

Surfing on Waves of Opportunities: Resilient Livelihood Strategies of Dayak Benuaq Forest Users in East Kalimantan, Indonesia

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The economic value of rain forests has been discussed controversially over the last 20 years. While some authors have praised the often unutilized richness of resources, others have been less optimistic and referred to the limited market potential.

On the other hand, the invisible use of forests is often underestimated. In many cases, subsistence needs can be met well, securing people's livelihoods, while risk and uncertainty often are mitigated through resource diversification.

This principle was also found to be vital for securing livelihoods among Dayak Benuaq forest users in East Kalimantan, Indonesia. Depending on resource availability, market prices, seasonality, or individual cash demand, the Benuaq frequently switch from one resource to another. This includes high intensity short-term resource extraction, e.g. of freshwater tortoises or certain bird species to utilize temporary income opportunities. In addition, the Benuaq use alternative income opportunities offered at logging companies or oil-palm plantations. Combined with additional swidden agriculture this extended subsistence has proven to be a reliable livelihood mode to maintain decent human well-being as well as a diverse forest environment.

This long-term community study reveals a highly dynamic pattern. The principal income sources vary from year to year. So does the importance of the supplementing subsistence agriculture. The forest system is sustainably managed through enrichment planting and cultivation of selected species. With this approach the villagers have established a highly diversified mosaic forest comprising more than 1,000 forest gardens and maintaining high biodiversity. At the same time, people are able to respond to external shocks, such as price fluctuations or natural disasters to avoid falling into poverty.

While there is strong evidence that the Benuaq's forests have been used in a sustainable manner over the last 300 years, better market access, good income opportunities, but also official development goals have put the system under pressure. Nonetheless, the Benuaq's extended subsistence could work as a model for securing livelihoods, ensuring well-being, and maintaining vital forest functions given some preconditions are met, including secure tenure and access to resources, sufficient social cohesion, and functioning markets for their forest products.

Introduction

The economic value of nonwood forest products (NWFPs) has been discussed controversially over the last 20 years. While some authors highlighted the often unutilized richness of resources (Peters et al. 1989; Redford and Padoch 1992), others referred to the limited market potential of many NWFPs and reduced overly optimistic expectations (Godoy et al. 2000; Ruiz-Pérez and Byron 1999; Belcher et al. 2003).

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On the other hand, the invisible use of forests was often underestimated. In many cases, subsistence needs can be met well, securing people's livelihoods (de Beer and McDermott 1989), while risk and uncertainty often are mitigated through resource diversification (Godoy and Feaw 1991; Ellis 1998; Lacuna-Richman 2002, 2004).

Closely related to the risk mitigation potential of NWFPs are local coping strategies as responses to events or shocks, such as natural disaster, drastic political changes, or economic crises (Gönner and Seeland 2002). The ability of a system to withstand shocks is commonly referred to as resilience (Levin et al. 1998; Folke et al. 2002), although the usefulness of this concept in social sciences has been questioned by some authors (Hanley 1998; Lélé 1998).

Whether tropical forests offer socio-economic resilience or not, their safety net or "natural insurance" function has been well described and analyzed (Pattanayak and Sills 2001). On the other hand, the causal direction between forests and poverty is not always clear and being dependent on forests might limit other development options (Angelsen and Wunder 2003).

This paper presents a case study from a Dayak Benuaq community conducted between 1988 and 2006 in the Indonesian part of Borneo (Kalimantan). It focuses on three questions. Firstly, how do forest-dependent people cope with uncertainty? Secondly, is this coping behavior a resilient strategy? And thirdly, is the forest dependency of Lempunah rather a safety net or a poverty trap?

The paper sets out with a brief description of methods and the research site, followed by a description of resource-use patterns. The final section discusses the three former questions.

Methods

Data were collected between 1988 and 2006 with the most intensive research phase occurring between 1996 and 2000.

Socio-economic data of households were collected through semistructured interviews with a census in 1996 and a sample size of at least 33% in 1997, 1998, 1999, 2003, 2004, and 2006. Details of the sampling from 1996 to 1999 are given in Gönner (2002); the sampling and questionnaires applied in 2003 are given in Cahyat et al. (2005); the one used in 2004 and 2006 is described in Gönner et al. (2007). Household interviews from 1996 until 1999 were conducted by the author, while interviews in 2003, 2004, and 2006 were part of a district-wide monitoring exercise conducted by local assessors (Cahyat et al. 2007). Qualitative interviews and interviews regarding resource and commodity prices between 2000 and 2006 were annually conducted by the author. Earlier data collected by the author between 1988 and 1993 were indirectly used for overall conclusions.

The semistructured interviews used for this paper covered the following aspects:

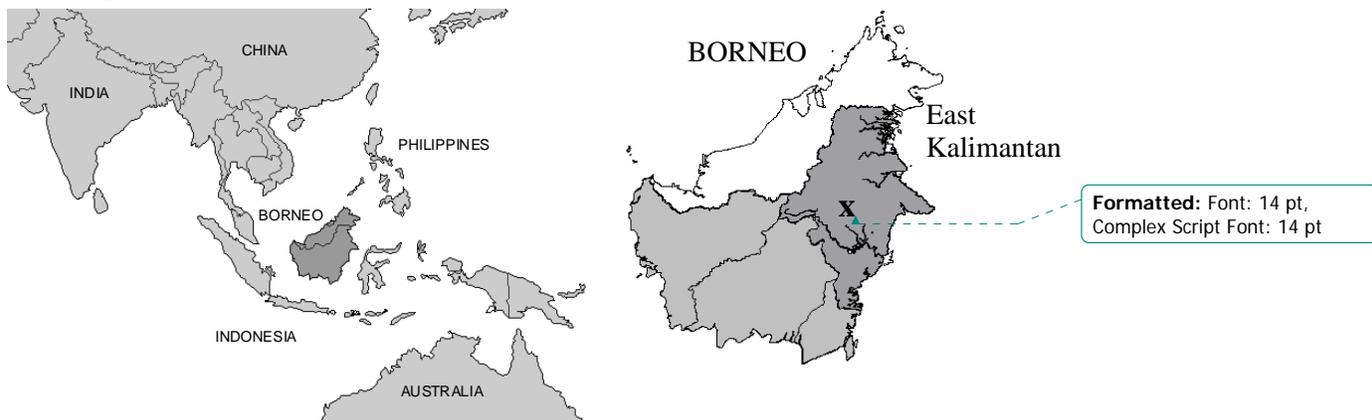
Rice cultivation: number and type of rice fields; amount of seeds (not every year); rice varieties (not every year); volume of previous harvest; rice availability during the last 12 months; forest age cleared for the rice field.

Sources of income: ranked sources of financial income (ranks from 1–4; 1 = most important; 2003, 2004, and 2006 only up to the three most important income sources).

Research Area

The study was conducted in Lempunah, a Dayak Benuaq community in Jempang subdistrict, East Kalimantan, Indonesia. The community's forest officially covers 9,200 hectares that are largely divided into individual plots of swidden fields at different stages of succession (between 1 and more than 50 years) and forest gardens (rattan, rubber, mixed *simpukng* gardens). A mapping inventory conducted in 1996–1997 revealed almost 1,000 forest gardens for a population of approximately 350 people (117 households). A detailed description of Lempunah, including settlement history (more than 300 years), ethnography, and demography is given in Gönner (2002).

Figure 1: Southeast Asia, Borneo and the Location of Lempunah (x)



Findings

Main Patterns of Resource Use in Lempunah

The overall resource-use strategy in Lempunah can be called “extended subsistence” (Gönner and Seeland 2002) comprising a subsistence basis supplemented by market-oriented resource use.

Subsistence is provided through swidden agriculture and the use of a large variety of forest products; 106 local rice varieties as well as 150 additional cultivated vegetable and fruit taxa were recorded in the community, and at least 402 wild-growing plant species and 104 animal species are extracted from the forest (Gönner 2002).

The basis of subsistence is the annual swidden field of 1–2 hectares per household cleared from secondary forest. The main crops are rain-fed rice, maize, manioc, and a large variety of vegetable and fruits. In some cases the swidden is reused a second year, although in most cases people shift to a new location before returning to the original one after five to 30 years depending on many factors. Once the swidden is left fallow, secondary forest grows along with planted fruit trees, rubber, and rattan. These cultivated species form distinct islands of forest gardens in the secondary growth. In 1996 to 1998, 461 mixed forest gardens (*simpukng*), 339 rattan gardens, and 189 rubber gardens were mapped.¹ These gardens are later used depending on demand and resource availability (ibid).

The decision to prepare a swidden field depends on a plethora of reasons and considerations, including availability of a suitable fallow forest in a suitable location, availability of workers (family members), available rice stocks, alternative occupations, social obligations (e.g. large

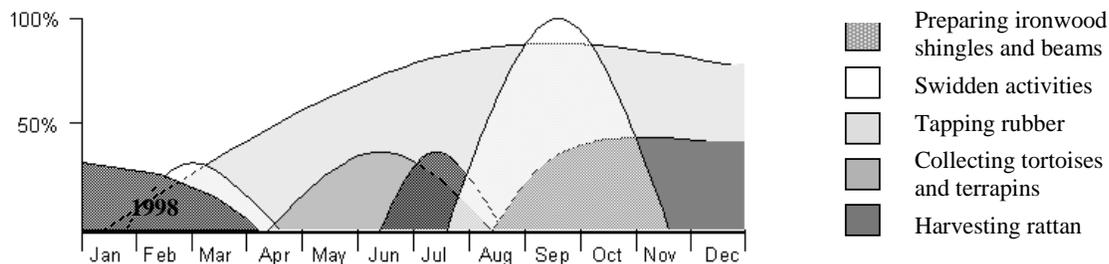
time- and resource-consuming rituals), emotional aspects, dreams, omens, and expected weather conditions. The balance between subsistence agriculture and income-oriented occupations depends to a large extent on the prospects to generate financial income. If people can earn enough money to buy rice, the labor-intensive field work is often skipped or only small rice fields are prepared to produce seeds for the coming year. In years with great uncertainty regarding cash income or diminishing rice stocks people tend to prepare larger swiddens.

Cash income is generated from various sources, including sale of agricultural products; forest-based products, such as rattan, rubber, fruits, timber, wooden shingles, birds' nests, birds, tortoises, terrapins, bushmeat, or pet animals; handicrafts often based on forest products; gambling; wage work; trade; small shops; and a few permanent jobs, including work as teachers and village officials.

Resource-use Dynamics

Like in many other places, resource-use activities show distinct seasonal patterns in Lempunah. The agricultural calendar follows the average seasonal rainfall pattern and uses star constellations for the exact timing of fieldwork. Although the seasonal distribution of rainfall is highly uncertain with great annual fluctuations, the calendar is the best guess based on long-term rainfall patterns. In between field activities people generate income from extracting or processing natural resources. Figure 2 reflects seasonal resource-use activities in 1998, indicating the estimated percentage of invested labor time of people involved in that activity (from Gönner and Seeland 2002).

Figure 2: Seasonal Activities in Lempunah

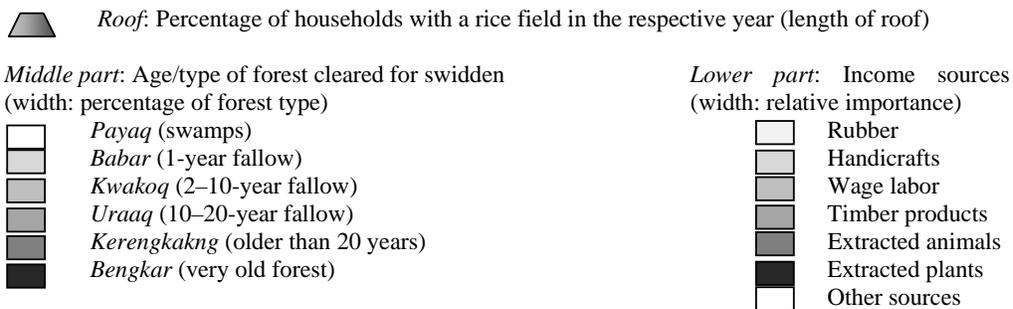


While these seasonal patterns are not surprising, the question is how resource use changes over several years. Figure 3 summarizes a few key components of extended subsistence, including the percentage of households that prepare a swidden field, the forest type cleared for swidden, and the relative importance of income sources.

Figure 3: Resource-use Longhouse



Legend



One of the most striking results of this long-term study is that resource use is anything but stable.

The percentage of households preparing a swidden field fluctuates between 25 and 100%, mainly due to extreme weather (drought in 1997) or good alternative income opportunities (e.g. rubber in 2005). However, as few people have stable income sources (e.g. teachers), most people only dare to omit one or two agricultural cycles. In any case, subsistence agriculture is *the* insurance of people in Lempunah.

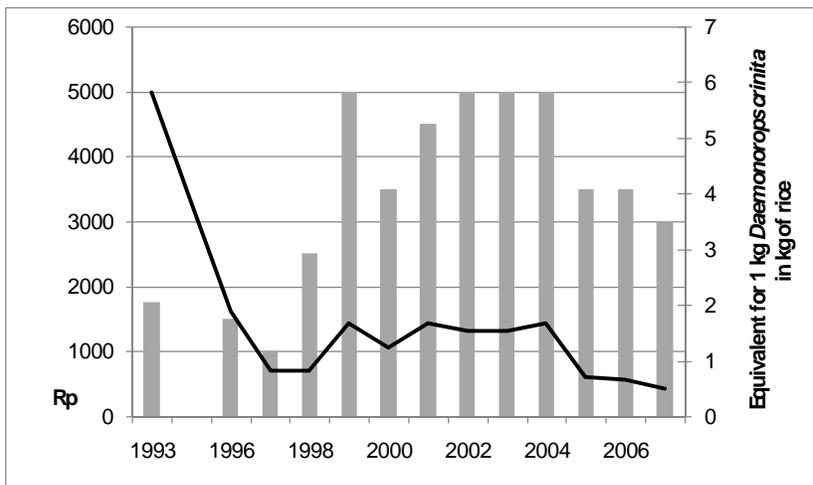
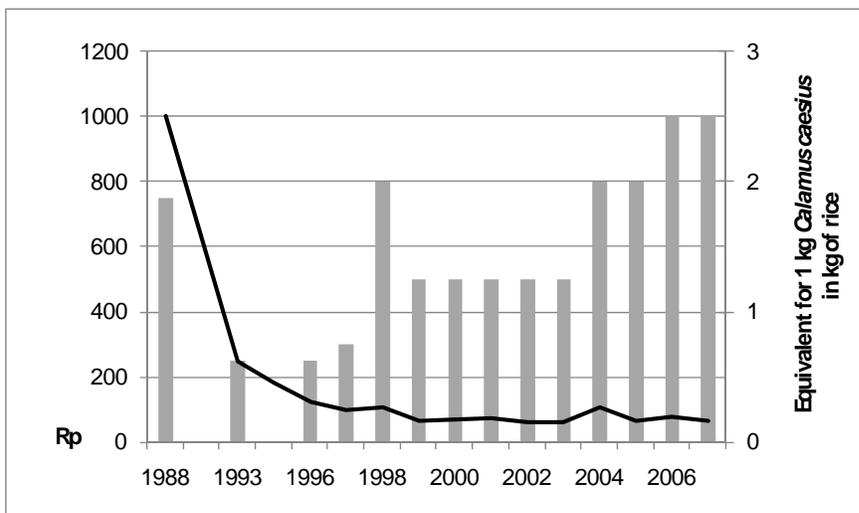
The type of forest cleared for swidden also depends on many impact factors. In general, one can say the older the forest the higher the soil fertility and the expected harvest. However, old forests are usually far away from the village, which increases travel time, transportation costs, and the risk that the harvest gets eaten by animals. Old forests also mean harder work to clear them. Hence, the decision as to which forest to choose requires some careful deliberation. This also includes the consideration of weather conditions. For example, during the drought

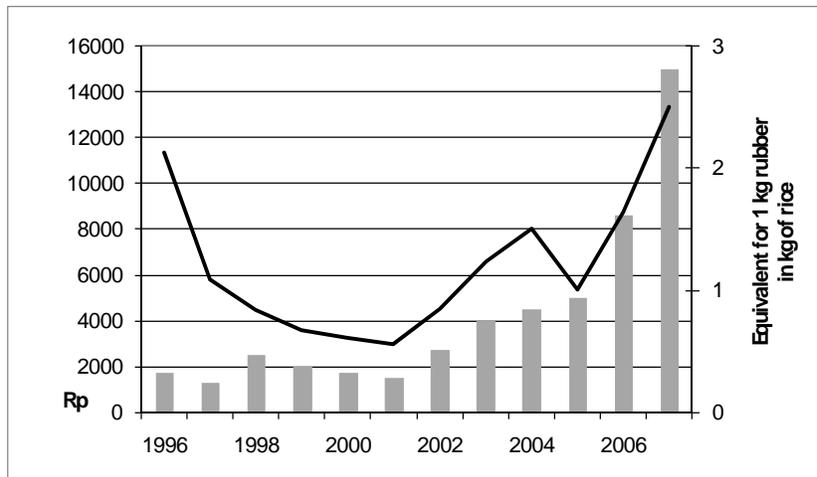
of 1997/1998 the proportion of swamp forest used for rice cultivation was much higher than in all other years.

The variation of income sources mainly depends on available opportunities and resource prices. For example wage labor from work on a nearby oil-palm plantation started to gain importance in 1996 but disappeared in 1998 when the company faced financial problems and found itself entangled in a severe land rights conflict with neighboring communities. Income from handicrafts was important during the mid-1990s and again in 2003 to 2005, while it suffered from the drastic decline in tourist numbers in 1998.ⁱⁱ

On the other hand, rubber changed in its importance mainly based on the highly fluctuating market price. So did rattan. Figure 4 shows the price development for rubber and two rattan species between 1988 and 2006. As a measure of local purchasing power the equivalent in kilograms of rice that can be bought for the selling price of 1 kilogram of rattan or rubber is shown on the secondary y-axis.

Figure 4: Rattan and Rubber Prices in Lempunah





Primary y-axis (bars): selling prices in Lempunah (in rupiah) for 2 rattan species (*Calamus caesius* and *Daemonorops crinita*) and rubber (*Hevea brasiliensis*); secondary y-axis (black line): equivalent in kilograms of rice for 1 kilogram of sold rattan/rubber; the price of rice is locally used as an equivalent to purchasing power.

The underlying reason for this very distinct dynamic pattern is a mixture of intentional resource-use strategies and adaptive response to the constantly changing framework conditions people are facing.

Adaptive Response: Surfing on Waves of Opportunities

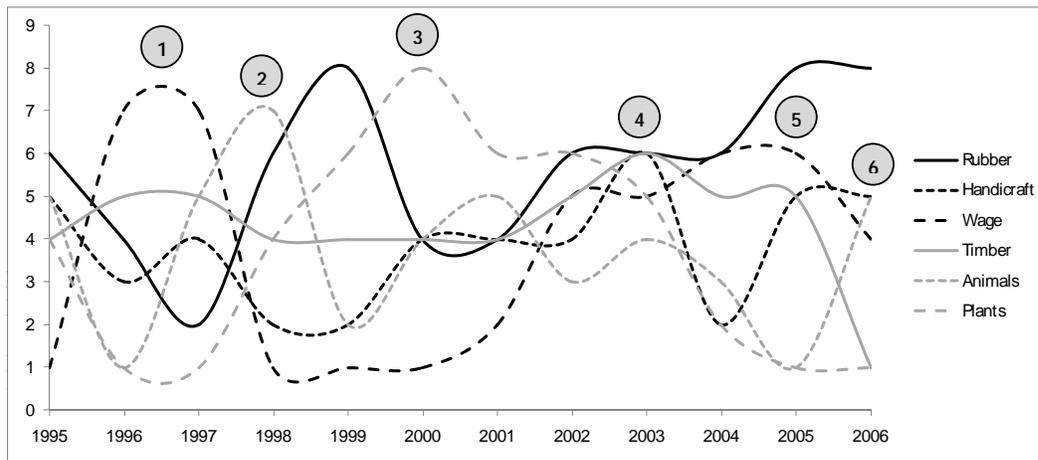
As shown elsewhere (Gönner 2002; Gönner and Seeland 2002), people in Lempunah apply a broad portfolio of strategies in using natural resources. These include manipulation of the environment (e.g. enrichment planting of rattan and fruit trees); conservation of resources (e.g. through certain food taboos, but also through locally protected areas); diversification (e.g. broad diversity of rice varieties, different locations of swidden fields); and socially and religiously embedded strategies (e.g. social cooperation, agricultural rituals).ⁱⁱⁱ Many of these strategies “preact” to an unforeseeable future by getting prepared for various possible scenarios. Similar strategies have been described from many other areas (Dove 1993; Godoy and Feaw 1991; Brookfield and Padoch 1994).

In addition to these proactive strategies that all imply some sort of planning, people in Lempunah show flexible and adaptive behavior to cope with uncertainty and to respond to events and shocks.

These events can be sudden economic opportunities offered by the dynamics of the world market, but they can also be a natural disaster like the drought of 1997/1998 or a conflict such as the clash between Lempunah and a nearby oil-palm company in 1998/1999.

The economic reaction to these events can be visualized through trajectories of ranked importance of income sources. The trajectories shown in Figure 5 reflect the *waves of opportunities* local resource users are “surfing” on.

Figure 5: The Waves of Opportunities



The following examples illustrate how people react to mainly external events:

❶ An oil-palm company starts clearing forests and begins to establish a plantation near the village. Many people find temporary work for land clearing and in the nursery. In 1998 a land rights conflict escalates between the company and the neighboring communities. In addition, the company faces financial problems due to the Asian financial crisis, and most people are out of work for the next four to five years.

❷ Hundreds of tortoises and terrapins are collected from swamp forests that dried up during the long drought of 1997/1998. Through a chain of intermediaries the animals are exported to Hong Kong and Singapore. Soon, stocks are depleted and after May 1998 the swamps are inundated and inaccessible again.

❸ The price of rattan (*Daemonorops crinita* and *Calamus caesius*) increases. Gardens of both species are full of mature cane (10 years after the last rattan boom) and most people decide to harvest.

❹ The selling price for rubber slowly increases and many people decide to skip rice cultivation. Instead of investing in subsistence agriculture they tap rubber or join the logging boom revitalized by decentralization. The rattan species *Daemonorops crinita* still sells at a high price, while some people produce handicrafts for the slowly recovering tourism market.

❺ After more than 10 weak years the rubber price reaches a nominal maximum.^{iv} In addition, both the oil-palm company, as well as a new coal mine in the vicinity of Lempunah offer wage labor. Rattan stocks are largely depleted and prices begin to fall again. New forest regulations have been passed and illegal logging is severely prosecuted.

❻ Logging has become too risky. The price of *Daemonorops crinita* has dropped most likely due to synthetic substitutes used for café furniture in Europe.^v The two companies have mainly hired workers from other Indonesian islands leaving only a few job opportunities for local people. More than 10 years after the last massive catches (Jepson et al. 1998), the population of hill-mynahs (*Gracula religiosa*) has partially recovered and more than 100 birds are caught and sold to pet traders.

Many of these waves of opportunities are relatively short-lived. Resource availability or market opportunities are often limited in time, and people need to react swiftly to get on a wave as long as it can carry the resource surfer. For instance, the tortoise and terrapin wave only lasted for about three months in 1998. After this intensive phase of resource extraction, swamp forests became inaccessible again. In addition, resource stocks were largely depleted and it was no longer worthwhile to search for the animals. At the same time, the rubber price started to increase. So, most people switched from collecting tortoises and terrapins to tapping rubber. When the rubber price declined again,^{vi} the price of *Daemonorops crinita* rattan increased and offered the next wave to jump on.

Conclusion

What Are the Principles of Resource Use in Lempunah?

Like many other people who live in uncertainty and who largely depend on forest resources, people in Lempunah are masters of making the best use of their economic opportunities. These opportunities are often triggered by events far away from the community, such as the fashion of café furniture in the case of rattan (see *Daemonorops crinita*) or the ups and downs of the international rubber price. In addition to economic trends and events there are uncertainties due to nature, such as unpredictable weather conditions, devastating forest fires, droughts, floods, or pest outbreak, but also political events, such as the drastic changes brought by decentralization.

The Benuaq apply a broad mixture of resource strategies to cope with this uncertainty. Besides getting actively prepared for an unknown future, e.g. through diversifying field locations and crops, they also show distinct flexibility in reacting to events. Applying extended subsistence for securing their livelihoods allows them to shift the balance between subsistence-oriented and income-oriented resource use upon demand. While profits can be invested to become less vulnerable to uncertainty (e.g. by planting cash crops, through savings, or investing in the education of children), subsistence agriculture remains a vital part of the Benuaq's safety net. Combined with the relatively good social cohesion—especially within extended families^{vii}—this economic safety net has so far spared the inhabitants of Lempunah from famine and severe poverty.^{viii} Due to its flexibility, extended subsistence offers individual niches along the gradient from markets to subsistence. While the most vulnerable households might enjoy the safety net function, more entrepreneurial ones might act closer to complete commercial resource use.

Thus, surfing on waves of opportunities secured by complementary subsistence is a suitable strategy to cross the waters of uncertainty. However, this strategy only works where there are enough waves to offer opportunities. The waves also need to be high enough, i.e. providing enough income to be a real alternative to subsistence agriculture, and people need to have the right to surf on these waves, i.e. secure rights to access and use resources.

The elements of extended subsistence have evolved over a long period of time, and the fact that no larger mammal or bird species have disappeared from the forest of Lempunah until recently (Gönner 2002) indicates that resource use, so far, has been genuinely sustainable.

This does not mean that resource stocks always were in equilibrium or in steady state. On the contrary, depending on market demand some resources were almost depleted (e.g. rattan during the rattan boom in 1988, tortoises and terrapins during the drought in 1998). However, after these intensive phases of resource extraction time was given to the (sufficiently large) environment to recover. For some resources (e.g. tortoises and terrapins) this did not happen out of conservation-minded deliberations, but rather due to the decreasing cost-benefit ratio of

extracting increasingly scarce resources and interrupted market links.^{ix} In other cases (e.g. some rattan species, such as *Calamus caesius* and *Daemonorops crinita*), people replanted the species in forest gardens.

Spatial and temporal buffers are critical preconditions for maintaining continuous surf that provides freedom of choice. If resources have the time and space to recover after intensive extraction, they can become another wave of opportunities in the future. These buffers, however, are increasingly threatened by demographic pressure or forest conversion.

Is Surfing Waves of Opportunities a Resilient Strategy?

In the classical ecological sense (see Holling 1973), resilience refers to the “stability domain around stable time-invariant equilibria or stable oscillations” (see Lélé 1998). In other words resilience is related to the maximum distance from the (eco)system’s equilibrium to which a variable can be moved (e.g. by an event) without getting attracted by another equilibrium, and, thus, without changing the system’s quality (e.g. from a forest landscape to savannah). This understanding provokes two fundamental questions (1) what is the system? and (2) has it ever been in a state of equilibrium?

I have summarized the main points of critique regarding the ecosystem concept (especially in its anthropological application) elsewhere (Gönner 2002). My major concerns against seeing the Benuaq’s livelihood mode as a classical system are the nonexisting boundaries of such a “system” and the lack of stable framework conditions that would require permanent redefinition of a Benuaq system. An alternative is the softer approach of causal chains (see Vayda and McCay 1975; Vayda 1996) which is based on less ambitious assumptions.

While the ecosystem is still a popular concept, there is unanimous agreement that ecosystems and socio-economic systems are nonlinear exhibiting “far-from-equilibrium dynamics” (Levin et al. 1998). But if these systems typically are far from their theoretical equilibria, what sense does the classical definition of resilience make? If these systems are too complex to know their theoretical equilibria, it remains undecided whether the system reacts to an external shock by swinging back (towards the suspected equilibrium)—i.e. showing *resilience*, or whether framework conditions have changed so much that there is a permanent transition of systems—i.e. permanent *adaptation*.

Apparently, it is not very practical to stretch Holling’s original definition too far. A softer understanding, however, could still make resilience a useful concept for analyzing socio-economic patterns. Applied to this case study, resilient behavior would maintain the general livelihood mode (here, extended subsistence) while adaptive behavior would mean a qualitative change of the mode (e.g. transition from extended subsistence to full-time employment in a plantation company). As mentioned by Lélé (1998) resilience carries the temporal notion of a short-lived event, while adaptability refers to more long-term impacts. Distinguishing between resilience and adaptability becomes especially relevant if there is concern about a system’s sustainability. A resilient system (in the soft sense) might be sustainable, while an adapted one might just have lost (not sustained) all previous properties and become a new system. Again, this reemphasizes the doubts on the usefulness of stretching the (classical) system concept too far.

So is surfing waves of opportunities in Lempunah a resilient strategy? The observations of this long-term study show that the basic mode of livelihood (i.e. extended subsistence) has not qualitatively changed over the last 20 years. Most households still combine subsistence agriculture and flexible income generation. Shocks are mitigated through flexible response, and only few people have “adapted” and switched to permanent jobs in nearby plantation and

mining companies (though, still with the fallback option of returning to the village and their previous extended subsistence).^x

As surfing waves of opportunities has maintained the main mode of livelihood in Lempunah it can be regarded as a resilient strategy in the soft understanding of the term.

Is Forest Dependency in Lempunah a Safety Net or Poverty Trap?

This study, as well as a recent well-being survey (Gönner et al. 2007) shows that flexible forest use, both for subsistence needs (including swidden agriculture) and for income generation, secured some decent well-being. In contrast to other communities in Kutai Barat that lost most of their natural resources in the process of land conversion (to plantations and coal mines) people in Lempunah usually can choose which forest product they want to use.

When rattan prices collapse, the price of rubber might increase. When no mynah birds are left, tortoises might fetch a good price. These are the waves of opportunities explained above. In their full diversity supported by safeguarding subsistence agriculture, access to markets, and reliable social cohesion, they make up a strong safety net.

On the other hand, the well-being survey also revealed critically low rates of subjective well-being for Lempunah.^{xi} There are a number of possible explanations reaching from unresolved land rights conflicts with an oil-palm company to poor access to the district's center. However, one cause of perceived poverty is the unfulfilled desire for a modern lifestyle (Haug in preparation). Extended subsistence might have spared people from extreme poverty,^{xii} but it also limits chances for changing the livelihood mode. Education and income-generation opportunities as well as market links and access to information are much weaker in Lempunah than in the district's capital. Therefore, young people often try to escape from extended subsistence either by looking for jobs in logging, mining, or plantation companies, or by moving to the regional centers. Although they might earn more income for some time, many of them eventually return to the village and benefit from the sustained social and economic safety net of a forest-dependent community. Compared to better educated and better connected competitors from areas close to the district's center, they have limited chances to get a permanent and well-paid job.

Yet, as Angelsen and Wunder (2003) put it, it would go too far to call the forest a poverty trap, especially given all the risk-mitigating properties that help people avoid extreme poverty.

Outlook

What is the use of the Benuaq's resource-use strategies in an increasingly modernizing world with greater cash demand and decreasing buffers? Is extended subsistence outdated and only useful as a fallback strategy for failed entrepreneurs?

The answer is that surfing waves of opportunities and other strategies coping with uncertainty is highly suitable to face yet new unpredictability. Very much in contrast to their often traditionalized image, the Benuaq like other Dayak groups (see Colfer 1983: 84 for the Kenyah) also switch to new opportunities like wage work on plantations and in mines, or like the production of charcoal after the forest fires in 1997/1998. Others started tourism enterprises or invested in modern agroforestry using grafted crops.

The unpredictable future of Borneo's Dayak groups requires a mindset as exemplified in surfing waves of opportunity and extended subsistence. Making the best use of new economic

chances and maintaining reliable social and economic safety nets is a well-proven combination. The latter will probably shift from subsistence farming to better education and diversified investment including various forms of savings and insurance. The underlying flexibility and risk awareness, however, will remain a fundamental strategic basis for managing the future.

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Endnotes

ⁱ Control counts along two transects of 3 km each suggests that the real total number of forest gardens is higher with 720–770 *Simpukng* gardens, 540–570 rattan gardens, and 250–270 rubber gardens.

ⁱⁱ Visitor numbers to a nearby major tourist destination (Tanjung Isuy) dropped by 90% from 1996/1997 to 1997/1998 mainly due to forest fires, a plane crash, and increasing political instability in the country (related to the financial crisis in Asia).

ⁱⁱⁱ However, in extreme years, such as the El Niño year 1997/1998, all rice varieties failed with the exception of rice that was directly planted into lakes and swamps.

^{iv} Note that the real price (measured against the rice price) is still below the price in 1996.

^v The case of *Daemonorops crinita* is another good example of Homma's transformation theory (Homma 1996) with a phase of extraction from nature, followed by cultivation and finally by substitution. However, the second phase was triggered by conflicts about access rights to natural rattan rather than by economic reasons (Gönner 2002).

^{vi} At the international markets, rubber prices reached their lowest level in 30 years in late 2001/early 2002 (Budiman undated), before they increased again to reach similar levels to the mid-1990s in 2005 (FAO undated).

^{vii} More than 90% of the villagers are members of a tight family network connecting its member households through parent–children or sibling relations (see Gönner 2002: 228).

^{viii} The Kutai Barat household well-being survey of 2006 showed for Lempunah average well-being values with good marks for health and knowledge, and critical values of subjective well-being and the natural sphere (CIFOR-BMZ Poverty and Decentralization Project data; Gönner et al. 2007).

^{ix} Tortoises and terrapins were also difficult to find once the drought had ended in mid-1998 and swamp forests were inundated again.

^x This does not mean that deeper market involvement and specialization are always prone to failure. There are successful examples where families successfully invested their income in education and economic fields less dependent on nature. However, the hurdles for the successful shift from extended subsistence to an entirely nonsubsistence-based livelihood are high. Many people—usually young men—who earned substantial income from logging, mining, and forest fees during the first years of decentralization in Kutai Barat soon lost most of it to gambling, drugs, and prostitutes (Gönner et al. 2007). Many of them would have fallen into severe poverty had not the old social- and subsistence-based economic safety nets again proved their function.

^{xi} Subjective well-being was critical in absolute terms, as well as relative compared to other communities in Kutai Barat.

^{xii} The well-being survey revealed that forest dependency was significantly higher in specifically vulnerable households (e.g. households led by widows/widowers or households with disabled members) compared to less vulnerable ones (Gönner et al. 2007). This underlines the safety net function of the forest.