latex from these trees. All rubber gardens are privately owned.

Dayak people use simple technique of rubber cultivation without any intensive management, particularly in case of *Karet Alam* meaning the rubber seedlings came from natural forests. Ground level shrubs, bushes and weeds are removed occasionally; fertilizers are seldom applied even when participating in government-sponsored projects. Natural vegetation grows along and competes with rubber trees. These rubber gardens may secondary forests after 15 years. Similar 'jungle rubber' system are common in Jambi province (Joshi et al, 2002).

Between 1992 – 1993, ADB and Plantation Agency introduced high quality, grafted rubber planting material through Rubber Plantation Project PDRB/TCSSP-ADB under a loan agreement. All rubber gardens planted with the higher yielding clones provided through project assistance is locally known as *Karet Proyek*. However, in many cases, the failure to supply enough planting material meant farmers had to supplement clonal material with natural rubber seedlings collected locally. During interviews, some farmers expressed their preference for natural rubber seedlings (*karet alam*) claiming these *karet karet* have much longer tapping life (more than 50 years compared to 25 years for clonal trees), competitive with local weeds and tolerant to intensive tapping.

Many farmers in Kutai Barat did not tap their rubber trees on a regular basis. This may be because of the insignificant income obtained from tapping (also due to very low price of latex). Latex after coagulation is rolled into sheets using manually operated pressing tools called presser or 'gilingan'. Quality of latex is not high and fetches a competitively low price. However, in the village of Tepulang (Sub-district of Damai, Kutai Barat), many communities have benefitted well from a previous ADB project. Large areas consisting of degraded land with poor sandy soil (unsuitable for rice cultivation) have been converted into rubber plantations.

Figure 6. A Dayak Benuaq woman tapping rubber trees in 'Karet Proyek'.

Community controlled landuses

Bengkar

The community usually owns most forests nearby and surrounding the villages. *Bengkar* (community forest reserve) in Dayak Benuaq language refer to forest area that is not 'cultivated' or managed intensively. It is also used to refer to very old secondary forests that look similar to primary forests, in which case this may be claimed as individually owned. The trees are relatively big and vegetation is rich.

All Benuaq Dayak villages possess a *Bengkar* that provides forest resources such as timber, medicinals, honey, wild vegetables, and animals. The *Bengkar* provides wild game and forest resources such as rattan, wood, and medicinals. The Benuaq Dayak *Bengkar* are located in mixed dipterocarp forests. This is a highly valued hardwood that has been heavily logged throughout Borneo. Characteristics of dipterocarp trees are based on color, density, and anatomical features. Several common species of *Meranti* found in the region are identified by the color of the wood which include red, yellow, and white *Meranti*. Various *Meranti* species were the dominant tree types in the *Bengkar*.

The forest have had minimal timber extraction and are primarily used for hunting and small-scale extraction. The *Kepala Desa* (Adat leaders) grants permission for resource extraction by community members. Before a harvest function, a ceremony *Pakaatn Nyahuq* is performed in which offerings are made to the holy spirit in *Bengkar*. People not following the adat rules can be fined.

Simpukng

Simpukng Lou/Lamin

Where a *simpukng* has been established around a longhouse, it will be called *Simpukng* Lou/Lamin. As *Simpukng* Lou is established by the families living in the same longhouse, all families have rights to harvest products from these *simpukng*. *Simpukng* lou normally has a graveyard within.

Simpukng Nunuk

The Dayak Benuaq believe that an area with *Beringin (Ficus sp.)* tree (also called Nunuk) with spiritual value. No trees are allowed to be cut. Various rituals are associated with *simpukng* nunuk - *Kuangkai* (Custom ceremony of secondary dead times) and *Belian* (Custom ceremony of healing by a local shaman). These local healers probably have much knowledge about medicinal values and properties in these complex *simpukng* systems.

Simpukng Kayuq Yaq Naan Entutn

This is where the holy spirit is believed to dwell and used of meditation. No trees are allowed to be cut. In terms of composition, *simpukng* kayuq are similar to *simpukng* nunuk and the role of this in healing is also similar.

Simpukng Lati

These are specifically designated reserve areas for harvesting natural rattan and other construction material. In terms of vegetation composition, they look like any ordinary forest.

Simpukng Rahaatn

After a period of planting paddy, at the same time to wait for a period of harvesting, to fill up their activity (men and also woman), generally go to forest for hunting, searching resin or look for materials for making Lou/Lamin, this activity are referred as Berahaatn/effort.

Discussion and conclusions

The indigenous Dayak communities are endowed with immensely rich natural resources. This richness has been the very reason for its attractiveness to logging and mining companies and the government. Most land in and around villages and settlements are either private or communal. The traditional adat laws recognize these private and communal rights. Even what appears as wild forest may belong to an individual or family or village community. In 1967 the Indonesian government declared 75% of the country as state forest, including forests in Kutai Barat, and distributed it to logging concessions and mining companies. Commercial logging started soon after the forest nationalization. As Gonner (2002) explains, these companies employed many local workers and farmers were allowed to use the logged-over areas for rice cultivation, the villagers did not particularly complain. In the 1990s, the situation changed with the companies receiving government permission to establish tree and oil palm plantations (HTI) on forest gardens clearly seen as private or communal property. Destruction of graves, rattan and other forest gardens started and so did the conflict between villagers and the companies. Although compensations were promised to settle conflicts, this was never implemented. Government programs to extend monoculture plantations of rubber, oil palm and Acacia without due consideration to local ideologies, local knowledge and local aspirations are likely to speed the rate of deterioration of natural resources and indigenous systems and culture and knowledge

For many centuries, Dayak people have lived in close harmony with the forest. The Dayak perspective of a "common house" (rumah bersama) with other creatures in the forest depicts that human is a part of the forest ecosystem and has no right to exploit it for only for our interest. Dayak rituals, e.g. prior to forest clearance for planting; include seeking "permission" from the co-habitants in forests. The sustainability of forest ecosystem determines the co-existence of human with nature. However, on-going over-exploitation of forest and other natural resources ignores this aspect of Dayak sentiment, culture and indigenous systems while focusing on short-term profitability vis-à-vis long-term sustainability. The traditional Dayak farming is basically a subsistence system and commercial exploitation of natural resources had not been an objective. Large-scale logging and mining activities in the region go against the traditional strategy of harmony and sustainability causing much social conflict and environmental degradation.

The Dayak indigenous systems, practices and preferences are geared towards maintaining biodiversity in their system. The *simpukng* typology, forest rejuvenation and cycling from *umaq* to *bengkar* are examples where natural succession is encouraged while biodiversity in these systems are ensured. Dayak '*karet*' system is another example where farmers have incorporated the exotic rubber trees but allowing natural vegetation to grow unrestricted. Not only a single commodity is extracted from these systems, but a range of building materials, vegetables, medicines, wild animals and firewood are possible.

The conservation of controlled exploitation of natural resources among the Dayak is ensured by customary adat laws to prevent over-exploitation and environmental destruction that we are witnessing in the recent years. These customary laws are often developed through experience and careful observations; with emphasis on the sustainability of the environment and thereby determining the survival of the Dayak community. Unfortunately, the declaration of customary forests as state forests and permitting large scale logging and mining in the area has undermined the importance of customary laws and norms in natural resource management. Not only the natural resources are damaged, but also the once-effective Dayak social institutions in natural resource management are becoming obsolete.

Dayak people with their long association with nature have learnt how to use the products while maintaining a continued supply of these products. They have knowledge about plants and wildlife in their different landuse systems. They know which plants are edible, which are harmful, which have medicinal values and what the requirements of these individual plants and animals are. It is this indigenous knowledge and wisdom at greatest risk of disappearance forever if quick action is not taken. The rapid pace of deforestation and land conversion in East Kalimantan means there will be less diversity both in terms of landuse and biodiversity within any landuse type. With clear division of labour between men and women in some farming activities, it is likely that there is gender division in knowledge as well. This may have implications on gender sensitive research and development initiatives. Likewise, knowledge about various landuse systems, their ecological benefits, plant and animal diversity among the new generation of Dayak will understandably be much less than that held by their parents and grand parents.

From a landuse system perspective, the *simpukng* systems offer an interesting challenge. These are genuine examples of ‘kebun lindung’ (or ‘protected forest gardens’ that provide both environmental and economic functions). Not only these systems provide material output to individuals and Dayak communities, these also provide many environmental services that benefit the global communities - plant and animal biodiversity, carbon sequestration and hydrological functions to name the key services. Both the individual and community owned *simpukng* have much potential for improvement. Enhancing tangible benefits to the people managing these *simpukng* while maintaining environmental functions intact will be a logical direction for research and development programs. 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.

There have been numerous cases where big multi-national companies are reaping benefits from the indigenous knowledge of people while the indigenous people who provided the knowledge are soon forgotten. To avoid such embarrassing situations, that is also ethically wrong, due consideration must be given to ensure the indigenous people actually benefit from their traditional knowledge and systems. As in many countries Indonesia is also progressing on developing mechanisms to protect the rights of the indigenous people and the intellectual property rights (IPR) over their knowledge. While documenting indigenous knowledge, appropriate national laws must be carefully reviewed. Likewise, the customary adat rules as well as government policies on land ownership and tenure issues are likely to impact on any natural resource management programs.

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Appendix A. People consulted during field visit to Kutai Barat, January 2004

Farmers and sites consulted

Hamdi, Mangkun dan Andi	:	Kp. Kemantar, Kec. Damai
Sulaiman dan Istri	:	Kp. Geleo Baru, Kec. Barong Tongkok
Solahuddin	:	Kp. Keay, Kec. Damai
Yohannes	:	Kp.Damai Seberang, Kec. Damai
Martius	:	Kp. Balok, Kec. Barong Tongkok

***Kepala Adat* and *Tetua Adat* consulted**

Sumau	:	*Kepala Adat* Kp. Damai Seberang, Kec. Damai
Ramid	:	*Tetua Adat* Kp. Benung, Kec. Damai
Siukng	:	*Tetua Adat* Kp. Damai Kota, Kec. Damai
Idarsah Lisoq	:	*Kepala Adat* Kp. Lambing, Kec. Muara Lawa

Professionals consulted

Prof. Dr. Ir M. Agung Sardjono. MSc	:	Center for Social Forestry University of Mulawarman, Samarinda
Ir. Ndan Imang	:	Center for Social Forestry University of Mulawarman, Samarinda
Yoga	:	Executive Director of SHK Kaltim
Paulus Kadok	:	IFAD West Kutai Project Coordinator
Ika Fransisca	:	CARE International Indonesia - FORMACS Projects

Appendix B. Species found in *Umaq* Benuaq Dayak shifting cultivation plots

English Common Name	Indonesian Name	Latin Name
Vegetables and Starches	Sayur-Sayuran	
Upland Rice	Beras Gunung	*Oryza sativa*
Cassava	Singkong	*Manihot esculenta sp*
Corn	Jagung *Zea*	*mays*
Sweet Potato	Ubi	*Ipomea batatas*
Turnip	Ubi Jalar	*Brassica rapa*
Eggplant	Terong	*Solanum melongena*
"Sour" Eggplant	Terong asam	
Longbean	Kacang pangang *Vigna*	*sinensis*
Chives	Bawang rumbut *Alluin sp.*	
Onion	Bawang	*Allium cepa*
Peanut	Kacang Tanah *Arachis*	*hypogaea*
Cucumber	Timun	*Cumumis sativas*
	Tebu Telur	
Fruit	Buah-Buahan	
Banana	Pisang	*Musa sp.*
Durian	Durian	*Durio zibethinus*
Jackfruit	Nangka	*Artocarpus heterophyllus*
Papaya	Pepaya	*Carica papaya*
Pineapple	Nanas	*Ananas comosus*
Tomato	Tomat	*Lycupesicon lycopersicum*
Spices	Bumbu	
Sugarcane	Tebu	*Ceanothus sp.*
Lemongrass	Sereh	*Cymbopogon citratus*
Turmeric	Kunyit	*Curcuma domestica*
Chili peppers	Cabe / Lombok	*Capricum frutescens*
Candlenut	Kemiri	*Aleurites moluccana*
Ginger	Jahe	*Zingiber officinale*
Other		
Rubber tree	Pohon Karet	*Hevea brasiliensis*
Rattan	Rotan	*Calamus spp.*
Bambo	Bambu	*Bambusa sp.*

Source : Crevello, 2003

Appendix C. Fruit tree varieties found in Simpukng, Benuaq Dayak fruit gardens

English Common Name	Indonesian Name	Latin Name
Rambutan	Rambutan	*Nephelium lappaceum*
	Langsat	*Lansium domesticum*
Durian	Durian	*Durio zibethinus*
Jackfruit	*Nangka*	Artocarpus heterophyllus
Papaya	Pepaya	*Carica papaya*
Mango	Manga	*Magnifera indica*
Beetle nut	Pinang	*Areca catetchu*
Coconut	Kelapa *Cocos*	*nucifera*
Coffee	Kopi	*Coffea sp.*
	Aren	
Candlenut	Kemiri	*Aleurites moluccana*
Other		
Rubber tree	Pohon Karet	*Hevea brasiliensis*

Source : Crevello, 2003