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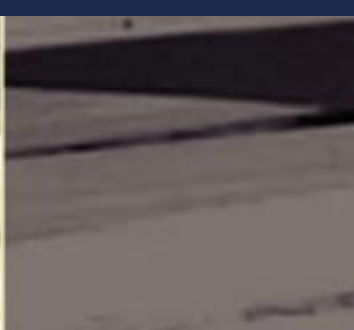
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A method to assess the outcomes of forest product trade on livelihoods and the environment

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Abstract

As part of a multi-collaborator research project on the potential of non-timber forest product (NTFP) trade for conservation and development we designed tools to assess the effects of NTFP trade on people's livelihoods and the environment. To assess livelihood outcomes of NTFP trade we used the Sustainable Rural Livelihoods framework and identified indicators to capture changes in financial, physical, natural, human and social assets at the household and community level. We also selected indicators to assess livelihood related changes at the national level. To assess the environmental impacts of commercial NTFP production we identified indicators at four levels: target species population, land use ecosystem, landscape, and global level. The method presented in this paper is meant to provide a time and cost effective tool to measure the effects of NTFP trade, based on expert judgment. We first present a brief overview of the research project and the challenges faced in the design of the method, followed by a description of the method.

Key words

Non-Timber Forest Products; conservation; development; livelihoods; assets; outcomes; impact; assessment

Introduction

As we strive to find better ways to achieve poverty alleviation through improved and more effective natural resource management, we also need better ways to measure and assess change*. Resource managers, development agencies, policy makers, and researchers all need more effective and efficient means to measure or estimate status and trends in livelihoods and resource bases, and to relate changes on the ground to the main driving factors.

A range of approaches and tools for doing this have been developed under the general heading of "impact assessment". Typically, impact assessment focuses on appraising the effect of interventions on particular variables of interest. The assessment may be *ex ante*, with an emphasis on predicting probable outcomes to aid planning space (which assumes that "with" and "without" situations are similar except for the intervention being assessed). Impact assessments of interventions and research have long been dominated by the use of quantitative methodologies that use economic returns and (and mitigation). A well-known example is Environmental Impact Assessment (EIA), which is used to predict the environmental outcomes of a planned project. Or, the assessment may be done *ex post* to determine actual outcomes to guide ongoing interventions or to evaluate the effectiveness of projects. Donors and development and conservation agencies are increasingly interested in monitoring and evaluating the impacts of their activities for example (see Roche 1999 for overview). Likewise, there is growing attention to assessing the impact of research activities, as research institutes are confronted with more competition for international research funding, and have to demonstrate impact (Gottret and White 2001).

Impact assessment can be done by actually measuring differences over time (which requires baseline data previous to the intervention) or adoption of technologies to measure impact (ibid.).

Alternatively, impact can be assessed using indicators that signal changes, either directly or indirectly. Indicators condense complex

information about processes, events or trends into reliable signals for management (Bossel 2001; Gottret and White 2001). Recently efforts have started focusing on more comprehensive ways of impact assessment that include qualitative indicators. A good example of new approaches of impact assessment of research is given by Campbell *et al.* (2001).

In this paper we describe an indicators-based "Outcomes[1] Assessment Tool" that relies primarily on expert judgment. We begin with a brief overview of the research project that this assessment tool was developed for, with an emphasis on the key problems and the resulting design requirements. We then describe the method and the indicators used for assessing the livelihood outcomes and the ecological outcomes of commercial production of forest products. The outcomes assessment tools themselves and sets of "guiding questions" are provided in the annexes.

Background and Design Principles

The conservation and development outcomes assessment tools described here were developed as part of a larger research project to compare and contrast cases of commercial NTFP production and trade. That work involved documenting a large number (61) of cases using a standardized set of descriptors. These descriptors provided a base to compare the ecological, economic social, and political characteristics of the selected cases. The collective data set provided a "snapshot" of the current situation, with some trend information. The approach is described in Belcher and Ruiz-Pérez (2001). Several products of the analysis are now available (e.g., Ruiz-Pérez *et al.* 2004; Belcher *et al.* 2005).

One of the main objectives of this research was to analyze the conditions that lead to positive or negative livelihood and environmental outcomes from the commercialization of NTFP. To do this, it was necessary to be able to classify the cases as to whether or not (and to what extent) the commercial trade in the product in question has resulted in positive (or negative) livelihood outcomes and to positive (or negative) environmental outcomes. Doing this, in the context of an ongoing research project, presented several challenges:

1. Comparability. The basic principle of the research approach is that all cases are to be included in the full analysis. All data needs to be defined and collected in a consistent way.

2. Comprehensiveness vs. data availability: The research approach stresses understanding whole systems, where the context may be as or more important than particular features of the resource or the product. In the "descriptors" data set, we used discrete variables to maximize understanding of the role and importance of different factors. For the outcomes assessment we aim for comprehensive understanding of overall outcomes, encompassing different components of livelihood and environmental changes. The outcomes indicators are designed to subsume several aspects of the characteristic they represent.

3. Accuracy and precision: Relating to the above point on data availability, it is inevitable that data for certain variables will not be available at high levels of precision. To maximize the usability of available data and to minimize the costs of collecting new data, it is necessary to reduce requirements for precision measurements, and to use estimates for some variables. This is acceptable for a comparative analysis of many highly differentiated cases. Some variables differ between cases by orders of magnitude, making comparisons effective and making highly precise measures redundant.
4. Scale of analysis: With any impact assessment the scale of analysis is critically important. Impacts of different kinds may be more or less important at different scales.

5. Objectivity: For comparing different cases it is best to use quantitative measures. It is possible to use relative rankings or other qualitative approaches with a small number of cases, where the assessors are sufficiently familiar with all cases to be able to judge relative ranks. However, as the number of

[1] We distinguish between "impact" and "outcome". Impact is the direct result of a certain action (policy, project or research) while an outcome is the result of a combination of changes. The principle of assessment (the use of indicators to capture changes) is, however, the same for both impact- as well as outcomes assessment.

cases increases it becomes increasingly difficult, and unreliable, to use qualitative approaches. With this project we sought to use absolute measures/estimates wherever possible.

6. Benchmarks: To assess change we need to know the original condition. It is unfortunately very unusual to have reliable baseline data available, so it is necessary to approximate a counterfactual situation; essentially, to imagine what would have happened in the absence of the change being assessed.

7. Analytical robustness: The main set of "descriptors" included a number of variables that relate to ecological and to livelihoods characteristics. It would be possible to use some of these to assess outcomes in individual cases. However, this approach, in combination with the multivariate analysis employed in the study, would result in problems with autocorrelation. That is, some of the same variables would be used to describe the case and to assess its outcomes. Therefore, we felt that it would be more effective, and more robust analytically to have an independent assessment of outcomes to compare to the case descriptions.

8. Cost: Data collection is expensive. We needed to find a way to collect sufficient data of sufficient quality for a reasonable, reliable outcomes assessment at low cost. With unlimited resources we could have commissioned a multi-disciplinary team to visit all the cases to make an independent assessment. However, this would be prohibitively expensive, in time and money terms.

Process of Methods Development

Taking these needs and the inherent constraints into account, the project decided to develop a separate outcomes assessment based on expert judgment. The premise was that the researchers that have studied the cases have a good understanding of "their" cases and a good sense of how the production, processing and marketing of the NTFP have affected conservation and development there. It was fully recognized that any individual assessment would be subjective, and would tend to focus on some issues more than others, depending on the professional orientation, personal preferences and actual experience with the case. In order to maximize the objectivity and the comparability, we designed two assessment tools to be used by the case researchers that would assist in making the individual assessments systematic, comprehensive (to help ensure that all important issues are considered) and consistent (such that different assessors familiar with the case would make similar assessments).

We used an iterative process to develop a set of indicators to capture the key changes resulting from commercial forest product trade. We began by outlining the objectives and constraints and proposing a prototype set of indicators to all collaborators. These indicators were then challenged, revised and refined with the input of scientists representing a wide range of disciplines and experience. This approach helped to prevent the disciplinary bias that is often reflected in indicator sets (Bossel 2001; Rigby et al. 2000).

Livelihood indicators

In this assessment the question we are considering is whether and how forest product trade has affected people's livelihoods. The hypothesis is that increasing trade of forest products provides income, employment, and other opportunities for poor rural people to improve their welfare (Peters, *et al.* 1989; Clay and Clement 1993).

Measuring or even defining livelihoods is highly problematic, with marked differences of opinion about what should be included. There have been harsh criticisms of assessments that rely too much on purely financial measures, and that often focus only on income. This kind of measurement may ignore (often negative) changes in the natural resource base, inequity within and between households, and in social structures. Although Increases in per capita income may be achieved, wellbeing (a healthy, contented, or prosperous condition[2]) may be getting worse. Many of the collaborators in the study expressed concerns along these lines and wanted to avoid purely financial measures.

The "livelihoods framework" (DFID 2005) uses a people centered approach. According to the

[2] As defined by The New Shorter Oxford English Dictionary

Institute for Development Studies[3], where much of the work to develop this concept has been done, a livelihood comprises the "capabilities, assets (including both material and social resources) and activities required for a means of living". A livelihood is sustainable when it can cope with and recover from stresses and shocks and maintain or enhance its capabilities and assets both now and in the future, while not undermining the natural resource base[4].

The discussions around this approach have identified a range of "assets" important in livelihoods. The actual asset set varies from author to author. For example, Bossel (2001) includes 'organizational assets', Bebbington (1999) includes 'cultural assets' and Baumann (2000) adds 'political assets'. We elected to use:

1. Natural assets. This includes the natural resource stocks from which resource flows and services (e.g. nutrient cycling, erosion protection) useful for livelihoods are derived. In our study it includes the species of interest as well as the many goods and services from the wider environment.

2. Physical assets: This comprises the basic infrastructure and producer goods needed to support livelihoods. In our cases it includes household ownership of basic shelter and buildings, producer goods (the tools and equipment that people use for their farming, forest management, processing, and marketing) and also the "infrastructure" (adequate water supply and sanitation, accessible and affordable transportation, energy and communications) that helps people to meet their basic needs and to be more productive.

3. Human assets: This represents the skills, knowledge, ability to work and good health that together enable people to pursue different livelihood strategies and achieve their livelihood objectives.

4. Financial assets: This is the more conventional measure of poverty. It represents the financial resources that people use to achieve their livelihood objectives, including "stocks" (savings in various forms, from bank deposits and cans under the bed to livestock or jewelry, and access to credit) and "flows" (income, including earnings, pensions and remittances). Together these contribute to consumption as well as production.

5. Social assets: This encompasses the social resources that people draw upon to help meet their livelihood objectives. It includes networks and "connectedness", institutions (rules, norms and sanctions), and relationships of trust, reciprocity and exchanges that facilitate co-operation, reduce transaction costs and may provide the basis for informal safety nets amongst the poor.

This follows the framework developed by DFID (Carney 1998; DFID 2005) as we feel that it is simple and comprehensive. This framework has been widely adopted as an organizing principle. Recent examples of impact assessments using the approach are given by Cramb *et al.* (2004) and Andersen and Kamelarczyk (2004). The lack of an equivalent standard between the asset groups makes it impossible to use them for poverty measurements or to make judgments about the desirability of situations. The asset categories do, however, provide a useful conceptual tool to get an overview of livelihood changes along different dimensions (Angelsen and Wunder 2003).

We identified indicators of change for each "asset" at three scales: household, community and national. At the household level we selected indicators to assess how the commercial production of the target species has contributed to household assets and equity within households. Effects between different stakeholder groups within a community may differ (Ashley and Hussein 2000), e.g., changes can be positive for processors and negative for extractors. It is therefore necessary to identify the stakeholder group for which the changes are assessed.[5] At the community level, indicators address the effects on overall community assets in an average community in the research area and the effects of commercial production on equity among households. When only a small percentage of people in a community can take advantage of opportunities for commercial production (see e.g.,

[3] A full discussion of the approach can be found at http://www.livelihoods.org/

[4] Adapted from Chambers, R. and G. Conway (1992) *Sustainable rural livelihoods: Practical concepts for the 21st century.* IDS Discussion Paper 296. Brighton: IDS.

[5] We focused on raw material producers.

Dove 1994), the positive effects for the community as a whole may be limited and inequity between households may increase. Table 1 presents the selected livelihood indicators on household and community level. To assess the outcomes of trade in the study area at the national level we selected the following indicators: export earnings; employment beyond community level; tax revenue; import substitution; and 'indirect results'. These outcomes depend largely on the size of the case study area.

Table 1. Livelihood indicators on the household and community level

Asset group	Indicator at household level	Indicator at community level
Natural	▪ Physical access to target resource ▪ Legal access to target resource ▪ Control over target resource/ability to exclude others ▪ Equitable access to target resource among household members	▪ Total flow of target species resource ▪ Equitable access to target species among households ▪ Total flow of other forest resources ▪ Equitable access to other forest resources among households
Physical	▪ Shelter and household possessions ▪ Ownership/access to means of transportation ▪ Ownership/access to production and processing equipment ▪ Equitable access to physical assets among household members	▪ Local infrastructure ▪ Communication facilities ▪ Equitable access to community owned physical assets among households
Human	▪ Health and nutritional status ▪ Endogenous skills ▪ Exogenous skills ▪ Access to information ▪ Empowerment of women ▪ Equitable access to social assets among household members	▪ Effective community organization ▪ Equitable access to education among households
Financial	▪ Household income level ▪ Regularizing income ▪ Household savings ▪ Access to credit ▪ Equitable access within households ▪ Safety net value	▪ Community financial resources ▪ Equitable access to community owned financial resources among households ▪ Access to income and employment opportunities outside of raw material production
Social	▪ Endogenous social resources ▪ Exogenous social resources ▪ Political power	▪ Socio-cultural cohesion among households ▪ Leverage with outside agents

The livelihood assessment is based on a ten-year time frame[6]. This is deemed sufficiently long to be able to observe changes, but short enough for the assessor to make reliable judgments of the changes based on available information.

The assessor considers the effect of commercial production of the target species (the species that was studied) on each indicator over the reference period. Since we want to know whether the outcomes of commercial NTFP production on livelihoods are positive or negative, the expert is asked to give value judgments. The guiding question is: "Did commercial production of the product lead to very negative; negative; positive; or very positive changes on the indicator, or has there been no effect?" In the livelihood assessment tool (Annex 1) the indicators are presented in three tables, one for each of the above mentioned levels of assessment. The researchers can use the tool to mark the score for each indicator using a five-point ordinal scale (Table 2). In the tables there is a column with space for a brief explanation of the score. As a general principle, indicators are marked as neutral unless there is a clear change that is attributable to the development of the NTFP trade.

Table 2. Five-point ordinal scale

-2	Strongly negative
-1	Negative
0	Neutral
1	Positive
2	Strongly Positive

Environmental indicators

The idea, still common in the literature, that increasing the trade value of NTFPs provides a sustainable and environmentally sound way of income generation is based on the assumptions that extraction does not result in depletion of the resource, and that NTFP land use provides environmental services associated with forests (Myers 1988; Nepstad and Schwartzman 1992).

We expect two major kinds of ecological impacts from the management of any biological resource. First is the impact on the species itself, with effects on population size and distribution, as well as on the genetic composition of the population due, for example, to selective harvesting, active selection, or deliberate genetic manipulation. Second is the impact on the broader ecosystem. Some of these effects come directly from the actions of harvesting and management. Potentially much more important are the results of decisions about overall land-use. One of the arguments for attention to NTFPs has been that they (collectively or individually) provide a flow of benefits sufficiently large to justify maintaining forest cover. If the benefits to forest management are more than the benefits of converting the forest to agriculture, there will be important ecosystem level conservation benefits (Evans 1993). Following this reasoning the promotion of commercial extraction of NTFPs, aimed to offer an alternative for destructive land uses such as logging and cattle ranching, has become a widely accepted conservation strategy (Ticktin 2004).

To address the above mentioned assumptions, we selected indicators to assess the sustainability of extraction, the environmental functions of the NTFP land use, and the importance of the product for people's land use choice. Environmental indicators need to address different spatial scales, because ecosystem properties differ at different scales (Allen and Hoekstra 1992; Hoekstra *et al.* 1991) and outcomes of management can diverge between scales (Gottret and White 2001, Ticktin 2004). We selected indicators at four levels. The 'target species population level' refers to the population of NTFP-species on which the case study has focused in the study area. The 'land use ecosystem level' refers to the zone within the study area in which the NTFP target species is produced. This can for example be a certain area of secondary forest, or the area in the study site that is covered with agroforest gardens. The 'regional landscape level' refers to the whole study area, generally encompassing a mosaic of land uses, including settlements, agricultural lands and forested lands. On the global level we assess whether the case has global significance in terms of conserving or threatening globally endangered species and rare ecosystems. The selected indicators for each level are presented in Table 3.[7]

[6] We used a reference period between 1990 and 2000, though some cases varied by a couple of years in either direction.

[7] We initially included changes in demographic processes (mortality, recruitment) and genetics (diversity and in-out breeding) on the target species level, and changes in carbon sequestration potential on the land use ecosystem level. These indicators were later omitted, as it was found that

Table 3. Environmental indicators

Level	Indicators
Target species population	▪ Changes in population size (abundance, frequency, biomass) ▪ Changes in distribution (range) ▪ Changes in population structure (sex and age ratio)
Land use ecosystem	▪ Changes in forest species diversity ▪ Changes in soil structure ▪ Changes in soil pollution levels
Regional landscape	▪ Role as a reservoir of forest species ▪ Role as a biodiversity corridor ▪ Role on erosion control and hydrology ▪ Role on pollution
Global	▪ Contribution to endangered species conservation ▪ Contribution to conservation of rare ecosystems

At the population and land use ecosystem level, we compare the current situation with two hypothetical alternatives:

1) Current situation versus mature natural[8] forest: If the land was not being managed as it currently is, it could (theoretically at least) be under natural forest. At the population level the comparison provides an indication of how size, range and structure of the current population in the study area differ from the naturally occurring population. At the level of the land use ecosystem we compare environmental functions of the present NTFP-land use ecosystem with those in natural forest. This enables us to address to what extent the NTFP land use system provides functions that are comparable to natural forest.
2) Current situation versus 'most likely land use alternative': The most likely land use alternative is the land use that would most likely occur if the NTFP target species would not have monetary value. Often alternatives already exist in the regional landscape, and the most realistic one is the land use system that would be most attractive to the relevant decision maker. Here the NTFP production system will have an impact *if and only if* the value of the product is enough to influence the choice of land use. Thus, if the NTFP use is irrelevant to the land use choice, the most likely alternative will be the same as the current use. The comparison allows us to address the assumption that the monetary value can prevent conversion to other land uses that are less environmental friendly.

The tool to assess the environmental outcomes (Annex 2) has a table for each of the four levels of analysis, and uses the same 5-point ordinal scale as the livelihood assessment tool. The tables for the population and ecosystem levels are divided in two parts. In the first part (section A) the researcher compares the indicator in the current situation, with the same indicator in the hypothetical situation of a natural forest (typical to the area). For example, when a product is cultivated in monoculture plantations, the size of the population may be much larger in the current situation as compared to the natural forest. The score for the indicator "change in population size" would thus be very positive. In the second part (section B), the researcher compares the current situation with the most likely land use alternative. For example, the score is very positive when the size of the population in the current situation (forest product plantation) is much larger than in the most likely land use alternative (cultivation of another product).

At the regional landscape and global level environmental features of a NTFP management system can be directly valued so we do not compare with alternative scenarios. At the landscape level we assess whether the NTFP land use has a significant impact on environmental conditions of the study area. For example, the outcome for the indicator 'reservoir of forest species' is positive when the NTFP land use system harbors a considerable part of the biodiversity in the study area and the NTFP land use does not threaten its function as reservoir for forest species. At the global level we assess the global implications of the individual case[9]. The outcome is negative when the NTFP land use threatens an endangered species. The outcome is positive if the NTFP land use contributes to the maintenance or increase of endangered species.

many case researchers had difficulties assessing these changes.

[8] With natural we mean non-planted.

[9] We do not extrapolate from the individual case to a larger scale. The outcomes may therefore depend on the size of the study area.

We assess the impact of the NTFP land use on endangered species that occur in the NTFP production area and also in the surrounding ecosystems.[10]

Implementation

The assessment is done by the case researchers themselves. Ideally, this should be done as a group exercise, with researchers assessing their own cases and discussing the process and the results, to facilitate consistent interpretation and scoring of the indicators. When group implementation is not possible, case researchers can use the guidelines (Annex 3 and 4), in which we spell out a guiding question for each indicator. The guidelines also provide examples of positive and negative outcomes to aid interpretation and to help maintain consistency. When all assessments are implemented, the complete data set should be checked for internal consistency, and ambiguous scores can be re-checked with the case researchers.

Weighting

Individually, the indicators show the direction and the degree of change for the multiple aspects of livelihoods and ecological change associated with the commercial forest product trade. In the absence of a compelling or theoretically sound argument to the contrary, we have chosen to assign equal weight to each indicator and to each asset category. We are interested in the multidimensional aspects of the outcomes of NTFP trade. As outside assessors, we are not competent to weigh the relative importance of different aspects of livelihood changes (this would have to involve the stakeholder group) and therefore we do not aim to subsume all aspects of people's livelihood changes into one value.

Limitations

Livelihood and environmental changes take place in complex contexts, influenced by interventions, trends, events, available resources, institutional processes, and organizational structures. Identifying the exact weight of different factors contributing to a certain change is virtually impossible as it is often unclear how outcomes are directly or indirectly related to which factors (Ashley and Hussein 2000). Using indicators on higher levels (e.g., regional, national or international level) it becomes even more difficult to identify relationships (Rigby 2000).

To assess livelihood outcomes we ask case researchers to identify causal relations between commercial production and changes on indicators. On this level of analysis (per case, per indicator), causality is thus attributed through interpretation of case researchers (expert judgment). Here we assume that each researcher has a good sense of how production, processing and marketing of the NTFP affected different aspects of livelihoods in his or her case. The scoring is only as good as the expert's knowledge and judgment, and our ability to give the assessor a clear understanding of the extremes of the scale. On a higher level of analysis, when grouping different indicators and cases, we will be able to identify relations, but it will be more difficult to attribute causality.

Value judgment is subjective and there may be biases in scoring, for example related to the professional background of the case researcher. Implementation in groups helps to reduce biases and to harmonize assessment criteria. And, a large enough data set will allow good comparability of general changes as a result of commercial production.

Final remark

We aimed to select an easy-to-use and small set of indicators for assessing livelihood and environmental changes by researchers. During the selection process, much discussion took place, with a wide range of scientists. The selection presented in this document is the result of these discussions – sometimes a compromise of different views. The final selection suited our objectives, time- and resource availability. Although any assessment will require indicator selection adapted to the objectives and resources of the study, we hope the method presented here provides an example that can be useful for the design of other studies. We would like to encourage ongoing discussion to refine and sharpen the method. [Correspondence: k.kusters@cgiar.org]

[10] This poses a potential scoring dilemma, as a NTFP land use ecosystem may harbor endangered species, while expansion of this NTFP land use ecosystem at the expense of natural forest may threaten (other) endangered species. Where this was the case we addressed the outcome for the land use ecosystem only.

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ANNEX 1 – LIVELIHOOD OUTCOMES ASSESSMENT TOOL

I. HOUSEHOLD LEVEL

		-2	-1	0	1	2	Explanation
1. Natural assets	a. Access to target resource by HH (physical)						
	b. Access to target resource by HH (rights)						
	c. Control over target resource / ability to exclude others						
	d. Equitable access to target resource within HH						
2. Physical assets	a. Shelter and household possessions						
	b. Means of transportation						
	c. Ownership/access to production and processing equipment						
	d. Equitable access within HH						
3. Human assets	a. Health and nutritional status						
	b. Endogenous skills						
	c. Exogenous skills						
	d. Access to information						
	e. Empowerment of Women						
	f. Equitable access within HH						
4. Financial assets	a. Household income level						
	b. Regularizing income						
	c. Household savings						
	d. Access to credit						
	e. Safety net value						
	f. Equitable access within HH						
5. Social assets	a. Endogenous social resources						
	b. Exogenous social resources						
	c. Political Power						

II. COMMUNITY LEVEL

		-2	-1	0	1	2	Explanation
1. Natural assets	a. Total flow of target species resource						
	b. Equitable access to target species						
	c. Total flow of other forest resources						
	d. Equitable access to other forest resources						
2. Physical assets	a. Local infrastructure						
	b. Communications						
	c. Equitable access among HH						
3. Human assets	a. Equitable access to education						
	b. Effective community organization						
4. Financial assets	a. Community financial resources						
	b. Equitable access to community financial resources						
	c. Income and employment outside of raw material production						
5. Social assets	a. Socio-cultural cohesion						
	b. Leverage with outside agents						

III. NATIONAL LEVEL

	-2	-1	0	1	2	Explanation
a. Export Earnings						
b. Employment Generation (beyond community level)						
c. Tax revenue						
d. Import substitution						
e. Indirect results						

ANNEX 2 – ENVIRONMENTAL OUTCOMES ASSESSMENT TOOL

I. TARGET SPECIES POPULATION LEVEL

A. Local population versus natural forest

	-2	**-1**	**0**	**1**	**2**	Explanation
a. Changes in population size (abundance, frequency, biomass)						
b. Changes in distribution (range)						
c. Changes in population structure (sex and age ratio)						

B. Local population versus most likely land use

	-2	**-1**	**0**	**1**	**2**	Explanation
a. Changes in population size (abundance, frequency, biomass)						
b. Changes in distribution (range)						
c. Changes in population structure (sex and age ratio)						

Describe here the most likely land use alternative

II. LAND USE ECOSYSTEM LEVEL

A. NTFP land use versus natural forest

	-2	-1	0	1	2	Explanation
a. Changes in "forest species" diversity						
b. Changes in soil structure						
c. Changes in soil pollution levels (fertilizers, pesticides)						

B. NTFP land use versus most likely land use alternative

	-2	-1	0	1	2	Explanation
a. Changes in "forest species" diversity						
b. Changes in soil structure						
c. Changes in soil pollution levels (fertilizers, pesticides)						

III. REGIONAL LANDSCAPE LEVEL (the whole study area)

The role of the NTFP land use in the study area

	-2	-1	0	1	2	Explanation
a. Role as a reservoir of forest species						
b. Role as a biodiversity corridor						
c. Role on erosion control and hydrology						
d. Role on pollution						

IV. GLOBAL LEVEL

Role of NTFP land use on the global level

	-2	-1	0	1	2	Explanation
a. Contribution to rare/endangered species conservation						
b. Contribution to conservation of rare ecosystems						

ANNEX 3. GUIDING QUESTIONS AND EXAMPLES - LIVELIHOOD OUTCOMES

I. Household level

I.1. Natural assets

I.1.a. Access to target resource by household (physical)
Question: Has commercial production of the NTFP target species led to much worse (-2) worse (-1), better (+1), much better (+2) physical access by producer households to the target resource?
Example of positive outcome: Commercial production has led to planting activities.
Example of negative outcome: Commercial production has led to over-harvesting.

I.1.b. Access to target resource by household (rights)
Question: Has commercial production of the NTFP target species led to much worse (-2); worse (-1); better (+1); much better (+2) rights to access the target species by the producer households in the study area, or no impact (0)?
Example of positive outcome: Commercial harvesting of the target species made a government decide to grant official extraction rights.
Example of negative outcome: Commercial harvesting of the target species made a government decide to restrict access to the resource. Or: One group has taken control at the expense of others.

I.1.c. Control over target resource / ability to exclude others
Question: Has commercial production of the NTFP target species led to much worse (-2); worse (-1); better (+1); much better (+2) ability of producer households to exclude others from using the same resource, or no impact (0)?
Example of positive outcome: Commercial production has led to improved rights that have enabled producer households to effectively prevent 'outsiders' harvesting from the same resources.
Example of negative outcome: Higher value has attracted more outside competitors and led to a breakdown of local rules of access.

I.1.d. Equitable access to target resource within household
Question: Has commercial production of the NTFP target species resulted in much less equal (-2); less equal (-1); more equal (+1); much more equal (+2) access to the target resource among the members of producer households (men vs. women; young vs. old), or no impact (0)?
Example of negative outcome: Higher commercial value leads men to extract the resource for commercial purposes, reducing access for women, who traditionally use the same species for subsistence purposes.

I.2. Physical assets

I.2.a. Shelter and household possessions
Question: Has commercial production of the NTFP target species led to much worse (-2); worse (-1); better (+1); much better (+2) shelter and household possessions, or no impact (0)?
Example of positive outcome: Money from trade of the targets species is used to purchase material goods.

I.2.b. Means of transportation
Question: Has commercial production of the NTFP target species led to much worse (-2); worse (-1); better (+1); much better (+2) transport facilities owned/accessible by the producer households, or no impact (0)?
Example of positive outcome: Money from trade of the targets species is invested in means of transportation.

1.2.c. Ownership/access to production and processing equipment
Question: Has commercial production of the NTFP target species led to much less (-2); less (-1); increased (+1); much increased (+2) ownership/access to production and processing equipment by the producer households, or no impact (0)?
Example of positive outcome: With money from trade of the targets species, households buy processing equipment.
Example of negative outcome: With increased trade, a local processor has started to charge producer households for making use of processing equipment, while before the processing facility could be used for free.

I.2.d. Equitable access within household
Question: Has commercial production of the NTFP target species led to much less equal (-2); less equal (-1); more equal (+1); much more equal (+2) access to physical assets (household possessions, transport facilities, production/processing equipment) among the members of the producer households, or no impact (0)?

I.3. Human assets

I.3.a. Health and nutritional status
Question: Has commercial production of the NTFP target species led to much worse (-2); worse (-1); better (+1); much better (+2) health and nutritional status of the producer households, or no impact (0)?
Example of positive outcome: Able to buy more and/or better food.
Example of negative outcome: Loss of access has led to reduced use of important subsistence products.

I.3.b. Endogenous skills
Here we are interested in the traditional knowledge and skills that have been passed on from generation to generation.
Question: Has commercial production of the target species led to much decreased (-2); decreased (-1); improved (+1); much improved (+2) local knowledge, or no impact (0)?
Example of positive outcome: As result of increased trade, producers are increasingly taking up traditional methods. Or: Local knowledge has gained greater recognition and prestige.
Example of negative outcome: As result of increased trade, producers have started taking up modern techniques and traditional techniques are eroding.

I.3.c. Exogenous skills
Exogenous skills are non-traditional skills, for example coming from formal education.
Question: Has commercial production of the NTFP target species led to much less (-2); less (-1); more (+1); much more (+2) exogenous skills of producer households, or no impact (0)?
Example of positive outcome: Increased trade has attracted extension services providing 'modern' knowledge to producers. Or: Earnings are used to pay school fees and send children to town for school.
Example of negative outcome: Commercial production has caused a boom, and producer households take their children from school, so they can participate in harvest/trade related activities.

I.3.d. Access to information
Information can come from radio, television, schooling, training programs, regular contacts with traders, etc.
Question: Has commercial production of the NTFP target species led to much less (-2); less (-1); improved (+1); much improved (+2) access to information by the producer households, or no impact (0)?
Example of positive outcome: As result of commercialization, more urban traders have started to come to the village, they are a source of information to the households.
Example of negative outcome: The market gets less transparent, and producers know now less about market prices than before.

I.3.e. Empowerment of women
Empowerment can broadly be defined as 'the expansion of freedom of choice and action'.
Question: Has commercial production of the NTFP target species led to much reduced (-2); reduced (-1); increased (+1); much increased (+2) freedom of choice and action of women, or no impact (0)?
Example of positive outcome: Women have more income from the participation in trade, increasing there options, and giving them greater control over the circumstances of their lives.
Example of negative outcome: Women marginalize as men take control of NTFP production.

I.3.f. Equitable access within households
Question: Has commercial production of the NTFP target species led to much less equal (-2); less equal (-1); more equal (+1); much more equal (+2) access to social assets (skills, knowledge, ability to work and good health) among the members of the producer households, or no impact (0)?
Example of positive outcome: Commercial production has increased household cash income, which is used to send girls to school, while before girls were kept home.
Example of negative outcome: With increased harvesting, girls are taken of school, to work in processing activities.

I.4. Financial assets

I.4.a. Household income level
Question: Has commercial production of the NTFP target species led to much reduced (-2); reduced (-1); increased (+1); much increased (+2) cash income for the producer households or no impact (0)?
Example of negative outcome: A boom in NTFP trade resulted in other income earning activities (e.g. farming) being neglected, which led to

decrease in income when the NTFP trade collapsed.

I.4.b. Regularizing income
We are interested to know whether commercial NTFP production has led to a more equal distribution of income over the whole year.
Question: Has commercial production of the NTFP target species led to a much less (2); less (-1); more (+1); much more (+2) regular income over the year, or no impact (0)?
Example of positive outcome: Commercial production has increased people's income in a season during which income earning opportunities used to be scarce.

I.4.c. Household savings
Question: Has commercial production of the NTFP target species led to much reduced (-2); reduced (-1); increased (+1); much increased (+2) household savings, or no impact (0)?

I.4.d. Access to credit
Question: Has commercial production of the NTFP target species led to much reduced (-2); reduced (-1); increased (+1); much increased (+2) access to credit by producer households, or no impact (0)?
Example of positive outcome: Earning expectations are higher so creditors are more willing to loan to producers.

I.4.e. Safety net value
When producers turn to the NTFP in times of hardship they may earn less than before, but the NTFP ensures survival. NTFP trade may for example give households a means to earn income in the face of few alternatives.
Question: Has commercial production of the NTFP target species led to much reduced (-2); reduced (-1); increased (+1); much increased (+2) value for the producer households as a 'safety net', or no impact (0)?
Example of positive outcome: Selling the NTFP has become more important as a source of income in times of need.
Example of negative outcome: The village elite have taken control over the production and trade of the species, limiting the possibilities of poor villagers to sell the product in times of need.

1.4.f. Equitable access within households
Question: Has commercial production of the NTFP target species led to much less equal (-2); less equal (-1); more equal (+1); much more equal (+2) access to financial assets among the members of the producer households, or no impact (0)?
Example of positive outcome: Women dominate NTFP trade, increasing their access to financial resources.
Example of negative outcome: The target species used to be an important source of cash income for women, but, with increased trade value, men have taken control.

I.5. Social assets

I.5.a. Endogenous social resources
With endogenous social resources on the household level we refer to factors such as cohesion (bonding/unity) and confidence among the household members.
Question: Has commercial production of the NTFP target species led to much less (-2); less (-1); more (+1); much more (+2) social cohesion and confidence between the household members, or no impact (0)?
Example of positive outcome: Commercial production has led to increased and more stable family income, which has improved the stability of relations amongst household members.
Example of negative outcome: Increased income earned by men with NTFP trade has led to drinking and/or gambling behavior that has disrupted the relations between household members.

I.5.b. Exogenous social resources
With exogenous social resources on the household level we refer to factors such as contacts with the 'outside world' (e.g. traders) and bargaining power.
Question: Has commercial production of the target species led to much decreased (-2); decreased (-1); increased (+1); much increased (+2) exogenous social resources of the producer households, or no impact (0)?
Example of positive outcome: Experience and contacts in trading are translated into more success in other trading activities.

I.5.c. Political power
Question: Has commercial production of the NTFP target species led to much less (-2); less (-1); more (+1); much more (+2) political power of producer households, or no impact (0)?
Example of positive outcome: Commercial production has stimulated organization of producer households and increased their local political activities and power.

II. Community level

II.1. Natural assets

II.1.a. Total flow of target species resource
Question: Has commercial production of the NTFP target species led to much reduced (-2); reduced (-1); increased (+1); much increased (+2) flow of target species to the community, or no impact (0)?
Example of positive outcome: A group of people within the community starts to plant the resource resulting in an increasing stock of the target resource. The total flow of the target resource to the community increases, so the outcome is positive. This indicator does not take into account equity between households. Thus, when the total flow increases, but certain groups within the community are left out (loosing access to the resource), the outcome is still positive. Aspects of equity are captured with indicator II.1.b.
Example of negative income: The resource is over harvested, reducing the total flow to the community.
Example of negative income: An actor from outside the community is claiming the resource, which is effectively reducing the flow of the resource to the community. Thus, it is theoretically possible that the target resource stock increases (e.g., when the outside actor starts to plant the resource), but the outcome is negative, because the flow to the community decreases.

II.1.b. Equitable access to the target species
Question: Has commercial production of the NTFP target species led to much less equal (-2); less equal (-1); more equal (+1); much more equal (+2); access to the target species among households of the community, or no impact (0)?

II.1.c. Total flow of other forest resources to community
This indicator refers to general forest resources.
Question: Has commercial production of the NTFP target species led to much reduced (-2); reduced (-1); increased (+1); much increased (+2) flow of other forest resources to the community, or no impact (0)?
Example of positive outcome: When harvesters go out to harvest the target resource but make use of the opportunity to collect other forest resources as well, increased harvesting activities of the target species may lead to an increasing the flow of other forest products to the community as well.
Example of positive outcome: Increased trade of the product has stimulated people to plant trees in their farms, and the area is gradually transformed into agroforest gardens that include naturally occurring useful forest products. The flow of forest products to the community is increasing.
Example of negative outcome: When increased trade value of the target species leads an outside actor to claim the forest land, limiting the possibilities of the community to access forest resources.
Example of negative outcome: Increased trade of the target species leads people to transform the forest into a plantation of the target species, decreasing the flow of other forest products to the community.

II.1.d. Equitable access to forest resources
This indicator refers to general forest resources.
Question: Has commercial production of the NTFP target species resulted in much less equal (-2); less equal (-1); more equal (+1); much more equal (+2); access to natural resources among households of the community, or no impact (0)?
Example of negative outcome: Some households have effectively claimed exclusive access to a forest area to extract the target species, hereby limiting the possibilities for other households to gather other forest products.

II.2. Physical assets

II.2.a. Local infrastructure
Local infrastructure encompasses roads, clinics, schools, water and sanitation facilities, etc.
Question: Has commercial production of the NTFP target species led to much worsened (-2); worsened (-1); improved (+1); much improved (+2) local infrastructure, or no impact (0)?
Example of positive outcome: Revenues from the trade have been used to build a community hall.

II.2.b. Communications
Here we refer to community communication facilities, such as village radio transmitters, but also to possibilities for people to have contact with the outside world, for example by improved public transportation.
Question: Has commercial production of the NTFP target species led to much worse (-2); worse (-1); better (+1); much better (+2) communication facilities on the community level, or no impact (0)?

II.2.c. Equitable access among households
Question: Has commercial production of the NTFP target species led to much less equal (-2); less equal (-1); more equal (+1); much more equal (+2) access to physical assets (infrastructure, communications) among households, or no impact?

II.3. Human assets

II.3.a. Equitable access to education
Question: Has commercial production of the NTFP target species led to much less equal (-2); less equal (-1); more equal (+1); much more equal (+2) access to education among households in the study area, or no impact (0)?
Example of positive outcome: Poor household have gained access to education because they have more money or because community resources are used to subsidize education.
Example of negative outcome: Capture of resource by elite leaves poor worse off, limiting their possibilities to send children to school.

II.3.b. Effective community organization
Question: Has commercial production of the NTFP target species led to much less effective (-2); less effective (-1); more effective (+1); much more effective (+2) community organization?
Example of positive outcome: Commercial production has led to producers organizing themselves, which has contributed positively to overall community organization.
Example of negative outcome: Competition and rivalry have eroded local organization.

II.4. Financial assets

'Community financial resources' are the financial resources that are owned by the community (for example in the local government's treasury), this is *not* the sum of the individual households.

II.4.a. Community financial resources
Question: Has commercial production of the NTFP target species led to much less (-2); less (-1); more (+1); much more (+2) financial community resources, or no impact (0)?

II.4.b. Equitable access to community financial resources
Question: Has commercial production of the NTFP target species led to much less equal (-2); less equal (-1); more equal (+1); much more equal (+2) access to financial community resources among households, or no impact (0)?

II.4.c. Access to income and employment opportunities outside of raw material production
This relates to the possibilities for people in the community to earn cash income with activities other than selling the unprocessed target species that may have increased (or decreased) as the result of commercial production of the target species.
Question: Has commercial production of the NTFP target species led to much less (-2); less (-1), more (+1); much more (+2) other sources of cash income in the community, or no impact (0)?
Example of positive outcome: The raw material producers are not selling the raw material directly anymore, but have started to process the raw material into semi finished products.
Example of positive income: A group of craftsmen in the community are now processing the target species into handicrafts.
Example of positive outcome: Increased trade is providing traders in the community with additional income.

II.5. Social assets

II.5.a. Socio-cultural cohesion
Socio-cultural cohesion refers to the bond and feeling of unity among the households of the community.
Question: Has commercial production of the NTFP target species led to much less (-2); less (-1); more (+1); much more (+2) socio-cultural cohesion among households of the community, or no impact (0)?

II.5.b. Leverage with outside agents (power)
This refers to the weight / influence that the community has when dealing with outside agents such as regional politicians or traders.
Question: Has commercial production of the NTFP target species led to much less (-2); less (-1); more (+1); much more (+2) leverage of the community, or no impact (0)?
Example of positive outcome: Through NTFP trade the community has become more affluent and better organized and as such has become a more powerful community that politicians and traders cannot neglect.

III. National level

III.a. Export Earnings
Question: Has commercial production of the NTFP target species in the study area led to much less (-2); less (-1); more (+1); much more (+2)

export earnings on the national level, or no impact (0)?

III.b. Employment Generation (beyond community level)
Question: Has commercial production of the NTFP target species in the study area led to a huge loss of employment (-2); some loss of employment (-1); some employment generation (+1); huge employment generation (+2) on the

III.d. Import substitution
Question: Has commercial production of the NTFP target species in the study area led to much increased (-2); increased (-1); reduced (+1); much reduced (+2) national imports, or no impact (0)?
Example of positive outcome: Commercial production of medicinal products reduces the need to import expensive pharmaceuticals.

Example of negative outcome: Commercial production has led over harvesting, and over harvesting *in the study area* has led to decreased national supply of a raw material, which has increased the national imports of the raw material.

national level (*beyond* the community level), or no impact (0)?

III.c. Tax revenue
Question: Has commercial production of the NTFP target species in the study area led to much less (-2); less (-1); more (+1); much more (+2) tax revenues on the national level, or no impact (0)?

III.e. Indirect results
Indirect results encompass the changes that are significant on the national level, and which are not yet captured under the previous indicators. An example provided by a case researcher is the positive effect of the woodcarving industry in the study area in stimulating tourism on the national level.

Question: Has commercial production of the NTFP target species in the study area had very negative (-2); negative (-1); positive (+1); very positive (+2) indirect results on the national level, or no impact?

ANNEX 4. GUIDING QUESTIONS AND EXAMPLES - ENVIRONMENTAL OUTCOMES

I. Local population level

I.a. Changes in population size
Question: Is the population size of the target species in the current situation in the case study area much larger (+2); larger (+1); the same (0); smaller (-1); much smaller (-2) if compared with (A) the area as natural forest and (B) the area under most likely alternative land use?

I.b. Changes in distribution (range)
Question: Is the distribution of the target species (the extent of the area in which the species occurs) in the current situation in the case study area much wider (+2); wider (+1); the same (0); narrower (-1); or much narrower (-2) if compared with (A) the area as natural forest and (B) the area under most likely alternative land use?
Note: Many cases will score neutral here; a positive or negative impact should only be recorded if the difference is clear and obvious.

I.c. Changes in population structure
Here the population structure (sex and age ratio) of the natural forest is used as benchmark, thus, when comparing the situation with the natural forest, positive outcomes are not possible.

A) Comparing with natural forest: Question: Is the population structure (sex and age ratio) of the NTFP species in the research area now very different (-2); different (-1); or the same (0) than the population structure would be in the natural forest

B) Comparing with most likely land use alternative: Question: Is the population structure (sex and age ratio) of the NTFP species in the research area now much less balanced (-2); less balanced (-1); the same (0); more balanced (+1); much more balanced (+2) than the population structure would be in the most likely land use scenario?

II. Land use ecosystem

II.a. Changes in "forest species" diversity
Question: Is the diversity of forest species in the present NTFP land use ecosystem in the study area much larger (+2); larger (+1); the same (0); smaller (-1); or much smaller (-2) if compared with (A) the area as natural forest and (B) the area under most likely alternative land use?
Note: Though the diversity of the land use ecosystem will generally be smaller than the diversity in the natural forest, the land use ecosystem can, in theory at least, have higher forest species diversity than primary forest, e.g., a fallow with high variety of pioneer species.

II.b. Changes in soil structure
Changes in soil structure and properties can have a positive or negative impact on growth, risk of erosion, water retention and water flows.
Question: Is the soil structure in the present NTFP land use ecosystem in the study area
much better (+2); better (+1); neutral (0); worse (-1); much worse (-2) if compared with (A) the area as natural forest and (B) the area under most likely alternative land use?

II.c. Changes in soil pollution levels
With soil pollution we mean pollution resulting from the use of pesticides and excessive use of fertilizers.
Question: Is the level of soil pollution in the present NTFP land use ecosystem in the study area much lower (+2); lower (+1); the same (0); higher (-1); much higher (-2) if compared with (A) the area as natural forest and (B) the area under most likely alternative land use?

III. Regional landscape level

III.a Role as a reservoir of forest species
Question: Does the NTFP land use have a very positive (+2); positive (+1); neutral (0); negative (-1); very negative (-2) effect on the availability of forest species in the study area?
Note: If the NTFP land use ecosystem represents a significant part of the forest species population in the landscape (study area) and the NTFP land use does not compromise its function as a reservoir of forest species, the outcome is positive. If the NTFP land use ecosystem does not represent a significant part of the population of forest species in the study area, the outcome is neutral. If the NTFP land use ecosystem does represent a significant part of the forest species population in the landscape (study area), but the

NTFP land use threatens its function as a reservoir of forest species, the outcome is negative.

III.b. Role as a biodiversity corridor.
Question: Does the NTFP land use have a very positive (+2); positive (+1); neutral (0); negative (-1); very negative (-2) role in providing corridors in the study area?

For example, if the NTFP production ecosystem represents forested corridors allowing the migration of forest species between natural forest areas, and the NTFP land use does not compromise this function, the outcome will be positive. If the NTFP production ecosystem is an intensive plantation system separating natural forest areas, the outcome will we assessed as negative. If the NTFP production ecosystem is not spatially linked to natural forest areas, the outcome will be neutral.

III.c. Role on erosion control and hydrology
Question: Does the NTFP land use have a very positive (+2); positive (+1); neutral (0); negative (-1); very negative (-2) role on erosion control and hydrology in the study area?

III.d. Role on pollution
Question: Does the NTFP land use have a very positive (+2); positive (+1); neutral (0); negative (-1); very negative (-2) role in terms of pollution in the study area?

IV. Global level

IV.a. Contribution to endangered species conservation
Question: Does NTFP land use have a very positive (+2); positive (+1); neutral (0); negative (-1); very negative (-2) effect on endangered species conservation?

Note: The outcome is neutral if there are no endangered species in the NTFP land use ecosystem. The outcome is negative if the NTFP land use contributes to the disappearance of endangered species. The outcome is positive if the NTFP land use ecosystem maintains endangered species, and the NTFP land use does not threaten the availability. If the NTFP land use ecosystem *effectively* functions as a buffer zone, protecting a neighboring ecosystem that harbors endangered species, the outcome is positive as well. When the NTFP land use harbors endangered species, while expansion of the NTFP land use ecosystem at the expense of natural forest threatens (other) endangered species, we address the NTFP land use ecosystem only. In this case the outcome would thus be positive.

IV.b. Contribution to conservation of rare ecosystems
Question: Does NTFP land use have a very positive (+2); positive (+1); neutral (0); negative (-1); very negative (-2) effect on conservation of a rare ecosystem?

Note: The outcome is negative if the NTFP land use contributes to the disappearance of a rare ecosystem. The outcome is positive if the NTFP land use ecosystem is a rare ecosystem itself, and the NTFP land use does not threaten it. If the NTFP land use ecosystem *effectively* functions as a buffer zone, protecting a neighboring ecosystem that is rare, the outcome is positive as well.


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