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Measuring forest and wild product contributions to household welfare: testing a scalable household survey instrument in Indonesia

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*Abstract

Abstract

Systematic comparisons of human dependence on forests and environmental resources have been challenging, as a result of heterogeneous methodologies. Specialized Forestry Modules have been developed, with the goal of filling current information gaps concerning the economic importance of forest and wild products in household welfare and rural livelihoods. Results from a pilot assessment of the Forestry Modules in West Kalimantan, Indonesia, are presented, showing that the Forestry Modules perform well in extracting the expected information : mean per capita forest and wild product income shifts according to the geographical "forest gradient". Significantly, in the forest-rich upstream village, mean forest and wild product income and mean forest-related wage and business incomes exceeds current mean agricultural income statistics for West Kalimantan and mean non-agricultural rural household incomes in the lowest bracket. Consumption of forest products and importance as a coping strategy was higher in the most upstream village, where sale of forest products in times of shock was more marked in the most downstream village (where forest coping strategies were also least important). The Forestry Modules' detailed and systematic approach can help ensure that contributions of forest and wild products are not underestimated in national figures.

Keywords

socioeconomic survey; methodology; forest-based livelihoods; household income; West Kalimantan;

Highlights

1. Forestry Modules fill information gap on economic role of forest and wild products
2. Mean forest and wild product income reflects forest proximity across villages
3. Forest-based coping found to be more important in forest-rich villages
4. current surveys may undervalue forest & wild products in household livelihoods.

1. Introduction

Forests usually play important provisioning and supporting roles in the livelihoods of rural households (Byron and Arnold, 1999; Sunderlin et al., 2005). Some figures estimate that as much as 90% of those who live in extreme rural poverty are to some degree reliant on forests for their livelihoods (Chao, 2012). Beginning with seminal studies nearly two decades ago (e.g. Cavendish, 2000), a growing body of case-studies from a range of contexts showed that products and services from non-cultivated ecosystems (such as natural forests, woodlands, wetlands, lakes, rivers and grasslands) can be significant sources of income for rural households, providing energy, food, construction materials and medicines, both for subsistence and cash uses (e.g. Bakkegaard et al., 2016a, Fisher, 2004; McSweeney, 2004, Mamo et al., 2007; Appiah et al., 2009; Rayamajhi et al., 2012).

However, systematic comparisons of human dependence on forests and other environmental resources have been challenging, as research to date has been comprised primarily of case studies using heterogeneous methodologies. In the 2005 World Development Special Issue on 'Livelihoods, Forests and Conservation', one of the main conclusions was that more worldwide studies, or synthesis of case studies, were needed in future research (Sunderlin, 2005). This call led to a global meta-study by Vedeld et al. (2007), synthesizing 54 case studies with an estimated average forest income contribution of 22%. The Center for International Forestry Research (CIFOR) initiated the Poverty and Environment Network (PEN), a pan-tropical comparative study with cases in 24 countries, where household (including forest-related) income was scrutinized using best-practice standardized methods, such as quarterly household surveys (www1.cifor.org/pen). PEN results showed an average contribution of 27.5% forest and environmental income to households living in or near forests; a figure that was only marginally lower than that of crop income (Angelsen et al. 2014). Other studies found that even people living in areas of lower tree densities may still rely substantially on the extraction of surrounding wild resources (Shepherd, 2012).

Given these indications of the importance of forests to the well-being of rural populations in many contexts around the world, there is a strong case to routinely include an adequate set of questions regarding households' reliance on forest and wild products in household welfare surveys that are used for policy development and evaluation. However, at present there is a systematic failure by the world's

key household-level socioeconomic surveys to capture the full contribution of forest and environmental income in rural livelihoods (GTZ, 2004; FAO, 2008; World Bank, 2008).

A set of standard methodologies that consistently measure the welfare contribution of forests and the environment to household income and poverty alleviation could eventually ensure that forests and other environmental products are more reliably captured in local livelihood metrics, regional poverty measures, and national gross domestic product (GDP). Nevertheless, several measurement and data collection challenges are associated with this goal. For instance, forest product extraction may be illegal, so that respondents may be uncomfortable reporting it in a household survey. Forests may provide essential subsistence-oriented products, but lacking a market price makes it difficult to value accurately (PROFOR, 2008; Wunder et al., 2011). Furthermore, extraction of many forest products is markedly more seasonal and sometimes related to specific events, such as household shocks, than average household income, for both forest supply and demand reasons (Byron and Arnold, 1999).

Despite these challenges, work towards a standardized data-collection process for the contribution of forests to household welfare has been progressing in recent years (Angelsen et al., 2011). Yet, developing nationally representative data on the role of forest and wild products in the household economy requires a more systematic approach across forest types and ecoregions that considers how to deal with background factors determining the levels of resource use (e.g. population density, ethnicity, forest cover, or proximity to roads).

In response to this challenge, FAO along with CIFOR, IFRI (International Forestry Resources and Institutions), PROFOR (Program for Forests, World Bank), and the LSMS-ISA team of the World Bank (Living Standards Measurement Study – Integrated Surveys on Agriculture) have joined forces to develop specialized modules on forest and wild products (hereafter referred to as Forestry Modules), with the goal of filling current information gaps concerning the economic importance of forest and wild products. The work involved two phases. In phase one, three reports were produced: (1) a review of the coverage of forest-related socioeconomic issues in selected surveys (Russo, 2014); (2) a micro-data analysis of selected socioeconomic surveys (Riggott, 2014); and (3), an analysis of CIFOR's Poverty Environment Network (PEN) survey (Bakkegaard, 2013). Phase two included: (1) the development of standard and expanded survey modules on forest and wild products; (2) field testing of modules in three different country contexts (including testing of a tablet version); and (3) producing a sourcebook to guide potential users (http://foris.fao.org/preview/90390/en/). The primary goal is for national

statistical offices to integrate this module into national-level household socioeconomic surveys, thus providing more complete information on national income, welfare, and livelihoods.

The Forestry Modules include household-level and community-level instruments to collect data on the welfare contribution of forest and wild products (and forest services) to rural households. They cover 13 different themes including aspects such as direct income, wage-related income, business-related income, health, construction and energy contributions, among other themes, as well as qualitative data on governance of forests and its resources, and their importance in crisis or coping responses. In the modules, forests are defined according to the FAO (2006, p. 169) definition as:

> *Land spanning more than 0.5 hectares with trees higher than 5 meters and a canopy cover of more than 10 percent, or trees able to reach these thresholds in situ. It does not include land that is predominantly under agricultural or urban land use.*

This definition encompasses old-growth natural forest, secondary and regenerating natural forest, and managed plantations. Forest products are therefore products originating from forests as defined above, and include timber and a wide range of non-timber forest products (NTFPs), including tree-based products (e.g. fruits and nuts), plants (e.g. tubers), and animals (e.g. bush-meat), and including other wood products derived from e.g. trees on farms. Wild products refer to products originating from "non-forest" and "wild" systems (e.g. other wooded lands, savannahs, *miombo*, fallows, scrub-, grass- and rangelands). Encompassing non-forest wild products is important, as their combined harvest in some environments can exceed the value derived from forests (e.g. Pouliot and Treue, 2013). Excluded from the module are products grown in agricultural lands (cropland, pastures, agroforestry, silvipasture, fallow areas) and cultivated and captured resources from aquatic environments, which are already covered in the LSMS under the Agricultural (World Bank, 2015a) and Fisheries Modules (World Bank, 2015b), respectively.

The objective of this paper is to present the results from a pilot assessment of the Forestry Modules in Indonesia, and scrutinize their effectiveness in capturing key socioeconomic data related to forest and wild products. We do this by first presenting an existing official tool that measures socio-economic data in forest areas, namely the Indonesian Forestry Survey, and then we turn to a description of the pilot site, the Forestry Modules and the main results of the assessment of the survey tool. We present the results of forest and wild product income across the village sites, which we predicted would reflect the gradient in forest cover and forest types, if the Forestry Modules were effective in collecting the data

they were designed for. From the most important sections of the Forestry Module (in welfare terms), the “Income” and "Shocks and Crises" modules, we present some in-depth substance findings from the pilot test. We then conclude with insights into further areas for methodological development, as well as on the contribution of forest-related data to national-level planning processes.

2. Pre-existing Indonesian sources of forest-related socioeconomic data

There are several pre-existing Indonesian data instruments that aim to collect socioeconomic data on households. A few years apart, different national household surveys have been carried out across Indonesia, including national socioeconomic household surveys since 1976, the Family Life Surveys since 1993, and agricultural censuses every decade starting in 1963. Following the 2003 Agricultural Census, several sub-surveys were developed and carried out in 2004, including the Indonesian Forestry Survey[1], which collected data on households living within, or on the fringes of forest areas. The Indonesian Forestry Survey was Indonesia’s first attempt at gathering comprehensive data on households’ use of different types of non-private forests, including conservation areas and protected forest areas, according to reviews of national socioeconomic surveys back to 1990 (www.rand.org/labor/bps/susenas). At least as far back as 1990, the national socioeconomic surveys collected data on products gathered in the forest, but were limited to rough estimates of yearly collection, consumption, and sales based on retrospective questions. The Forestry Survey was repeated in 2014, following the 2013 Agricultural Census. According to Statistics Indonesia (2014), the primary aim of the Indonesian Forestry Survey was to collect data on shifting cultivation, harvesting of forest products, and the socioeconomic condition of the households residing within, or in close proximity to, forests, primarily to allow the government to establish effective plans and policies to develop communities within or near forests. The survey components record a yes/no participation in, or occurrence of, an activity in a checklist form, rather than documenting the actual value or quantity.

Given the intended aim of the Indonesian Forestry Survey, the results highlight some of the difficulties in obtaining quality data on forest income. Though the survey includes questions regarding different types of product quantities extracted from forest areas, the lack of price or value data impedes the accounting

[1] https://sirusa.bps.go.id/webadmin/kuesioner/2014_3352_ques_ST2013-SKH.S.pdf. A guidance for agricultural and forestry survey has also been developed https://sirusa.bps.go.id/webadmin/pedoman/2014_3352_ped_Pedoman%20Pencacah%20ST2013-SKH.PCS.pdf

of (gross) income from forest and wild products collected by the households, thereby contributing to underestimation of this income source to total household incomes. The section on forest products collects data on groups of products, the quantity collected, and the proportion consumed, sold or other (e.g. given, lost or not yet consumed) over the past year. This is followed by a 'top-down' approach of asking the household to determine the percentage of the total household income that is derived from collection of forest products and capture of wild animals during the last year. This approach can lead to issues of imprecision, as the concept of percentages can be elusive and difficult to comprehend by some respondents as opposed to 'bottom-up' approaches of deriving income proportions from various, disaggregated sources (e.g. CIFOR, 2008). Furthermore, the survey also collects data on ownership of household assets with a limit of 10 household items, including a chainsaw, but their value or quantity is not recorded. This both limits the use of the data to assess the capacity of the households to exploit the forest resources, and also impedes any kind of meaningful wealth ranking based on asset holdings (which is needed for many common forest-livelihood analyses, e.g. see Nielsen et al., 2012).

The Indonesian Forestry Survey also contains other interesting data, such as on people's knowledge of and involvement in activities in the forest area, awareness of forest boundaries, existence of permits for forest product extraction, as well as perceived causes of any detrimental changes in the forest condition. Whilst such data is useful to understand how people are involved with the forest areas around them, it would be more useful if it was complemented with quantitative approaches to how households are actually relying on their forests (in terms of contributions to current consumption), the degree of reliance on forest and wild products as a safety net (in case of shocks and crises), and patterns of reliance when households use forest products for gap-filling during seasonal shortfalls. Having such information would provide holistic data on the nature and level of reliance of households on forest areas around them, thereby helping to shape more effective conservation and sustainable development policies. The Forestry Modules tested in Indonesia and presented in this paper, aim to provide exactly this kind of information: by collecting detailed data using a comprehensive approach to forest-people dynamics.

3. Site description

The Forestry Modules were pilot-tested in February 2015 as a stand-alone survey in the Kalis Sub-district of Kapuas Hulu District, West Kalimantan Province, Indonesia (also known as '*the heart of Borneo'*) (Figure 1). Kapuas Hulu District was selected for its broad variety of land covers and socio-economic

conditions, which were favourable for pilot-testing the forestry module under a range of conditions.[2] In 2014, the National Statistics Agency calculated the percentage of the population under the poverty line for the Kapuas Hulu district as 10.03% and the poverty line as IDR 323,786 (USD 27.85)[3] per capita per month (BPS, 2016). This region is well known for its tropical rainforest and rich biodiversity. The landscape in the southern part of the district - where the pilot testing was conducted - is relatively remote, hilly and mountainous.

Swidden cultivation is the main focus of livelihoods for the majority of households in all of the pilot villages, whereby a small area of natural forest is cleared to grow 'dry-rice' and other crops for one or two years, and then the land is left to fallow and re-grow into secondary forests before repeating the cycle after a period of up to 20 years. Being located on the Mandai River, villagers also rely heavily on fishing for both subsistence and cash income.

Four sample villages were selected along the Mandai River using a detailed vegetation cover map to represent a gradient of development, forest cover, and village accessibility, from the most upstream village of Rantau Bumbun to the downstream village of Semerantau. Rantau Bumbun has high levels of natural forest cover, traditional swidden agricultural systems, and poor accessibility. Conversely, Semerantau has little natural forest, predominantly cultivated landscapes (including smallholder rubber plantations), and was relatively easy to access (close to the district capital) (see Figure 1). The two middle villages, Nanga Raun and Lebangan, have characteristics somewhere in-between that of the most upstream and downstream villages. Nanga Raun (second most upstream) has predominantly natural forest with patches of swidden fields and smallholder rubber plantations. Lebangan (further downstream) is more accessible (being closer to the main road and to the nearest town) than Nanga Raun, having more natural forest than Semerantau, and the landscape is dominated by smallholder rubber plantations and swidden fields.

Table 1 presents basic characteristics of the four sample villages. Each village has two hamlets that are physically distant from each other, and basically organized as two different settlements; therefore the pilot testing was conducted at the hamlet, instead of the village level. Only one hamlet - the hamlet that serves as the centre of village administration - was selected in each village.

[2] Kalis Sub-district has also had little previous research or NGO interventions, and was deemed a good site so as to avoid research fatigue.

[3] Exchange rate of 1 USD = 11,628 IDR as of 28 February 2012. (http://www.exchangerates.org.uk/USD-IDR-28_02_2014-exchange-rate-history.html). For West Kalimantan Province the rural poverty line was lower and at IDR 294,044 per capita per month (IDR 237,928 in food and IDR 56,115 in non-food) compared to IDR 307,789 in urban areas (IDR 230,730 in food and IDR 77,058 in non-food). (BPS Kalimantan Barat, 2015).

[FIGURE 1 HERE]

[TABLE 1 HERE]

Thirty households were randomly selected from each of the four purposefully selected villages (i.e. a total of 120 households), to test the Forestry Modules under a range of conditions along the previously mentioned development/ forest-use intensity/ accessibility gradient. The selected sample represented an average of 47% of the total households in the hamlets.

4. Assessment of the Forestry Modules survey tool

The Forestry Modules in their entirety were pilot-tested:

1) **The standard household modules**: implemented as stand-alone surveys, these surveys included modules on income (Module A) from forest and wild products, forest-related wage, forest-related business and other forestry-related income sources; forestry-related assets (Module B); forests in energy, health and construction (Module C); and forest and wild product use in food shortage and crises (Module D). These modules used quantitative income accounting to collect information on the monetary contributions of forests and wild products to households (but without accounting for non-forest income sources, such as agriculture or fisheries, as this should already be collected by other household socioeconomic surveys; e.g. LSMS). The main respondent of the household modules was the household head or spouse. In many instances, both household head and spouse were present during the interview and completed or clarified each other responses. In fewer instances, another household member (e.g. adult child/child in law, parent/parent in law) also participated in the survey and provided information on forest extraction activities carried out exclusively by them.
2) **The standard community modules:** to provide contextual information about the site as well as overarching data on use and access to resources; several modules were implemented. Through

community focus group discussions (FGDs), most important[4] forest and wild products for cash and for subsistence (Module A) and a seasonal calendar (Module B) were discussed. Indeed, as 'importance' differs whether it is for cash income generation or subsistence, this division is necessary to appropriately capture the varying roles of forest and wild products. Each community FGD comprised around 10-15 people of both genders, who were proposed by other community members at an introduction community meeting for their knowledge on the discussion topics. Through key informant interviews, information on units and pricing (Module C) and community benefits (Module D) were derived. Informants were village officials and other long-term residents who were knowledgeable of village events.

3) **The extended household modules**: these modules are extra sections that can be appended to the standard modules, and comprise detailed questions about forest cover changes and clearance (Module E), participation in environmental service programs and perceptions of climate change (Module F).
4) **The extended community modules**: Using FGDs, information on the forest institutions governing resource use (Module E) was derived, as well as community participation in environmental service programs (Module F).

When conducting the standard and extended household-level surveys, the enumerators used a five-level Likert scale to systematically record their observations and impressions about the individual survey questions. The results were then analyzed to quantitatively evaluate the structure and flow of the interview, the time taken to complete individual survey modules (and total interview length), and to identify questions that were problematic for the enumerators to deliver or for the respondents to understand. General observations and timing of the community modules and the key informant interviews were also recorded.

The main results from the enumerator evaluation of the perceived adequacy of the survey tools are presented in Figure 2. Generally, the Indonesian pilot tests suggest that rapport with the respondent scored the highest in terms of having 'very good'/'good' Likert scale scores. Other 'good' responses included the attentiveness and seriousness of the respondent and the flow of interview. For the 'fair' score, length of the interview and level of understanding of the concept was scored the highest. The

[4] Importance was defined by the community, whether for income, consumption or other.

more problematic areas (i.e. those receiving 'bad' scores) were on the language and translation of complex concepts, and the structure and sequencing of questions.

[FIGURE 2 HERE]

The category "level of understanding of concepts" was assessed to be mainly 'fair' or 'good', yet the majority of cases where questions were difficult to answer were a result of concepts that respondents found hard to grasp. Out of a total of 156 recorded cases of difficult questions, 104 (67%) were related to respondents not understanding the concepts asked about. The majority of these cases were specifically related to environmental services and related terms, which were new to most of the respondents (as there had never been any environmental service related projects in their community before). This resulted in enumerators spending a substantial amount of time carefully explaining concepts including pollination services from insects in the forest, control of agricultural pests by proximity to forest, and climate regulation by forests, but with little comprehension. This demonstrates the complexity of transferring concepts that may be commonly used in academic and policy discourse to the household level, in various forest contexts.

Other complex concepts that were difficult for respondents to comprehend related to adaptation strategies towards climate change. In order to include these concepts in the Forestry Module, more field testing with new approaches to questioning will be required. Besides the difficulties in explaining the concept of environmental services, there were only a few other cases of difficult questions, which related to respondents' ability to attach prices to forest products or attach a value to assets. Yet, most rural households are capable of giving price and value estimates of collected forest and wild products. The methodological lessons learnt from these results, as well as subsequent pilot tests from Tanzania and Nepal, were used to develop the final version of the Forestry Modules (Bakkegaard et al., 2016b).

5. Forest and wild product contributions

5.1 Income from forests and wild products

Data on the income from forest and wild products, as well as forest-related business, wage, and other income were compared to several figures derived from the national statistics. These included the annual per capita poverty line for Kapuas Hulu district in West Kalimantan in 2014 (i.e. USD 334.14 or IDR

3,885,432), the mean per capita agricultural income per annum (USD 649.94 or IDR 7,557,456) for agricultural households in West Kalimantan in 2013 (SPP, 2013), as well as 2008 figures for total income for rural households grouped as agricultural worker households (USD 514.83 IDR 5,986,392), agricultural business households (USD 982.12, IDR 11,420,100), and non-agricultural rural households (lowest income brackets[5]; USD 1154.27, IDR 13,421,796; BPS, 2016). Since 59.5% of the working age population (above 15 years of age) are engaged in agriculture in West Kalimantan, per capita agricultural annual income is a relevant comparison to judge the size of forest-related income earned (SPP, 2013). Income from forest and wild products includes quantities and cash or cash-equivalent value of products collected for sale or subsistence, using own-reported values for the past 12 months. The analysis of absolute income from forest and wild products per capita shows marked variation between the sample villages (Figure 3), which as expected correlates with the variation in proximity, abundance, and types of forest from upstream to downstream villages (see Figure 1 for details of the forest types and land use classification in the study sites).

[FIGURE 3 HERE]

The most upstream village (V1), Rantau Bumbun, is located at the 'forest frontier'; being surrounded by dense hilly and lowland natural forests, with patches of swidden fields and swidden fallows that have already grown into varying ages of secondary forests. About 10 km downstream is the second village site of Nanga Raun (V2), which has similar types of forest as Rantau Bumbun, except that shrub and grasslands are located close to the settlement area. Households in these two most upstream villages rely on the natural forest as an important source of food and timber. Hunting and logging of lucrative Bornean Ironwood (*Eusideroxylon zwageri*) are common livelihood activities. Villagers also collect some NTFPs, such as forest fruits, rattan, and tubers, reflected by the proportion of collection occurring in old-growth natural forests, which is over 50% for V1 and V2 (Table 3). The most important forest and wild products for cash and subsistence identified during focus group discussion in the community module A (Most Important Forest and Wild Products; MIP), also reflect ironwood and *tekam* wood (*Shorea* spp.) as most important cash products, and various wildlife and rattan as most important for subsistence.

[5] As reference, the highest income bracket annual income for non-agricultural rural households in Indonesia amounts to USD 2,511.51 per capita (i.e. IDR 29,203,800).

For Village 1, the mean per capita annual income from forests and wild products amounted to USD 1,031.42 (IDR 11,993,372). Mean forest-related business income per capita was USD 314.65 (IDR 3,658,726) and consisted of mainly trade in forest products (60%; n=10), with logging, traditional medicine and other forest-based activities (NTFP collection) making up (10%, 10% and 20% respectively). For mean forest-related wage income (n=15), this amounted to USD 158.34 (IDR 1,841,230) per capita with 53% of households engaged in forestry transport, 27% in forestry logging, 13% in 'other forestry' and 7% in carpentry. In total for Village 1, forest-related income per capita far exceeds the mean agricultural income for West Kalimantan and even the mean non-agricultural rural household income (lowest income bracket) for Indonesia. This fact suggests that forest-related income in national socioeconomic surveys is not adequately reflected, suggesting that a systematic collection of forest-related income in national surveys may lead to a change in percentages of households that are actually under the poverty line.

In Village 2, mean per capita annual income from forests and wild products amounted to USD 392.61 (IDR 4,565,294), with mean forest-related wage comprising USD 118.03 (IDR 1,372,493), and mean forest-related business less than USD 10 (IDR 110,833; n=2). Forest-related wage occupations (n=15) were mainly in forestry transport (47%), forest-other (13%), forest logging and processing (33%) and carpentry (7%). Forest-related business was recorded in only two households engaged in carpentry and rubber production. Forest-related income here lies below the mean agricultural income per capita for West Kalimantan (Figure 3), but again has the potential to increase the mean household income figures for rural households, if forest-related incomes are incorporated into total household income figures.

[TABLE 2 HERE]

[TABLE 3 HERE]

The two most downstream village sites, Lebangan (V3) and Semerantau (V4), are located in the lowlands, which compared to upstream areas are characterized by forests that are predominantly a mix of rubber plantations and secondary forests with shrubland and secondary swamp forests. Hunting and consumption of wild animals is rare because of the villages' close proximity to other villages and the limited natural forest. This was also reflected in the locations of collection of forest and wild products, which could occur in more than one area; 41% of the forest products collected by households in Village 3 and 30% of forest products collected by Village 4 households were from secondary/regenerating

forests (Table 3). Tapping rubber used to be one of the most important livelihoods in the villages and most of the households had small rubber plantations. However many households left their rubber untapped because of the low rubber price (rubber price had been declining for the past two years from 1 USD per kg to half that price). For cash income, villagers harvest *puri* leaf (Kratom Borneo, *Mitragyna speciosa*) leaves, used for medicinal purposes as an anti-depressant and pain relief, as well as for recreational purposes. In Semerantau, many men go to Malaysia, illegally, for months to look for highly valuable *gaharu* (agarwood), a dark resinous heartwood used for perfume and incense (the best quality *gaharu*, called 'super king', fetches up to USD 3,000 per kg).

In Village 3, mean per capita annual income from forests and wild products amounted to USD 120.61 (IDR 1,402,460), with mean forest-related wage comprising USD 87.72 (IDR 1,019,975) per capita annually, and mean forest-related business USD 240.10 (IDR 2,791,927) per capita annually. The majority of forest-related wage occupations were in forestry transport (7 out of 8 households, 88%), while the remaining one household concentrated on forestry processing (12%). In this village, forest-related business was more common (9 households), with four households (44%) concentrating on NTFP collection of agarwood, *puri* leaf and second grade agarwood, another four (44%) involved in rubber process and trade, one household (12%) in carpentry, and one household (12%) in trade of other forest product. Compared to the levels of other incomes in Figure 3, forest-related income contributions would likely be a supplement to the household economy.

In Village 4 mean per-capita annual income from forests and wild products amounted to USD 184.16 (IDR 2,141,410), with mean forest-related wages comprising USD 87.21 (IDR 1,014,127), and again a negligible involvement in forest-related business (n=3) in NTFP collection (66%) and trade of forest products (33%)(mean income being less than USD 4 or IDR 45,381). The forest-related occupations (n=7) were in forestry processing (29%), forestry transport (43%), and 14% each in logging and carpentry.

In module design, the data derived from household modules and the community modules were assumed to resonate with each other well - that is, in each site the most important products for cash and subsistence should have the highest proportion of household engagement and involvement. However, results showed the opposite: across the four sites, the most important cash products (V1 = ironwood, V2 =rubber, V3 = *puri* leaf, and V4 = rubber) mentioned during the community module FGD were obtained by less than 50% of households in the standard household module on Income from

Forest and Wild Products. This suggests that participants in the FGD on Most Important Forest and Wild Products (MIP) module may have defined 'importance' based primarily on the monetary value of products. Moreover, such cash products, like many other lucrative forest products, may be collected by a few households trading in that product, as a result of limited access or lack of availability of the product. The cumulative value of mentioned MIPs may therefore also be relatively low, due to the limited participation in product collection.

5.2 Forest and wild product role in shocks and crises

The types and amount of shocks faced by households are presented in Table 4. The data are split according to the sample villages, which, given the variation between the villages, shows that the Forestry Modules are reflecting the context-specific patterns of forest use in the different villages. For example, droughts and floods were more prominent in the lowland Villages 3 and 4, which is consistent with the increased flood occurrence in lowland areas. Another example is the difference in frequency of crop disease and crop pests between the most upstream village (Village 1, which has more traditional, low intensity agricultural systems) and the furthest downstream village (Village 4, which has larger-scale more intensive agricultural systems). Out of the 275 counts of shocks experienced among all the surveyed households, almost 50% of the responses regarding corresponding coping actions involved an increased use of forest products, either for own consumption, for sale, or both. General patterns show that consumption of forest and wild products was significantly higher in Village 1 (upstream, 13 counts) than Village 4 (downstream, 1 count). In Village 1, *belian* (or Borneo ironwood) consumption was often for the construction of coffins in responses to deaths in the family. Conversely, sale of forest products was least common in V1 compared to the other villages (18 counts). In Village 3, sale of *puri* leaf (Kratom Borneo) was frequent (13 counts), reflecting the fact that *puri* grows well in lowland, swampy areas alongside rivers - an ecosystem only found in Village 3. Other wood species are used in response to chronic/severe illness or accident of household member for their medicinal and healing properties. In Village 4, the sale of rubber and wild animals (ten and five counts, respectively) was also prominent, reflecting the large engagement in rubber production and ready markets for their sale: these products may be easily liquidated for cash, perhaps due to proximity to markets.

[TABLE 4 HERE]

From this it is clear that forest income plays some role as a safety net (Angelsen et al. 2014) although it is not always clear how important forest income is in relation to other coping strategies (Wunder et al. 2014). To help fill this gap in knowledge, in the Forestry Modules households were asked to rank how important forest or wild products are in coping strategies, compared to the other coping strategies used in times of shock and crises. Table 5 indicates that over 30% of households across the four villages responded that forest and wild products were the most important coping strategy when faced with shocks or crises, yet correspondingly almost 50% said it was the least important compared to other strategies. Ranking of forest and wild products differed however along the forest gradient - in Village 1 the large majority of responses stated that forest and wild products were the most important compared to other coping strategies, where in Village 3 and Village 4 it was almost exactly the opposite (56% and 58% respectively stating that forest and wild products were least important).

[TABLE 5 HERE]

6. Discussion and conclusion

With a more detailed focus on specific forest and wild products, e.g. recording absolute quantities collected and household resources spent on forest and wild product collection, as well modules on supporting information such as units and pricing, we made the case that the Forestry Modules presented in the above can collect in-depth information, and do so at scale. The Forestry Modules also enable a closer examination of the role of forest income in household economies, when the tool is used in conjunction with standard LSMS modules. Hence, it can potentially make regional or national income accounts more accurate, and thus provide a better quantitative basis for development plans, poverty alleviation strategies, comprehensive conservation initiatives, and other policies and interventions.

Operationally, we looked at the tool itself, evaluating the various aspects of the survey, questions, and sequencing. During the pilot testing, the sequence of questions, which attempted to maximize the flow of the interview through connecting different sections, was found to hamper the interview process. While most questions were readily understood, some involving complex concepts such as environmental services and climate change were difficult to explain and time-consuming to gather information for, furthermore questioning the validity of the responses given. This led to modifications in the final version of the Forestry Modules, and acknowledgement on the need to further work separately on methods for valuing environmental services (Bakkegaard et al., 2016b).

To scrutinize the effectiveness of the Forestry Modules in capturing forest and wild product income, we analyzed the levels of income from forest and wild products, as well as the wide array of forest uses and benefits. While these questions are time consuming and, in certain sections, difficult, they also capture important income contributions. The general trend shows that per capita annual income derived from forest and wild products follows the "forest gradient", such that the upstream villages are collecting more in terms of value than downstream villages, and also collecting more frequently in the old-growth forests.

Moreover, we demonstrated how mean forest and wild product income and other forest-related incomes compared to readily available information on the poverty line, mean per capita agricultural income, and mean per capita rural household incomes. Importantly, we demonstrated that, comparatively speaking, mean forest-related incomes exceed mean per capita agricultural incomes and even mean per capita non-agricultural household incomes in the lowest income brackets for Village 1 (the village closest to the forest). This may indeed demonstrate that forest-proximate household incomes are being significantly underestimated: many market-remote, forest-near villages may not be quite as radically poor as the official statistics so far have told us, when we manage to better take into account their privileged access to good-quality forests and their extractive resources. Furthermore, mean forest and wild product incomes and forest-related incomes currently exceed the poverty line in Village 1, Village 2, and Village 3. If, as suggested above, these incomes are not adequately reflected in household statistics, absolute numbers of households below the poverty line may change. At the very least the forest-related and direct forest and wild product income are a demonstrably significant proportion of total household incomes, and comparable to other significant household income sources e.g. agriculture, in cases like Village 1. Combined with earlier scrutiny of the existing national forest surveys, such as the Indonesian Forestry Survey, we may conclude that current national tools will not sufficiently reflect the economic contribution of this income source in national figures. This has implications for the comprehensiveness of information that is used to inform national policy development.

To illustrate the depth of information that could be derived from the Forestry Modules, we presented how households use forest and wild products in coping with shocks and crises, as well as the diversity of products used in their coping strategies. Interestingly, the ranking of forest and wild products relative to other coping strategies also reflected the geographical "forest gradient". Households in Village 1 tended to consume more forest and wild products in response to shocks compared to other villages, and forests

also featured in over half of the household responses as the most important coping strategy compared to other coping strategies. This was almost opposite to the situation in the downstream villages (V3 and V4), where over half of the responses ranked forests and wild products as being the least important in their choice of coping strategies. Similarly, consumption of forest products in times of shock and crises reduces and forest products were predominantly sold in the downstream village (V4), reflecting their proximity to markets and ability to realize cash values of such products.

In general the analysis has shown that the Forestry Modules do perform well in extracting the expected information according to the "forest gradient". In addition, the pilot testing underlines the significance of differentiating data collection at different spatial and time scales, e.g. community vs household and cash vs subsistence, capture of seasonal products vs accuracy of a twelve month recall - considerations that may go unmarked in other sectors. Importantly, the Forestry Modules needed to consider the balance between survey implementation at the national scale, and the importance of capturing detail at various scales. Therefore, the Forestry Modules aim to ensure that the specificities of forest-related activities and contributions can be captured whilst guaranteeing their applicability across many forest contexts. Their systematic implementation will maximize (under constraints of survey harmonization and costs) the effectiveness and representation of forest and wild product environments in national socioeconomic data and contribute to shaping appropriate national policy that reflects the situations of households in forest areas.

8. References

Angelsen, A., Larsen, H.O., Lund, J.F., Smith-Hall, C., Wunder, S. 2011. (eds) Measuring livelihoods and environmental dependence: methods for research and field work, Earthscan, Edinburgh (UK) (240 pp).

Angelsen, A., Jagger, P., Babigumira, R., Belcher, B., Hogarth, N.J., Bauch, S., Börner, J., Smith-Hall, C. Wunder, S. 2014. Environmental income and rural livelihoods: A global-comparative analysis. World Development 64 (1), S12–S28.

Appiah, M., Blay, D., Damnyag, L., Dwomoh, F.K., Pappinene, A., Luukkanene, O., 2009. Dependence on forest resources and tropical deforestation in Ghana. Environment, Development and Sustainability 11, 471–487.

Bakkegaard., R.K., Nielsen., M.R., and Thorsen, B.J., 2016a. Household determinants of harvesting of bushmeat and eru (*Gnetum africanum*) for cash in the Democratic Republic of Congo. Environment Development and Sustainability. DOI 10.1007/s10668-016-9812-9.

Bakkegaard, R.K., Agrawal, A., Animon, I., Bosselmann, A., Hogarth, N.J, Miller, D., Persha, L., Rametsteiner, E., Wunder, S., and Zezza, A., (2016b) National Socioeconomic Surveys: Guidance and survey modules for measuring multiple roles of forests in household welfare and livelihoods. FAO, World Bank, CIFOR, IFRI, Rome, 2016.

Bakkegaard, R.K. 2013. CIFOR PEN survey analysis consultancy report. December 2013.

BPS (Badan Pusat Statistik) 2016. Rata-rata Jumlah Pendapatan perkapita Menurut Golongan Rumah Tangga (ribu rupiah), 2000, 2005, 2008. Online at: http://www.bps.go.id/linkTabelStatis/view/id/953. Accessed April 2016.

BPS Kalimantan Barat, 2015. Berita Resmi Statistik Provinsi Kalimantan Barat No. 05/01/61/Th. XVIII, 2 Januari 2015. Online at: http://kalbar.bps.go.id/website/brs_ind/brsInd-20150115094925.pdf. Accessed April 2016.

Byron, N., Arnold, M. 1999. What futures for the people of the tropical forests? World Development 27(5), 789 - 805.

Cavendish, W. 2000. Empirical regularities in the poverty-environment relationship of rural households: evidence from Zimbabwe. World Development 28(11), 25.

Chao, S. 2012. Forest peoples: Numbers across the world. Forest Peoples Programme: Moreton-in-Marsh, U.K.

CIFOR, 2008. PEN prototype questionnaire. Online at: http://www.cifor.org/pen/research-tools/the-pen-prototype-questionnaire.html. Accessed February 2016.

CIFOR. 2008. PEN prototype questionnaire (available online at http://www.cifor.org/pen/research-tools/the-pen-prototype-questionnaire.html).

FAO, 2006. Global forest resources assessment 2005. Rome.

FAO. 2008. Links between National Forest Programmes and Poverty Reduction Strategies. Forestry Policy and Institutions Working Paper No. 22. Forestry Department, Food and Agriculture Organization of the United Nations: Rome.

Fisher, M., 2004. Household welfare and forest dependence in Southern Malawi. Environment and Development Economics 9, 135–154.

GTZ. 2004. National monitoring of strategies for sustainable poverty reduction/ PRSPs. Volume 1: Main Report. Deutsche Gesellschaft für Technische Zusammenarbeit (GTZ): Bonn, Germany.

Mamo, G., Sjaastad, E., Vedeld, P., 2007. Economic dependence on forest resources: A case from Dendi District, Ethiopia. Forest Policy and Economics 9, 916–927.

McSweeney, K. (2004). Forest product sale as natural insurance: the effects of household characteristics and the nature of shock in eastern Honduras. Society and Natural Resources, 17(1), 39-56.

Nielsen, M. R., Pouliot, M., & Bakkegaard, R. K. 2012. Combining income and assets measures to include the transitory nature of poverty in assessments of forest dependence: Evidence from the Democratic Republic of Congo. Ecological Economics, 78, 37-46.

Pouliot, M., & Treue, T. 2013. Rural people's reliance on forests and the non-forest environment in West Africa: evidence from Ghana and Burkina Faso. World Development 43, 180–193.

PROFOR. 2008. Poverty and forests linkages – a synthesis and six case studies. Washington, DC, World Bank.

Pusat Data dan Sistem Informasi Pertanian, 2014. Analisis Data Kesejahteraan Petani. Kementerian Pertanian. Online at: http://pusdatin.setjen.pertanian.go.id/tinymcpuk/gambar/file/Analisis_Kestan_2014.pdf. Accessed April 2016

Rayamajhi, S., Smith-Hall, C., & Helles, F. 2012. Empirical evidence of the economic importance of Central Himalayan forests to rural households. Forest Policy and Economics, 20, 25-35.

Riggott, M. 2014. Micro-data analysis of selected socioeconomic surveys. FAO Consultancy report.

Russo, L. 2014. Review of the coverage of forest-related socio-economic issues in selected surveys. Consultancy report. March 2014

Shepherd, G. 2012. Rethinking forest reliance. Findings about poverty, livelihood resilience and forests from IUCN's "Livelihoods and Landscapes" strategy. Gland, Switzerland, International Union for Conservation of Nature and Natural Resources.

Sunderlin, W.D., Angelsen, A., Belcher, B., Burgers, P., Nasi, R., Santoso, L., Wunder, S. 2005. Livelihoods, forests, and conservation in developing countries: an overview. World Development 33(9), 1383–1402.

Statistics Indonesia. 2014. Census of Agriculture 2013. National Figures of Households Around Forest Areas, 2014. Results of ST2013 Survey. BPS-Statistics Indonesia, p. 248.

XVIII, 2 Januari 2015 http://kalbar.bps.go.id/website/brs_ind/brsInd-20150115094925.pdf

SPP, 2013. Analisis Sosial Ekonomi Petani di Kalimantan Barat: Hasil Survei Pendapatan Rumah Tangga Usaha Pertanian Sensus Pertanian 2013. Badan Pusat Statistik Provinsi Kalimantan Barat. Online at: http://kalbar.bps.go.id/website/pdf_publikasi/Analisis-Sosial-Ekonomi-Petani-Di-Kalimantan-Barat--Hasil-Survei-Pendapatan-Rumah-Tangga-Usaha-Pertanian-Sensus-Pertanian-2013-.pdf. Accessed April 2016.

Vedeld, P., Angelsen, A., Bojö, J., Sjaastad, E., & Berg, G. K. (2007). Forest environmental incomes and the rural poor. Forest Policy and Economics, 9(7), 869–879.

World Bank. 2008. Forests sourcebook: Practical guidance for sustaining forests in development cooperation. World Bank: Washington, D.C.

World Bank. 2015a. National Panel Survey 2010-2011. Agricultural questionnaire Tanzania. Online at: http://siteresources.worldbank.org/INTLSMS/Resources/3358986-1233781970982/5800988-1286190918867/NPS_Agriculture_Qx_English_(Year2)_v2.pdf. Accessed March 2016.

World Bank. 2015b. National Panel Survey 2010-2011. Fisheries questionnaire Tanzania. Online at: http://siteresources.worldbank.org/INTSURAGRI/Resources/7420178-1294154345427/NPS_Fishery_Qx_English_Year_2.pdf. Accessed March 2016.

Wunder, S., Luckert, M., Smith-Hall, C. 2011. Valuing the priceless: what are non-marketed products worth? In: Measuring livelihoods and environmental dependence: Methods for research and fieldwork. A. Angelsen, H. O. Larsen, J. F. Lund, C. Smith-Hall and S. Wunder. London, Earthscan: 127-145.

Wunder, S., Börner, J., Shively, G., Wyman, M. 2014. Safety nets, gap filling and forests: a global-comparative perspective. World Development 64(1), S12–S28.

Figure

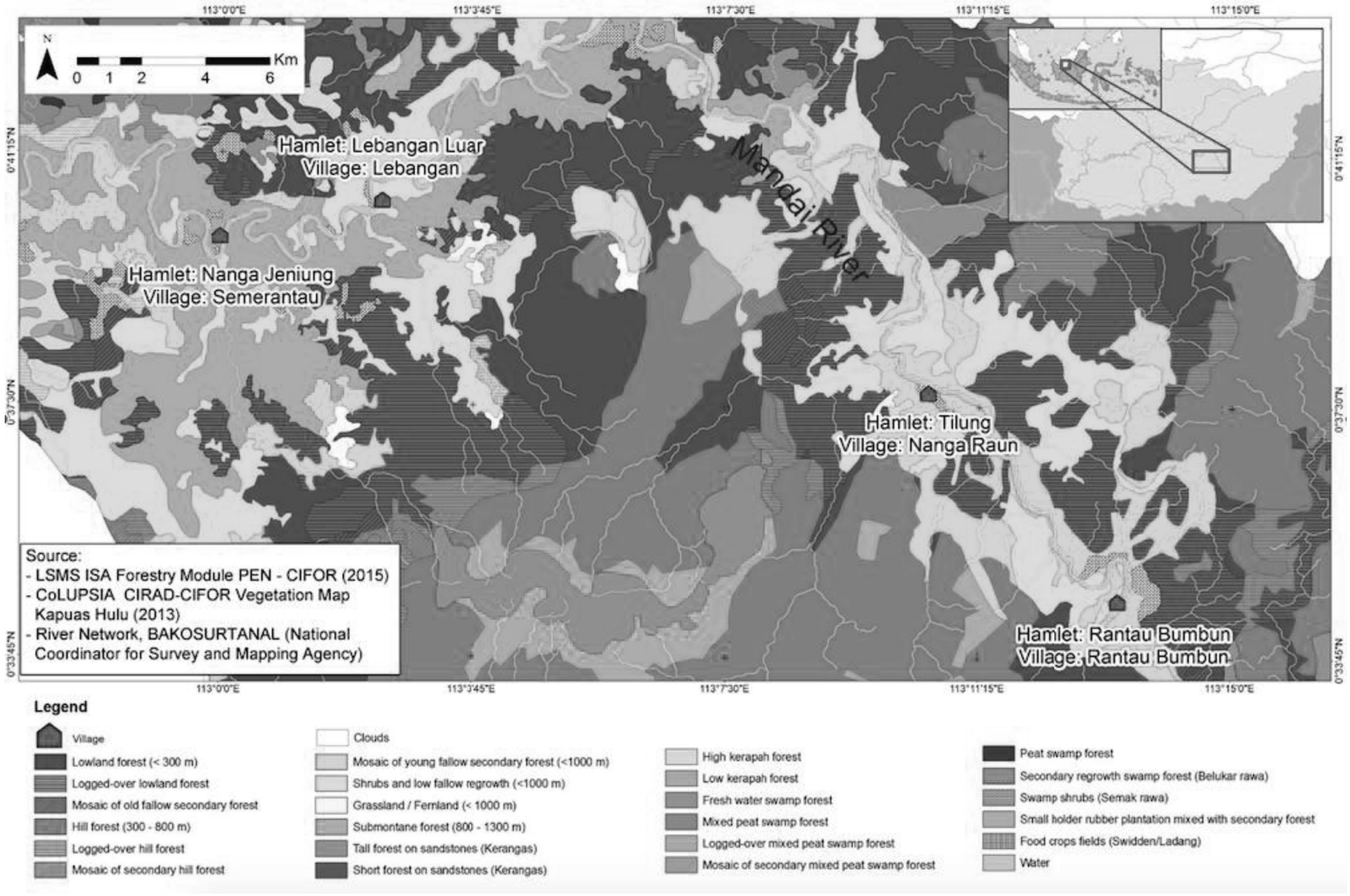

Figure 1. Map of sample village locations with vegetation cover; Kalis Sub-district, Kapuas Hulu District, West Kalimantan, Indonesia.

Table 1 Basic characteristics of pilot testing village/hamlet sites

No.	Hamlet (village) name	Land cover description	No. of Hh in the hamlet (based on our definition)	Hamlet/village population	Approx. distance to nearest market (to the sub-district capital of Nanga Kalis)	Approx. dist. to district capital of Putussibau (km)	Ethnicity
1	Rantau Bumbun (Rantau Bumbun)	- Lowland and hill forests - Mosaics of old and young fallow secondary forests - Logged-over hill and lowland forests - Heath forest - Swidden fields	40	162/394	41	51	Majority Dayak Orung Da'an
2	Tilung (Nanga Raun)	- Mosaics of young fallow secondary forest - Shrub and low fallow regrowth - Swidden fields - Logged-over lowland forests - Grassland/fern-land	133	815/1196	34	44	Majority Dayak Orung Da'an
3	Lebangan Luar (Lebangan)	- Smallholder rubber plantation mixed with secondary forest - Shrub and low fallow regrowth - Swidden fields - Mosaics of old fallow/ secondary forest	48	236/456	20	30	Majority Dayak Orung Da'an
4	Nanga Jeniung (Semerantau)	- Secondary regrowth swamp forest - Smallholder rubber plantation mixed with secondary forest - Shrub and low fallow regrowth - Swidden fields	107	740/590	11	21	Majority Malay Kapuas Hulu

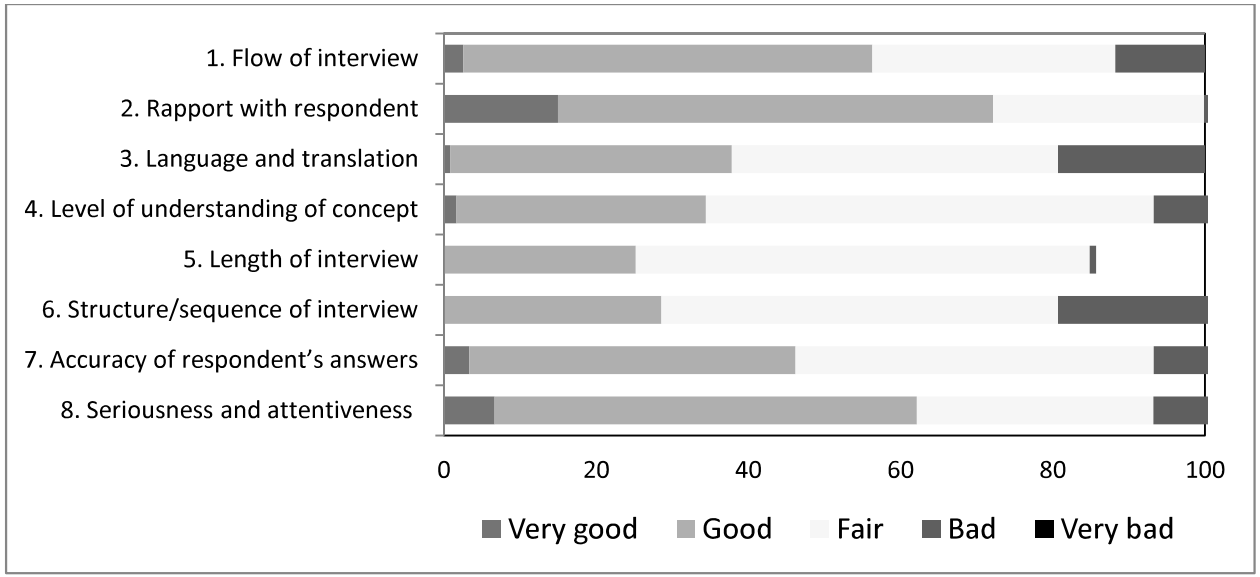

Figure 2. Summary of enumerator assessment of the survey tool. Each of the eight aspects were assessed after every household interview (n=120); the bars indicate the percentage of interview counts for each category.

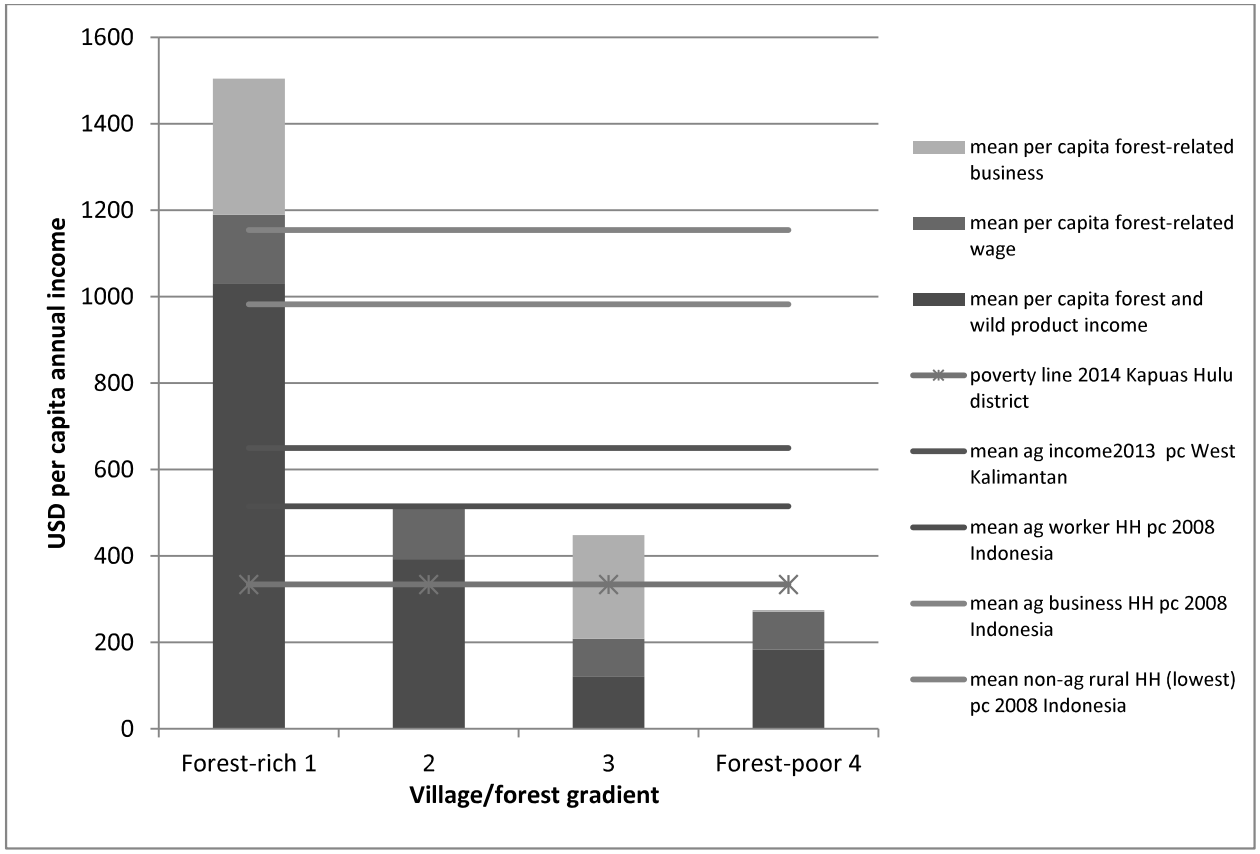

Figure 3. Annual per capita forest and environmental incomes by village (in bars), compared to means of agricultural income and total income for agricultural households (in USD)

Table 2 Most important forest and wild products for cash income and subsistence (based on an FGD result with approx. 10-16 village representatives in each site)

	Village 1 (upstream)	**Village 2**	**Village 3**	**Village 4 (downstream)**
Cash 1	Ironwood	Rubber	Puri leaf	Rubber

Cash 2	Semah fish	Ironwood	Tekam wood	Fern
Cash 3	Tekam wood	Tekam wood	Fish	Meranti wood
Subsistence 1	Ironwood	Fish	Ironwood	Fern
Subsistence 2	Animal (boar, deer, mousedeer, roe)	Boar	Fish	Fish
Subsistence 3	Rattan	Rattan	Fish fern	Meranti wood

Table 3 The percentage of forest and wild products collected in different forest categories by households in each village.

	Old-growth natural	Secondary/ regenerating	Managed plantation	Other non-forest environmental
V1	52.0	15.0	8.5	24.5
V2	50.2	24.5	5.4	19.9
V3	25.2	41.3	11.2	22.4
V4	23.1	30.3	24.2	22.4

Table 4. Count of shocks by village and action taken with forest or wild product in shock coping, by village

Type of shock or crises faced by household in last 12 months	Village				Grand Total
	1	2	3	4	
Crop disease or crop pests	8	16	13	18	55
Large rise in price of food	6	13	17	13	49
Drought, severe water shortage or floods	3	10	18	14	45
Livestock died or were stolen	5	8	9	2	24
Large rise in agricultural input prices or large fall in sale price for crops	2	11	9	9	31
Chronic/severe illness, accident or death of household member	9	6	12	7	34
Other shocks incl. job loss, business failure, property loss, damage, theft	6	18	5	8	37
TOTAL SHOCK COUNT	39	82	83	71	275
Action taken					
Missing response	9	41	50	45	145
1 SELL	18	25	22	24	89
Timber / wood	14	24	9	17	64
Animals	4	1	0	5	10

Leaves, ferns, other	0	0	13	2	15
1.2 BOTH		8	3	1	12
Animals		8	1	1	10
Timber / wood			2		2
2 CONSUME	13	8	7	1	29
Timber / wood	9	8	4	0	21
Animals	1	0	1	0	2
Leaves, ferns, other	3	0	2	1	6
TOTAL ACTION COUNT	40	82	82	71	275

Table 5 Ranking of importance of forest and wild products in coping with shocks (in percentage)

1 (most important) to 10 (least important)	Village 1		Village 2		Village 3		Village 4		Total	
RANK	%	number	%	number	%	number	%	number	%	number
1 Most important	57%	21	36%	28	26%	21	17%	12	31%	82
2	14%	5	6%	5	4%	3	1%	1	5%	14
3	3%	1			3%	2			1%	3
4	3%	1							0%	1
5	8%	3	8%	6			23%	16	10%	25
7					1%	1			0%	1
8					9%	7			3%	7
9					1%	1			0%	1
10 Least Important	16%	6	49%	38	56%	45	58%	40	49%	129
-9 (don't know)	-	2	-	5	-	3	-	2	-	12
TOTAL		**39**		**82**		**83**		**71**		**275**