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The potential contribution of non-timber forest product extraction to tropical forest conservation and development: lessons from a case study of bamboo utilisation in a Sierra Madre community, the Philippines

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Abstract—This article presents the results of a study of bamboo exploitation carried out in a village in the Sierra Madre, the Philippines. With a view to providing evidence for the hypothesised link between exploitation and conservation/development in the non-timber forest product (NTFP) debate, it evaluates the feasibility of using the commercial exploitation of buho (*Schizostachyum lumampao*) as a strategy for conserving the rain forest. An analytical framework is used to assess whether the principal conditions of sustainable extraction — ecological sustainability, economic feasibility and political and social acceptability — are being fulfilled. The authors conclude that, despite the lack of possibilities for adding value, the lack of organisation and the illegality of extraction, buho gathering in the study village is economically feasible as an ancillary activity. Moreover, the regenerative capacity of the plant is such that buho extraction itself does not cause the depletion of the resource, as long as immature poles are not cut. The authors argue, however, that the sustainability of buho extraction — as of any other non-timber forest product — cannot be judged on the basis of the features of the extractive economy alone. The extraction of buho does not affect agricultural expansion or migration to the forest frontier, which are the main causes of deforestation and depletion of buho resources in the study area. Only in relatively stable situations, where forest resources are not under pressure, may buho extraction offer opportunities to improve peoples' livelihoods and sustain forest conservation. In such instances, the authors recommend the organisation of gatherers into cooperatives and the demarcation of protected extraction areas.

Key words: Bamboo; buho (*Schizostachyum lumampao*) extraction; non-timber forest products; forest conservation; deforestation; sustainability; forest use; livelihoods; The Philippines.

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INTRODUCTION

Non-timber forest products (NTFPs) can be defined as 'all tangible animal and plant products other than industrial timber, which can be collected from forests for subsistence and for trade' [1]. They comprise both plant products and products of animal origin. Animal products include items like game, fish, birds and edible bird nests, eggs, honey and silk. NTFPs of plant origin comprise such products as fruits, nuts, seeds, spices, medicinal plants and plant parts (leaves, bark), resins, essential oils, latex, ornamental plants, rattan and bamboo [2].

In the last decade of the 20th century, several scholars considered the exploitation of these products as a potential strategy for the conservation and sustainable use of tropical rain forests (see, for example, Refs. [3–7]). It was assumed that the commercial exploitation of NTFPs, by adding value to the forest and generating incomes and foreign exchange, could provide an incentive to keeping the forest intact and managing it sustainably [1]. The claimed exploitation–conservation link made NTFPs an important issue in discussions on tropical deforestation. Several authors pointed to the important benefits of NTFP exploitation for local communities (goods, income and employment), and the sustainable nature of their harvesting (e.g. Ref. [4]). The exploitation of NTFPs was introduced as a combined solution for the development needs of local communities, forest degradation and deforestation. NTFPs were expected to offer a model of forest use which could serve as an economically competitive and sustainable alternative to logging [8]. In addition, it could be argued that commercial NTFP extraction might be able to provide an extra income with which investments in more sustainable forms of agriculture could be made [9].

Other authors, however, argued that the returns from NTFP gathering are marginal compared with those of timber extraction and that efforts should therefore be aimed at developing sustainable timber exploitation instead of or along with NTFP extraction (e.g. [10, 11]). They pointed to the precarious socio-economic conditions under which the extractors usually live and work (e.g. [10]), the exploitative trading relations [12, 13] and the combination of NTFP extraction with less sustainable forms of land use, such as farming, gold mining or logging [1, 12].

To evaluate the development and conservation potential of NTFP extraction in concrete situations, Ros-Tonen *et al.* [1] proposed an analytical framework aimed at identifying whether the conditions for sustainable NTFP extraction are met in a specific case. This approach has been used in the study of bamboo exploitation carried out by Kusters [9] in the Sierra Madre, the Philippines. The present article presents the results of this study and discusses them against the background of the NTFP debate and the analytical approach used.

RESEARCH OBJECTIVES AND STUDY AREA

The Sierra Madre mountain range is located in the northeast of the island of Luzon and contains one of the largest areas of intact tropical moist forest in the Philippines.

The forest is, however, under great pressure. This can be attributed mainly to small-scale logging and the eastward expansion of agricultural lands, both driven by migration from Ifugao and the Cagayan Valley to the uplands of the Sierra Madre [11]. Upland migration, in its turn, is driven by rapid population growth (2.4%) [14], and the inequitable distribution of resources and lack of economic opportunities in the lowlands [15].

The study deals with the commercial extraction of bamboo in a community of forest migrants in the Sierra Madre Mountains, called Puerta. Out of the more than 1250 bamboo species, the study focuses on buho (*Schizostachyum lumampao*). This species grows abundantly in the residual forest of the Sierra Madre and has a market in the lowland villages, where the poles (or culms) are used extensively for house building and the drying of tobacco leaves. The buho pole is reasonably durable, although not as durable as the two other bamboo species which are commercially used in the Cagayan Valley, but do not occur in natural stands in the uplands: kauayan tinik (*Bambusa blumeana*) and bayog (*Dendrocalamus merrillianus*). The primary aim of the study is to discover to what extent present commercial buho exploitation is ecologically sustainable, economically feasible and influenced by contextual factors, in order to assess whether bamboo utilisation can play a role in forest conservation.

The study community is situated near the forest margin and consists of 53 households. Fieldwork was carried out from November 1998 to April 1999 under the Cagayan Environment and Development Programme. This programme is a joint effort of the Centre of Environmental Sciences of Leiden University in the Netherlands (CML) and the Isabela State University (ISU) in the Philippines. All 53 household heads of the community were interviewed. Women and children do not participate in the collection and sale of buho and were therefore not included in the survey. Semi-structured interviews were also held with ten heads of households from the neighbouring upland village of Balete, nine buho buyers and six buho traders from the lowlands. Moreover, open interviews were held with 29 key informants, including teachers, traders, truck drivers, landowners, middlemen, etc. In addition, Rapid Rural Appraisal/Participatory Rural Appraisal methods were used, such as individual and collective mapping (of resources, land uses, infrastructure and residents), walking transects and making a transect inventory of buho in the forest and participatory observation.

ANALYTICAL FRAMEWORK

As was stated in the introduction, this study used the analytical framework proposed by Ros-Tonen *et al.* [1]. The main objective of this framework was to provide a scientific basis for the link between commercialisation and conservation and to make it operational for policy makers and land-use planners. It tried to do so by providing an insight into the conditions for sustainable commercial extraction. Following the definition of sustainable economic development by Barbier [16], and

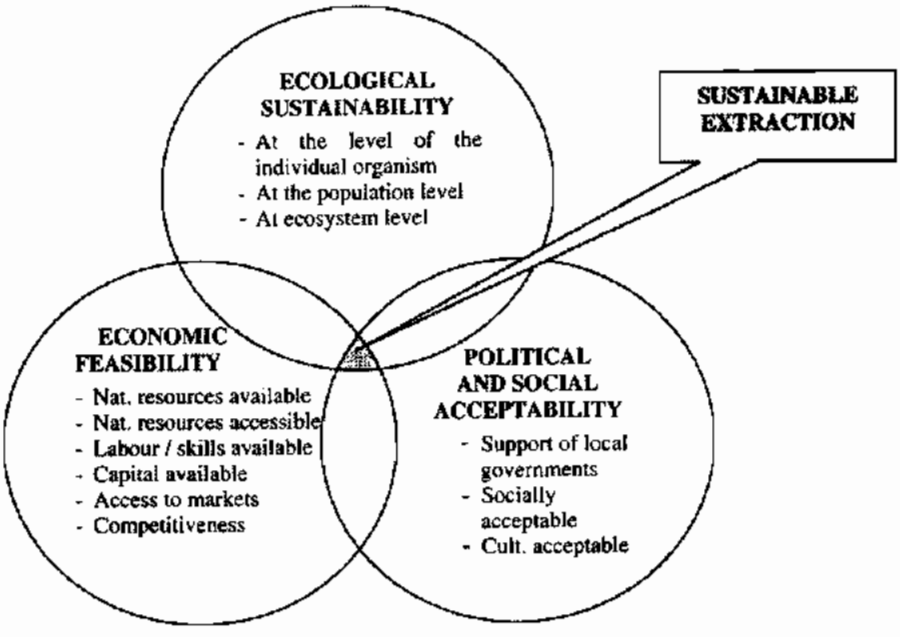

Figure 1. The main attributes of sustainable NTFP extraction [17].

his distinction between a biological, economic and social system, the study provided an overview of attributes of sustainable NTFP extraction, under the headings of ecological sustainability, economic feasibility and socio-political acceptability (Fig. 1).

Barbier's conceptualisation of sustainable economic development was taken as a starting point, because his definition of sustainable economic development included not only ecological, but also economic and social aspects, focussing on the satisfaction of the basic needs of the poor and the participation of social groups which are most affected by any change [16, p. 103]:

> 'The primary objective of sustainable economic development is reducing the absolute poverty of the world's poor through providing lasting and secure livelihoods that minimise resource depletion, environmental degradation, cultural disruption and social instability'.

This distinction between an ecological, economic and social system could also be applied to the extractive economy. Ecologically sustainable extraction can then be defined in terms of the continuous availability of the resource, with minimal disturbance to the ecosystem. This implies that ecological sustainability is evaluated at the level of the organism (plant or animal), the population and the ecosystem.

Extraction can be considered economically feasible if the cost-benefit balance is positive and income and returns compete favourably with other economic activities. This requires that production factors (natural resources, labour and capital) are available and accessible, and that there is a market for the products.

The social and political acceptability of NTFP extraction refers to the social and political context of forest exploitation. It implies that the extraction of NTFPs contributes to the welfare of rural and forest-dwelling people, that it does not lead to cultural disruption or social instability and that it is supported by local governments. It also includes aspects related to social justice and the cultural acceptability of NTFP extraction. Land and tree tenure are important factors in this respect, as well as other aspects of 'entitlements to natural resources' [18].

Ros-Tonen *et al.* considered the identification of conditions for sustainable and successful NTFP exploitation, which is an essential step towards the integration of NTFP use into forest land-use planning. The role of individual case studies, such as the one carried out in the Philippines, was seen as providing further insight into the factors determining (or obstructing) successful and sustainable NTFP exploitation.

THE ECOLOGICAL SUSTAINABILITY OF BUHO CUTTING

To assess the ecological sustainability of buho cutting, one should ideally be able to establish the critical harvesting level beyond which the reproduction of the buho population and the structure and functioning of the ecosystem will be irreversibly disturbed. Insight into the effects of extraction on the reproduction and, hence, the future availability of the resource, requires information on the regeneration and yield of the population [19]. Such a long-term study of the population dynamics of buho fell outside the scope of this study. It is also difficult, if not utopian [20], to carry out a study of the effects of buho extraction at the ecosystem level (i.e. its effect on biological diversity). The diversity of species in tropical rain forests is often extremely high and the interaction between them (e.g. pollination and seed dispersal) too complex to be completely known [20]. As an alternative, ecologists use various indicators, such as changes in tree regeneration, or they simplify and structure diversity by aggregating species into functional groups [20]. In this study, qualitative parameters were used to assess whether the availability of the buho resource was at stake. These included the ecological properties of the resource, the availability of buho, the quantities cut and the quality of the cutting. In addition, attention is given to the collectors' impression of the ecological sustainability of buho cutting.

Ecological properties of buho

Buho grows in the humid tropics in lowland and hill dipterocarp forest at medium altitudes up to 1500 metres. Buho rarely forms pure bamboo forest, but may become dominant in logged-over forest, as is the case with buho in the study area. Most of the buho seems to grow in the outer shell of logged-over forest. Cutters also indicated that buho grows better near creeks (deeper inside the residual forest, buho even grows solely along the creek sides) and that it does not grow in rocky areas. According to Dransfield and Widjala [21], buho grows best on well-drained sandy

loam or clay loam with a pH of 5.0–6.5, on forested hills, at average temperatures of between 28–32°C and an annual rainfall of around 1900 mm.

A buho plant consists of the underground system of rhizomes, the aerial culms, and the culm branches. All of these parts are formed through alternating series of nodes and internodes. Rhizomes are underground stems which grow away from the buho plant and enable new territory to be colonised. The rhizomes are often so tightly packed that the soil under a buho plant seems to be filled with them. The rhizomes are very shallow, however. Each year, poles arise from the rhizomes to form the aerial parts of the buho. The standing pole usually reaches a height of 10–15 metres, has a diameter of 4–8 cm and a wall thickness of about 5 mm. The internodes are 25–50 cm long. Branches occur only on the upper nodes [21].

Buho grows extremely fast. Young shoots emerge during the rainy season and develop to their full height in 4–6 months but, according to Dransfield and Widjala, they need a further 1–2 years to mature. Poles which are at least one year old can be cut without adversely affecting the viability of the whole buho plant. As long as young poles are left standing, mature poles can be harvested again from the same plant in one year. The respondents even claimed that the cutting of mature poles resulted in the sprouting of more young shoots. Dransfield and Widjala confirm this, writing that: 'Systematic and regular exploitation increases the production of the bamboo stock' [21, p. 14]. And: 'By regulating the harvest correctly, it is possible to increase yield. In addition, a regular cutting system might influence the flowering behaviour of a bamboo stand' [21, p. 41]. Varmah and Bahadur [22, p. 28] also write of the management of bamboo clumps in India that: 'Various techniques for selective felling can be applied to promote a higher productivity of clumps.'

In order to maintain the resource base, which renews itself on a yearly basis, it is essential not to cut immature poles. In other words, the sustainability of the cutting of buho is directly related to the actual cutting practices.

The quality of buho cutting and management

Buho poles are extracted during the dry period (January–April), when trails and roads are passable, the culms are easier to cut because of their low moisture content, and the poles cut are less vulnerable to insect attacks. This period also coincides with the harvesting of tobacco, when the demand for buho poles is highest.

Buho gatherers in the study area practise selective cutting. Only straight poles of at least one year old and with the desired diameter (depending on the end use) are cut. The harvesters recognise mature poles by the yellowish colour of stems and leaves and the white spots on the stem caused by fungi. But the absence of the bamboo shell which covers the nodes of younger poles, the absence of branches on the lower half of the stem and the sound produced when the pole is knocked are further indicators of maturity.

Once one or more good poles have been found, they are cut at half a metre above the ground with a large sharp machete, called *bolo*. The pole is felled by two opposing half-cuts and the branches are removed up to a height of approximately 5

metres from the base. After this, the top portion of the pole is cut off. In this way, the cutter will harvest 25 poles, which together form one *bundle* and is the number a buffalo (*carabao*) can pull down from the forest in a sled. Sometimes, a cutter leaves the cut poles in the forest for a few weeks to dry. Usually, however, a bundle is brought down to the village immediately.

The cutters are aware of the adverse impact that indiscriminate cutting can have on the regeneration of the buho plant, but this is not the reason why they cut selectively and leave the immature poles standing. Immature poles are simply not useful and the demand is only for mature poles. The fibres of young poles, which contain a lot of water, are soft and the cell wall is still thin, so the poles break very easily when the water evaporates (G. van Boven, personal communication 1999). In fact, young poles are generally useless within three weeks of cutting, since they burst during the drying process.

The practice of leaving the young poles standing implies that the common cutting practices in the study area are quite sustainable on their own. The fact that poles less than one year old are not suitable for use virtually eliminates the risk that pole harvesting will jeopardise the resource base. This is not to say that the natural stands need no management. Dransfield and Widjala [21] stress that maintenance of bamboo forests should not be overlooked. Their advice is to manage natural stands of any bamboo species on a yearly basis by encouraging the formation of healthy and vigorous clumps. They recommend cutting over-mature and other non-marketable culms (thinning) in order to preserve maximum vigour and productivity of the rhizomes and culms. Virtucio and Tomboc [23] also emphasise the importance of thinning to prevent congestion of clump-forming bamboos.

Cutters in the study area are not deliberately thinning the buho. In fact, none of the cutting respondents indicated that congestion was a problem. Curved poles are only sporadically removed from a clump. It is fair to say, however, that cutters do indeed practise some kind of clump management, since they will not remove young poles, even if that would make it easier to reach the mature poles. In addition, some farmers indicated that they remove the vegetation surrounding the clumps in order to protect them against fire. This, too, can be regarded as a management activity, but it has only been reported and observed on privately-owned lands and not in the public forest.

The availability of buho

Three methods were used to assess the availability of buho in the study area, i.e. participatory mapping, walking transects and stratified systematic sampling. As no detailed maps were available of the study area, informal maps based on observation and local knowledge were made both individually and collectively in small groups *cf.* [24, 25]. This method is considered to be very suitable for making rapid assessments of issues affecting natural resources [26]. The results of the mapping exercise are diagrammatically presented in Fig. 2. The figure shows that the most

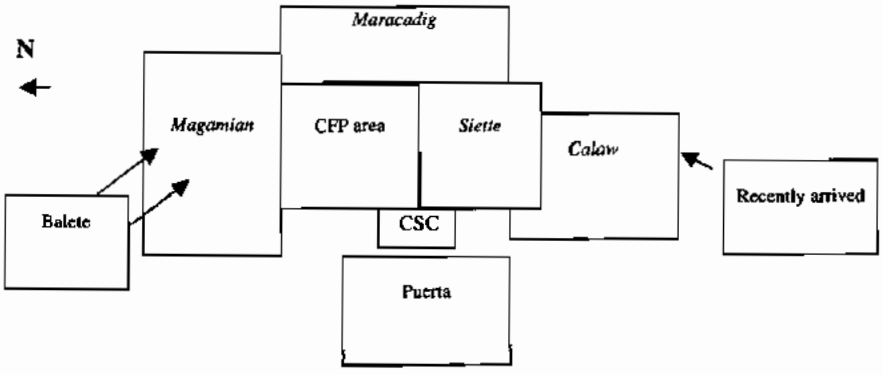

Figure 2. Diagrammatic representation of the buho extraction areas and human settlements. CFP = Community Forestry Project area — area designated for the enrichment of forest with commercial tree species; CSC = Certificates of Stewardship Contracts — land titles given to farmers under the Integrated Social Forestry Program. Arrows indicate the direction of agricultural expansion.

Table 1.
Number of gatherers from Puerta per extraction area ($n = 50$)

Extraction area	Commercial cutters	Subsistence gatherers	Total
Own land	4	5	9
Siette	16	7	23
Calaw	5	1	6
Magamian	7	1	8
Maracadig	3	1	4
Total	35	15	50

important extraction areas for buho were identified as Magamian, Maradig, Siette, and Calaw. According to the respondents, some of these names were given in the era that a logging company had a Timber Licensing Agreement in the area (1972–1990). Other names were given a long time ago by hunters and gatherers during their trips in the forest. *Calaw*, for example, is the local name for hornbills, which were seen in large numbers in the part of the forest that is now called Calaw.

Table 1, which gives the number of extractors per area, shows that most cutters from Puerta presently rely on Siette as the main extraction area. A partial explanation for this can be found in Fig. 2, which shows that the extraction areas northeast and southeast of Puerta are under pressure. The Magamian area faces encroachment by slash-and-burn farmers (*kaingineiros*) from the neighbouring village of Balete. As a result, the buho resources are decreasing and the frontier of buho extraction areas is moving eastwards. The shifting cultivators who recently arrived south of Puerta are approaching and will soon affect the Calaw extraction area.

The decision where to cut is also related to the gatherers' places of residence: cutters living in the northern part of Puerta predominantly gather buho in Magamian,

while cutters living near the trail leading to Calaw, naturally cut in Calaw. The place where cutters from the lowlands go — tobacco farmers who cut the buho themselves — is generally not the place which they can reach most easily by cart, but depends on the place of residence of their upland relatives or friends, where they stay overnight. Rumours about the places where the most and best quality of buho can be found also play a part.

During the mapping exercises, the participants claimed that buho gatherers in general do not penetrate further than 2 km into the forest, because the amount of buho decreases with distance into the forest. The amount of buho in natural stands seemed to be inversely related to the density of the canopy.

Information about the availability of buho was also obtained through walking transects, i.e. systematic walks, during which differences in land use and vegetation were explored. Besides some non-systematic transects (i.e. 'roaming around while looking around'), the stratified systematic sampling method (see [27]) was applied to a 1-km transect line which was selected on the basis of the participatory mapping exercise. Along this transect line, which was located in the centre of the Siette extraction area, buho was sampled in 10 by 10 metre plots at fixed intervals of 100 metres. The transect was chosen carefully in order to include possible zoning in the abundance and presence (or absence) of buho. Examples of such zoning could be found on the hill slope, where slope form, soil moisture and altitude give a distinct vegetation, and across gradients of human impact (e.g. cutting and burning). The transect line was therefore designed from west to east, proceeding uphill and, starting near the human settlement, going in the direction of less disturbed forest. Existing trails were avoided in laying out the transect line, as these would have resulted in heavily biased samples.

In the sample plots, the clumps and poles per clump were counted, distinguishing between harvestable and non-harvestable poles. The indicators used to identify harvestable poles were the absence of the bamboo shell, yellowish leaves, and white fungi spots. The poles should also be full-grown, i.e. not destroyed.

Because of the small size of the transect inventory its outcomes are far from exact, but they suffice for a global indication of the availability of buho. From the survey, we estimated that there are about 11 000 poles per hectare in the area of Siette, 60% of which is harvestable. The results correspond reasonably well with the findings of Dransfield and Widjala [21], who found an average of 9000 buho poles per hectare and numbers as high as 25 000 in dense natural stands.

The quantities cut

Fifty of the 53 households in Puerta engage in the gathering of buho. Fifteen of them cut buho for subsistence use only, while the others cut for the market as well. The average number of poles cut per household for subsistence use lies between 35 and 50 poles per year. An average of 425 poles per selling household are cut for commercial purposes. This means that the households of Puerta cut an estimated number of about 16 000 poles yearly for the market, while around 650 poles are

Table 2.
Number of poles cut yearly by gatherer households from Puerta per extraction area ($n = 50$)

	Siette		Own land		Other public forest		Total	
Purpose	sellers ($n = 16$)	non-sellers ($n = 7$)	sellers ($n = 4$)	non-sellers ($n = 5$)	sellers ($n = 15$)	non-sellers ($n = 3$)	sellers ($n = 35$)	non-sellers ($n = 15$)
For own use	640	309	200	247	600	107	1140	663
For sale	9350	—	1075	—	4450	—	14875	—
Total	9990	309	1285	247	5050	107	16315	663

cut for subsistence use (Table 2). Only 9% of the poles are cut on privately-owned land, while the rest comes from natural forest. Two-thirds of the poles from natural stands are extracted in Siette and one-third from the other areas indicated in Fig. 2.

The average numbers of commercial poles per household — 584 for Siette as against 269 and 297, respectively, for households cutting on their own land and in other public forest areas — also reveal the relative importance of Siette as an extraction area.

Besides the local households, gatherers from the lowland also exploit the extraction areas near Puerta. Their number and the quantities involved are hard to estimate. People from Puerta, as well as tobacco-growing farmers from the lowland, estimate the number of outside cutters at 50–150 persons. These outsiders cut mainly for their own use as tobacco farmers.

The number of lowland farmers cutting buho in the forest seems to have decreased since the 1980s, as a result of the moving up of the extraction frontier and the consequently increasing distances from the lowland to natural stands of buho. But the declining importance of logging also plays a role here. When the logging company was still active in the area, it maintained the roads and trails. These were therefore of better quality in the 1980s, which made it easier to reach the extraction areas. Moreover, fewer inhabitants of Puerta were engaged in the sale of buho when logging provided an income, and more tobacco farmers needed to collect the poles themselves. In addition, some respondents claimed that there are simply fewer tobacco farmers since the introduction of hybrid yellow corn in the 1990s. According to them, a lot of non-tenants also cultivated tobacco before the booming of hybrid corn cultivation, while now only tenants cultivate tobacco — whether under obligation or otherwise.

The extractors' impressions of ecological sustainability

As indicated under the ecological properties of buho, the cutting of poles enhances the sprouting of other culms. The gatherers' impression confirms this: they all emphasised strongly that the present cutting practice results in more vigorous growth and will not lead to the depletion of the resource, as long as immature poles are left standing and no clear-cutting (removal of the whole clump) is practised.

The gatherers are, however, concerned about the future availability of the buho. They noticed that the availability of buho had decreased in the past five years as a result of fires and shifting cultivation. They blamed the slash-and-burn practices of the farmers from Balete as the cause of the diminishing resource base.

Besides the expansion of agricultural lands by the Balete farmers, the accidental spread of fires was mentioned as a threat to the buho stock. This refers not only to the fires started by the shifting cultivators to clean their fields, but also to those started by permanent farmers from Puerta (who use fire to clean their fields from grasses) and pasture land owners (who use fire to make space for young grass shoots). Sometimes, these fires get out of control. The accidental spread of fires does not kill the rhizomes, but affects the short-term availability of buho. Accidentally burnt areas of residual forest do, however, facilitate the opening up of those areas and therefore attract new migrants who like to settle there.

THE ECONOMIC FEASIBILITY OF BUHO UTILISATION

For commercial extraction to be economically feasible, production factors (natural resources, labour and capital) need to be available and accessible, markets need to be accessible and the returns must be competitive with those generated by other economic activities (Fig. 1). The very existence of commercial buho extraction proves that it is currently economically feasible, at least as an ancillary activity. By showing *why*, we aim to make clear that the long-term feasibility might be jeopardised under changing conditions, such as depleting resources, collapsing markets, or a shift in the relative profitability of economic activities.

Availability of production factors

As we have seen above, natural stands of buho are still sufficiently available. They are a *de facto* open access resource. Physical access used to be better before the extraction areas were affected by shifting cultivators who pushed the forest margin farther away from the community. However, access to the resource base is not yet a hindrance to exploitation.

Labour and skills are also sufficiently available, especially since logging is becoming a less viable option because of dwindling timber stocks. Labour availability is best when there is not much work to do in the fields. Farming usually has the priority, so farmers gather buho only when labour demand in agriculture is low. Cutting buho is a seasonal activity and takes place only in the dry season.

Commercial buho cutting requires little investment. A *machete* suffices for the cutting itself, and a buffalo and sled are needed for transport from the forest to Puerta. Should a cutter wish to bring the buho from Puerta to the lowlands — instead of letting buyers come to Puerta — he will need a cart, which is a wagon pulled by a buffalo that can carry up to 100 poles. Both the sled and the cart are often made by the cutter himself (except for the axle of the cart).

It was mainly the possession of a buffalo or strong cow that appeared to be the deciding factor for a cutter to participate in the market. All market-oriented buho gatherers possess a strong cow or buffalo. Of the fifteen gatherers who did not cut buho for the market, five did not so for lack of a cow or buffalo and four because their animal was too weak to be used for transport.

Some cutters occasionally hire a truck in cooperation with one or two others in order to transport loads of 500 to 1000 poles from Puerta to the lowland villages. Hiring a truck costs 2 pesos per transported pole, so the costs for a truck range between 1000 and 2000 pesos, and are equally split among the participating cutters. The daily returns of these gatherers depend on the number of man-days that is spent on transport and transaction, but they are generally higher than the daily returns for gatherers who let buyers come to Puerta or bring the buho by cart to the lowland villages. However, not everyone is able to hire a truck; those who do not know the truck driver personally may be obliged to pay for the truck in advance, which requires cash that most gatherers do not have.

Market access and trade structure

Most of the buho cut by inhabitants of Puerta is sold to tobacco-growing tenants in the lowlands who need raw buho poles for drying tobacco leaves. The cultivation of tobacco is concentrated in three lowland villages located about 15–20 kilometres from Puerta. Most buho transactions take place directly between cutters and end users, who are often relatives or acquaintances. Sometimes a middleman is involved, who buys buho from several gatherers and may arrange a truck to transport the load to the lowlands. However, a truck can only reach the upland community during the dry season (only a few months per year); for the rest of the year the community is not accessible by any motorised vehicle.

When middlemen are engaged in the trade of non-timber forest products, this may adversely affect the net returns to individual gatherers. In the extractive economy, exploitative commercialisation systems, in which intermediaries take most of the benefits, tend to prevail [13]. This is not the case, however, in the buho trade in the study area. The fact that markets are relatively nearby and accessible enables the gatherers to transport the buho themselves, which gives them a good bargaining position when dealing with middlemen. Moreover, middlemen are usually operating within existing kinship and acquaintance relationships, which may prevent them from 'bleeding' their suppliers. Such lines of kinship and acquaintance exist abundantly between Puerta and the tobacco-producing lowland villages. Many former tobacco-growing tenants in the lowlands migrated to the uplands in the hope of escaping dependency and debt. About 40% of the household heads in the study community originate from one of the three tobacco-producing lowland villages.

Competitive returns

Although no value is added through processing of the raw material, the selling of unprocessed buho does contribute significantly to the household incomes in the study community. During the interviews with 53 household heads, 49 of them were able to estimate the number of pesos earned yearly from different income-generating activities. Figure 3 shows the relative importance of different activities contributing to the household incomes. The figure shows that the lion's share (58%) of the farmers' income comes from the cultivation of hybrid corn for the market, but that the selling of buho, with a contribution of 13% to the total incomes, is the most important ancillary activity. Moreover, it became clear that the average annual income of the households who do not sell buho (9689 pesos or US$ 249, $n = 14$) is considerably lower than that of the households who do regularly sell buho (12 747 pesos or US$ 327, $n = 35$).

Figure 3 shows that buho-selling households owe their higher income mainly to the exploitation of buho, although they earn more from the selling of bananas and logging as well. These three activities all require a draught animal to transport the products to the market, and this is precisely the way in which these households differ from the others. The selling of corn does not require a draught animal, as the buyers usually pick up the corn in the village.

Buho gathering in relation to small-scale logging and upland farming

Corporate large-scale logging in the study area stopped in the early 1990s, but small-scale logging has continued to play an important economic role in Puerta since then. Men from the village engaging in these small-scale logging activities are usually hired to haul logs with a draught animal from the forest to a logging truck or to the place where the logs are sold. The accessible timber resources have now been depleted to such an extent that timber extraction and the economic importance of hauling activities for the community are diminishing as well.

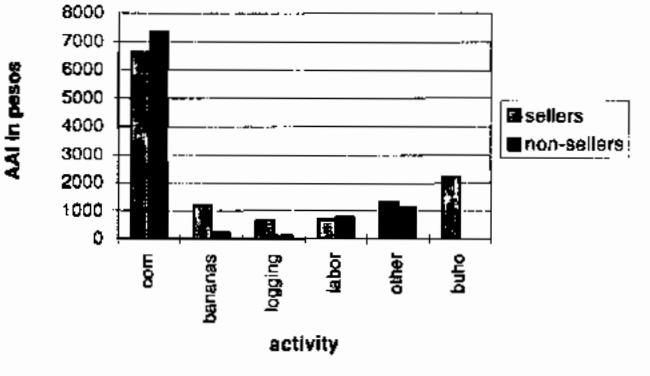

Figure 3. Average Annual Income (AAI) in pesos per activity for sellers ($n = 35$) and non-sellers ($n = 14$) of buho.

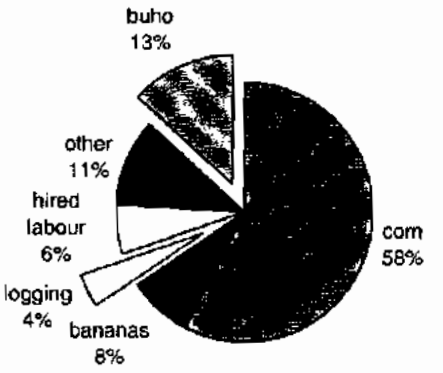

Figure 4. The composition of incomes in the study community ($n = 49$).

It was found that the incomes earned from the sale of buho were higher than those earned from hauling timber, both as a total (Fig. 4) and in terms of daily returns. A hauler earns between 175 and 225 pesos per day, which is comparable with the daily earnings of a buho cutter who brings his product to tobacco-producing villages by buffalo cart. Buho gatherers who sell in Puerta or the nearby village of Masapí East earn between 240 and 265 pesos per day. Those who arrange a truck to transport their buho to the lowland villages earn between 265 and 365 pesos per day.

These findings are remarkable, since earlier studies suggested that small-scale logging provides the most important off-farm activity for forest migrants and that the net returns from these activities are much higher than those from non-timber forest product extraction (e.g. [11, 28–30]). With the dwindling stocks near the village, it has become harder and more time-consuming to find good trees and, consequently, small-scale logging activities have become less profitable. The profitability of selling buho now exceeds the profitability of hauling, and this has resulted in the growing importance of buho gathering and the declining importance of hauling and small-scale logging.

Agriculture is the main activity for migrants settling at the forest frontier. In the past ten years, land use in the study area has changed quite dramatically from subsistence-oriented shifting cultivation to more sedentary and cash-oriented *bangkag* cultivation. *Bangkag* lands are permanent fields planted with hybrid corn, where ploughs are used and often fertilisers and agrochemicals are applied. Approximately 90% of the farmers in Puerta cultivate *bangkag* lands.

There are two main factors that have made this shift possible:

- The increased number of households possessing a draught animal, which is required to plough the fields. Most households acquired the money for a draught animal not only by incorporating cash crops into their farming systems, but also by assisting with corporate logging activities in the 1980s, for which it was not necessary to have a draught animal.
- The fact that Puerta is reasonably accessible by truck in the dry season enabled the corn farmers to sell their product. Furthermore, accessibility during the dry

season gave the corn buyers the security they needed to make loans to corn farmers for the inputs (mainly fertilisers and agrochemicals).

The selling of buho did not play a role in creating the conditions for sedentary farming, as the conditions for both activities — possession of a draught animal and accessible markets — are largely the same. The money for purchasing a draught animal (which is a necessary investment for *bangkag* farming) cannot be earned from selling of buho, since the selling of buho itself demands a draught animal.

THE SOCIAL AND CULTURAL ACCEPTABILITY OF BUHO EXTRACTION

The third aspect of sustainable buho extraction is the social and political context. It covers local government support, social justice aspects, and the cultural acceptability of commercial extraction. Formal regulations for resource use form an important aspect.

Government support and regulations

To be legally allowed to cut and sell buho an official licence in the form of an Ordinary Minor Forest Products Permit is needed, granted by the Department of Environment and Natural Resources (DENR). The permit requires the payment of an application fee and of forest charges (Section-68 of Presidential Decree 705, execution order 255). The DENR grants such a permit for buho cutting only to individuals or associations who participate in public bidding for a concession area. Since there is no licence holder in the study area, all cutting activities are prohibited *de jure*, but *de facto* there is a situation of open access for cutting buho in most of the residual forest. There are few restrictions on small-scale transport and trading of buho cut in the public forest and they are tolerated by the DENR. However, the transport of illegally cut buho by truck does not seem to be tolerated and faces the risk of confiscation. Transport by truck therefore usually takes place at night in an atmosphere of uncertainty and secrecy.

Social and cultural acceptability

Attitudes towards and perceptions of the importance and future possibilities of extraction activities are relevant, since they may influence the investment behaviour of gatherers. The gatherers interviewed perceived limited potential for the future, even though buho selling is currently their most important source of income after the selling of corn. There are two important factors influencing this perception. Firstly, the cutting and selling of buho is officially illegal, which makes these activities uncertain. Secondly, most gatherers expect the resource base to diminish further in the future as a result of agricultural expansion by new migrants. Since it is an open access resource, the residual forest is equally accessible to shifting cultivators and buho cutters, so that the resource is under considerable pressure.

In relation to this perception, there is very little organisation amongst gatherers from the community, but when they were asked, many of them liked the idea of more cooperation. They felt that an organised group of cutters, together supplying a large amount of buho, might attract big buyers and improve the competitiveness with other buho suppliers. They further reasoned that an organised group of gatherers (e.g. a cooperative) could apply for a permit, which would legalise the activities and facilitate trade in larger quantities. Legal buho exploitation may be more attractive to big buyers, who now run the risk of confiscation when they buy large amounts of illegal buho. Another advantage of organisation in the form of a cooperative would be that it might enjoy several tax privileges.

CONCLUSIONS

Despite the lack of possibilities for adding value, the lack of organisation and the illegality of extraction, buho gathering in Puerta proved to be economically feasible as an ancillary activity. Moreover, the present situation in which timber resources near the village have been depleted has enabled buho gathering to become economically competitive with small-scale logging. Unlike timber extraction, however, which requires a long rotation period to be ecologically sustainable, the collection of buho can be sustained in the same area for a long time as long as immature poles are not cut. As a sustainable form of forest use it can thus play a role in forest conservation in situations where there is little external pressure on the forest.

Buho extraction cannot, however, be regarded as a strategy for rain forest conservation. This study has made it clear that the potential of such a strategy cannot be evaluated on the basis of the features of the extractive economy alone. The analytical framework used for evaluation proved to be highly useful for examining the various aspects of sustainable extraction (ecological sustainability, economic feasibility and social, political and cultural acceptability). But the prospects of such a strategy in the long term cannot be assessed without taking account of other activities that form a part of peoples' livelihood strategies and of the contextual factors affecting them. As in most cases where the exploitation of non-timber forest products contributes to peoples' incomes (*cf.* [17]), buho exploitation is not the farmers' main source of income. It is a seasonal activity, which is combined with the cultivation of hybrid corn and other cash crops and participation in small-scale logging. As such, it is not a viable alternative to agricultural expansion or the migration of farmers to the forest frontier, which are the main causes of deforestation and the depletion of buho resources in the study area. This emphasises the need for an integrated approach to local forest use, which focuses not only on non-timber forest product extraction, but also takes other economic activities and contextual factors into account.

Where, forest resources are not under pressure, there may be opportunities to improve peoples' livelihoods with the help of buho extraction. Obviously, the

protection of extraction areas is an important condition for the success of such a strategy. The organisation of individual gatherers into a cooperative could be an important step in this direction. In addition to the advantages of cooperatives referred to above — legal extraction and transport, a better market position and tax privileges — the organisation of cutters could pave the way to demarcated and protected extraction areas. A formal status as an extraction area, combined with the presence of an organised group of local people who have a direct and immediate interest in the conservation of the buho stock, may be an important condition for effective protection. In order to stimulate local bamboo production in the long term and reduce the pressure on natural forest, it is recommended that a study be made of the feasibility of planting bamboo in home gardens or small-scale bamboo plantations. Local gatherers do not see the need to plant buho, which still grows abundantly in the forest, but might be interested in planting more valuable species such as *bayog* or *kayayan-tinik*, as some households already do. These species grow as quickly as buho and are used in furniture making. The possibilities of growing these species in small-scale plantations and the marketing opportunities for plantation-grown bamboo would be an interesting area for further research.

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Historical column

In this Journal I would like to have also a historical column. Even though the history of written articles on bamboo and rattan is still very young, we are already confronted with many articles which are about to be forgotten. I think this is a pity. Personally, I started in 1974 to visit many libraries looking for articles from long forgotten journals. Trying to select one of these articles for this first issue turned out to be very difficult. How to make a choice which would suit every reader? Therefore, all of you, esteemed readers, are invited to make your selection from the next list. This list covers all articles from 1903 till 1939 which are present in my files. For each item the bibliographical data are followed by personal comments.

1903, Spörry, H., Die Verwendung des Bambus in Japan und Katalog der Spörry'schen Bambus-Sammlung. (In German, The utilisation of bamboo in Japan and a catalogue of Spörry's collection of bamboo objects.) Deals with topics like bending, tools, housing, waterpipes, Japan.

I found this booklet in the library of Kew Museum in London around 1976. In fact we will have to make an abstract because the original comprises 200 pages. In my files I have only copies of some pages. I remember I checked if I could visit that collection but in a note from a few years after 1903 I read that the collection was already full with beetles and the like!

1909, Loeber, J. A., Bamboe in Nederlandsch Indie. (In Dutch, Bamboo in the Dutch Indies.) *Bulletin Koloniaal Museum Haarlem*, over 100 pages. Covers items like bridges, housing, handicraft, musical instruments, sayings, woven bamboo, beautiful reproductions, medicine, Indonesia.

I like this booklet very much. I keep it at home and not in my office at the university! It contains beautiful photographs of bamboo carvings from different parts of Indonesia.

1923, Meyer, H. F., and Ekelund, B., Tests on the mechanical properties of bamboo. *Proceedings of the Engineering Society of China*, paper 7, pp. 141–169. Covers mechanical properties, bending, shear, E-modulus, tension, compression,

reinforcement, bamboocrete, trusses, masts for boats, friction, thermal expansion, China.

Really a surprise! They did series of tests, and they report with many tables. The presentation is followed by a discussion with the participants. They developed the right way to perform a compression test on bamboo, as now appears in the draft ISO standard. Their way to do this test remained hidden until Dr. Arce revealed it in 1993.

1925, Teodoro, A. L., A preliminary study of the transverse strength of structural bamboo. *Agricultural Engineering* **6** (11), pp. 266–267. Covers bending, E-modulus, moisture content, test method, bambusa spinosa, bambusa vulgaris.

Short article, much information.

1925, Galloway, B. T., Bamboos: their culture and uses in the United States. Bulletin US Department of Agriculture, no. 1329, pp. 22–24. Covers general information, and splitting, USA.

1930, Trojani, F., Passerelles en bambous. (In French, Bamboo footbridges.) Bull. econ. Indo Chine, April 1930, pp. 369–373. Bridges, bending, compression.

I still remember how I felt when I came across this article in the library of Kew Museum in London, maybe in 1975 or so. They made good designs for bamboo footbridges, and even developed a graphical calculation method!

1930, Takenouchi, Y., Systematisch-vergleichende Morphologie und Anatomie der Vegetationsorgane der japanischen Bambus-Arten. (In German, A systematic comparison of the morphology and anatomy of the vegetative parts of Japanese bamboos.) 60 pages. Deals with anatomical structure, vessels, microscopy, and has many beautiful drawings. The bibliographical data are less clear; it originates from the Memoirs of the Faculty of Science and Agriculture of the Taihoku Inperial university.

Imagine: such an old Japanese publication, and in German!

1930, Espinosa, J. C., Bending and compressive strengths of the common Philippine bamboo. *Philippine Journal of Science* **41**, pp. 121–135. Compression, bending, strength, test method, dimensions, allowable stresses, Philippines, bambusa spinosa.

1933, Schlotmann, A., Untersuchungen uber die Struktur pflanziger Haare und Fasern. (In German, Research into the structure of hairs and fibres from plants.) *Planta* **19**, pp. 313–334.

1934, Arber, A., The gramineae: a study of cereal, bamboo and grass. Chapter 6 on pp. 95–107 deals with 'Bamboo: reproductive phase'. Cambridge University Press.

1937, Hommel, China at work. A marvellous series of books about all aspects of China. Much information about bamboo and bamboo products (bending by heat p. 70, bending pp. 307–3088, shaving pp. 222–224, furniture pp. 303–308, roofs p. 258, nails. pp. 23 and 70).

1937, Timber joints, only half a page in the Indian forester, December 1937. pp. 864, about bamboo joints for timber structures!

1937, Kumpe, G., An experimental bamboo truss. *Military Engineer* **8**, pp. 288–289. Two pages only but useful information on bamboo bridges and trusses in the Philippines.

1938, Herzog, A., Zur Microscopie der Bambusfaser. (In German, About the microscopy of bamboo fibres.) *Wochenblatt fuer Papierfabrikation* **49**, pp. 1025–1031. Subjects: cellulose, cell, microscopy, dimensions, fibres.

I am a layman in this field but I was surprised at these results so many years ago!

1938, Meeuse, A. D. J., Development and growth of the sclerenchyma fibers and some remarks on the development of the tracheids in some monocotyledons. *Receuil. Trav. Bot. Neerlandais* **35**, pp. 288–321, Subjects: fibres, cell, lignin, anatomical structure.

1938, McClure, F. A., Some preliminary tests on the longitudinal crushing strength of Hua-Mei-Chu, a variety of Bambusa tuldoides, *Lingnan Science Journal* **17** (1), 8 April, 1938. I do not have the original but a summary of three pages, made by the Library of B.R.S in the UK. Subjects: compression and dimensions of bambusa tuldoides.

1939, Shimada, A chemical study of the bamboo used in concrete. *Inst. Japanese Archit. Trans.* **13**, pp. 17–25 (in Japanese).

Unfortunately my Japanese is not good enough to read this, but the drawings and tables make me anxious to learn what knowledge remains hidden from me.

So, for the present, please inform me as to your opinion: is this historical column a good idea, or do you recommend me to throw away all this old stuff? And I repeat the question: which item do you like most for publication in this Journal? Please send me your comments about the previous text; please write to me at j.j.a.janssen@bwk.tue.nl

If my webmaster tells me my mailbox is over its limit due to your reactions I will be extremely happy.

JULES JANSSEN

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Foreword

Dear Reader

When I received the first issue of this Journal, I felt extremely glad, not to say proud about the result of our common effort. We discussed the need for such a scientific journal already for many years, and all of us were convinced it would be a boost for bamboo and rattan. Flipping over the pages from the first issue I felt convinced we are fulfilling what we promised ourselves. This feeling has been confirmed by several e-mails from all over the world. These messages were full with texts like: congratulations, great pleasure, it looks really good, and more of these encouraging words.

The front cover of the first and this second issue gives cause for some reflection. The photo on the cover of the first issue shows a path in between bamboo clumps, leading towards an open field at the end. This might be considered as a symbol: to which future will this Journal guide us? The photo on this cover shows participants on excursion in a bamboo plantation, which can give us similar thoughts. With regard to the future of this Journal, I took some time to reflect on the possible future developments. It came into my mind that the next generation will look back to our effort with some compassion. They will say something like: "Goodness, in those days they did not know anything about bamboo and rattan. They thought they could do with one journal only, covering all aspects, and they called that scientific!" And I think they will be right: our journal covers everything. In the first issue we see articles about plantations, growth, nitrogen fixation, transport to market, root distribution, house construction, soil suitability, and NTFP. It looks indeed like the books by Jules Verne: in those days there was only one type of engineer who knew everything. Imagine how many types of engineers we have now, and how many different journals about wood and timber! I am sure with bamboo and rattan we will go the same way. But this will only encourage us to give our best for this journal.

On the background of the cover of the first issue you will see woven bamboo baskets, representing the value of bamboo and rattan for income generation and job creation in many tropical countries. This brings me to a personal note. In November 2001, we had a new kitchen installed in our house, and imagine: it is made of bamboo boards! It looks great and my wife and myself feel very content with it. All the doors are made of split bamboo, crosslayered and glued to boards. Please permit me one little joke; when we went to the showroom we had agreed we