Factors Affecting Wild Resource Use: Actual Use of Wild Resources by the Penan Benalui of East Kalimantan

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Introduction

Many studies have shown that local people know numerous useful wild species (e.g., Boom 1987; Milliken et al 1992; Balée 1994; Christensen 2002). Long inventories of useful wild species are usually considered to express the importance of biodiversity to local people. Some (or even many) species on such a list, however, are hardly used (e.g., Dwyer 1990, 122; Koizumi & Momose 2007). Actual use of species is determined by availability, preference, need, and other factors.

This paper examines use of wild species by the Penan Benalui, a former hunter-gatherer group of East Kalimantan, Indonesia. Among 713 species of wild plants examined in a previous study (Koizumi & Momose 2007), 540 species are reported useful by the Penan Benalui. According to them, however, only 212 species are of good quality, often used, or important for a certain purpose(s) (ibid.). I describe two examples of wild resource use here. One is wild species used for food during a three-month survey. In this example, several species were intensively used. The other is rattan species used for basketry. Changes in the use from 2002 to 2007 are described. I then summarize factors affecting actual use of species and discuss the advantage of knowing currently less or rarely used but potentially useful species.

Penan Benalui

The Western Penan is a Bornean hunter-gatherer group, and the Penan Benalui is a subgroup of the Western Penan (Needham 1972; Hildebrand 1982; Brosius 1992, 52–55, 60–68; Puri 2005, 2–6). About 2900 Western Penan, not including the Penan Benalui, live in Sarawak, Malaysia (Brosius 1999), and about 450 Penan Benalui live in East Kalimantan, Indonesia. Traditionally the Western Penan were essentially self-sufficient in obtaining food, eating forest products such as sago palms, fruits, bearded pigs, leaf monkeys, and palm shoots, though they also interacted with farmers for trade and protection from raids (Brosius 1991; 1992, 111–96).

According to the Penan Benalui, farmers encouraged the Penan Benalui to live in their villages and to learn how to farm. Behind this encouragement was pressure from Indonesian bureaucrats and pastors on the farmers to persuade the Penan Benalui to settle and farm (Puri 1997, 78; 2005, 56). The Penan Benalui gradually adapted to sedentary life from the mid-1950s (Puri 1997, 77–78; 2005, 55–56). The present Penan Benalui are practicing a mixed subsistence economy. They, however, largely depend on forest products for cash income as well as for food and material culture.

Methods

Fieldwork was conducted in the village of Long Belaka (2°41´ N, 115°43´E), a Penan Benalui community, in East Kalimantan, Indonesia from 2002 to 2007. The residential site of the village is located about 300 m

above sea level and surrounded by mountains. The forest around the village is mainly lowland dipterocarp forest.

Plants were collected with informants in mature and secondary forests and along riversides around the village at about 300–600 m above sea level (Koizumi & Momose 2007). During these collections, informants were interviewed about ethnobotanical information including plant names and uses. The informants were ten men and two women between the ages of about 30 and 60 who were relatively knowledgeable about plants. I made a list of plants for each use mentioned in the field. For each use category, one or two (or three) villagers were asked to name plants associated with that use. I also asked which plants were often used, were of good quality, or were considered important for each use category.

The food survey was conducted from September to November 2004 for a total of 20 days (Dounias et al 2007). At each house of the study village, I conducted interviews about foods the inhabitants had eaten. I asked the names of dishes, ingredients of the dishes, and asked who hunted, collected, or harvested the ingredients. There were 20 houses in the village at the time of the survey. Data was collected for 346 day-houses. I could not interview at some houses on some days because the people were staying at a downriver village or swidden field. I analyzed the times of use of each kind of ingredient. If an ingredient was used at a house for a dish at a meal, it was counted as "1 time."

Voucher specimens were identified by me and other botanists. Voucher specimens are mainly deposited in Herbarium Bogoriense (Indonesia) and the Kyoto University Museum (Japan).

Results

(1) Wild plants and animals appeared in the food survey

Only 16 or 17 species of wild plants appeared in the food survey (Table 1), though the Penan Benalui know at least 193 edible species (Koizumi & Momose 2007). One of the reasons for this is that forest fruits were not available during the survey period. Some food resources, especially fruits and fungi, are not available throughout the year.

Although the Penan Benalui knew about 10 edible ferns, *Diplazium esculentum* (Retz.) Sw. was almost exclusively used. The species was abundant in open places around the village, especially on moist soil along rivers. The fern was thus easy to collect and considered a delicious fern by the villagers. The fern, however, was a far less favored food than meat, especially when oil was not available and the leaves were just boiled. Nevertheless, the species was often collected when meat was not available.

Sago starch was processed only from *Arenga undulatifolia* Becc., though the Penan Benalui know eight kinds of wild sago palms. Distribution, abundance, and taste of the palms account for the use of the species. Four palms are not found near the study village. Two palms grow near the village, but they are not very abundant. Two species, *A. undulatifolia* and *Eugeissona utilis* Becc., are abundant around the village. According to the villagers, the starch of *A. undulatifolia* is sweet, while that of *E. utilis* is bitter unless it is cooked with fat. The processing of sago starch requires much effort, and the villagers processed the starch only when they did not have rice. Furthermore, many villagers preferred to earn money to buy rice rather than to process the starch.

The shoots of *A. undulatifolia* and *E. utilis* were similarly often used. They were abundant, as explained

above, and have large shoots. The shoots of the two species have different tastes, but the villagers liked both of them. According to a villager, eating the shoots of *Oncosperma horridum* Scheft. is a good remedy for headache. Although it was not asked in the survey, the shoots were collected and eaten not only for its good taste but also for the medicinal property.

Leaves of *Albertisia* sp. were pounded and cooked with other ingredients like monosodium glutamate. The plant was not abundant but not rare in the forest around the village. Although monosodium glutamate was usually used, villagers said that palm shoots tasted better when they were cooked with the leaves.

Table 2 shows wild animals appeared in the food survey. (The villagers used wild meat bought in a downriver village at two times, but they are excluded from Table 2.) The bearded pig (*Sus barbatus*) was used far more often than any other animals. It was the most favored food for most villagers. When adult bearded pigs were hunted, the meat was distributed to all families of the village. The sambar deer (*Cervus unicolor*) is also a large animal, but the villagers did not value the meat so much as that of the bearded pig. The sambar deer is one of the pest animals, and they were usually hunted around swidden field. In general, when men went hunting with a spear and dogs or with a shotgun, they and other villagers hoped that they would get the bearded pig. Some men sometimes went hunting with a blowpipe to hunt the gray leaf monkey (*Presbytis hosei*) when the bearded pigs were scarce. The people may also hunt other animals that they happen to encounter (Puri 1997, 2005).

(2) Depletion of a rattan species and change in rattan use

During the study period, a change in use of rattans was observed. *Calamus caesius* Blume is the most valued rattan species for fine basketry in the study area. The villagers of Long Belaka were frequently producing **bukui**, a kind of rattan basket, made from *C. caesius*. In 2003 and 2004, they had bad rice harvests and worked hard to collect and process forest products to earn money to buy rice. Rattan baskets were among the most common forest products they sold. Some women even newly learned how to weave **bukui**. In 2005 or 2006, however, some families stopped producing rattan baskets made from *C. caesius*. According to an elder, his family stopped producing the baskets because the rattan was depleted. (Conversely, another man about 40-year old said that rattan was still abundant. Being asked further, he answered that the rattan was depleted around the village, but was still available at places which could be reached by 3–4-hour walk from the village.) The villagers started to produce **kavung**, a different model of rattan basket, for sale in 2006. They learned the model from the Kayan, swidden agriculturalists. The baskets can be made from *Calamus javensis* Blume and *Korthalsia* cf. *hispida* Becc., both of which are most common species around the village.

Discussion

(1) Factors affecting actual use

In the above examples, availability of resources in time and space affected actual use (Fig. 1). Availability in time or seasonality controls the possibility of use. It is impossible, for example, to collect the fruit of a certain species when it is not fruiting time. Seasonal resources, however, contribute to people's livelihoods when available. Availability in space, in terms of distribution, habitat, and abundance, is closely related to searching costs. Searching costs can be reduced if two or more resources are collected at the same time.

There are also collecting and processing costs, which are related to morphological, chemical, behavioral, or other characters of resources. The costs can be reduced or increased by collecting and processing techniques. The possibility to use a resource may even depend on whether a community or an individual has a proper technique or not.

The decision to use a resource depends on the balance of perceived costs and benefits. The perceived costs partly depend on the perception of effort by individuals. The same work, for example, can be a relatively easy task for young men and a hard task for elders. The benefits that can be gained from a resource are related to quality and amount of the resource. At the same time, however, it is not determined by the resource itself. People judge the benefits according to their perception of the quality, preference, and need. The need for a resource changes according to the situation of each individual, household, community, and of the outside world (e.g., the market).

(2) Advantage of knowing potentially useful species

People usually know several or many species for a certain purpose. In general, different species have different availability and quality. This will result in people's perception of different costs and benefits of using these species. (As I have explained, the costs and benefits here are determined not only by objective factors but also by subjective factors.) The species of a better cost-benefit balance will more likely to be used. As far as there is a highly available or highly valued species, the species is intensively used and others are less or not used. It is not surprising that people know seasonally available resources and resources used for special occasions (such as eating a certain food, etc. when someone is sick, when someone becomes tired), though they may not be used at all during a short period. Rare resources may not be searched for specially, but they will be collected or hunted when people happen to encounter them. What, however, is the advantage of knowing species of perceived inferior quality?

The situation can change. Availability of a good quality resource may be depleted by overuse, as in the rattan case in this paper. An alternative resource then exhibits a better cost-benefit balance than the depleted one. An inferior resource can even become a best resource if a new way of use or new technique is introduced, or if the people's preference changes. The informants often introduced a plant by saying, "This is used for ——— (a certain purpose) if there is no ——— (a plant name)." People are prepared, to some extent, for changing situations. Knowledge of alternative species or resources will help people to quickly adapt to a new situation.

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Table 1
Wild plants appearing in meals of 346 day-houses in September to November 2004 at Long Belaka

Category	Species	Habitat	Times of Use
Green leaves (ferns)	*Diplazium esculentum* (Retz.) Sw.	Open place	69
	Pteris tripartita Sw.	Open place	1
Green leaves (seed plant)	*Piper* sp.	Forest	2
Starch (sago palm)	*Arenga undulatifolia* Becc.	Forest	40
Starch (tuber)	Sp. 1	Village site	1
White shoots (palms)	*Arenga undulatifolia* Becc.	Forest	13
	Eugeissona utilis Becc.	Forest	13
	Oncosperma horridum Scheft.	Forest	3
	Daemonorops fissa Blume	Forest	1
	Licuala sp.	Forest	1
	Not asked		1
White shoots (ginger)	*Etlingera foetens* (Blume) R.M. Sm.	Forest	1
White shoots (bamboo)	Sp. 2	Open place?	1
Condiment	*Albertisia* sp.	Forest	12
Ginger flowers	*Etlingera. elatior* (Jack) R.M. Sm. and/or *E. pyramidosphaera* (K. Schum.) R.M. Sm.	Forest	2
Fungi	Sp. 3	Forest	1
	Sp. 4	Open place	1
Fruit	*Passiflora foetida* L.	Village site	1
	Total		16 4

Table 2
Wild animals appeared in meals of 346 day-houses in September to November 2004 at Long Belaka

Animals	Times of Use
Bearded pig (*Sus barbatus*)	316
Sambar deer (*Cervus unicolor*)	25
Barking deer (*Muntiacus muntjac* and/or *M. atherodes*)	9
Mouse-deer (*Tragulus javanicus* and/or *T. napu*.)	9
Malayan softshell turtle (*Dogania subplana*)	3
Bushy-crested hornbill (*Anorrhinus galeritus*)	2
Common porcupine (*Hystrix brachyura*)	2
Gray leaf monkey (*Presbytis hosei*)	1
Pig-tailed macaque (*Macaca nemestrina*)	1
Asian leaf turtle (*Cyclemys dentata*)	1
Rough-necked monitor (*Varanus rudicollis*)	1
Palm weevil (species not studied)	1
River shrimp (species not studied)	1
Fishes (species not distinguished)	165
Total	537

	Necessary conditions	Costs			Benefits
		Searching	Collecting Hunting	Processing	Use (domestic use or sale)
Biological factors	· Phenology (Availability in time)	· Distribution · Habitat · Abundance (Availability in space)	· Morphology · Behavior	· Physical character · Chemical character	· Quality and amount
Human factors	· Technique · Physical ability	· Technique (knowledge, experience) · Physical ability · Perception of effort			· Perception and evaluation of the quality · Preference · Need (domestic, market)

Fig. 1 Example of factors affecting wild resource use