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## Learning to select and apply qualitative and participatory methods in natural resource management research: self-critical assessment of research in Cameroon

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### ABSTRACT

Biophysical scientists are increasingly interested in undertaking research on natural resources management from a social science perspective. This, however, requires at least a basic understanding of the different social science approaches and the philosophical perspectives underlying them. We present a meta-analysis of a researcher's experience when applying qualitative and participatory research methods for the first time, and reflect on the challenges and lessons learned that could help other aspiring researchers in conducting research with such methods. We compare researcher's experiences with a quantitative research tool (household surveys) and qualitative non-participatory (focus group discussions) and participatory tools (seasonal activity calendars and access and control matrices) used in a gender-responsive forestry study in Cameroon. The field research included almost 50 gender- and age-disaggregated group sessions. Based on the meta-analysis of the research process, we identified key factors affecting the perceived ease of eliciting and interpreting information with different types of social research tools: specificity and acceptance of a tool, ease of managing social dynamics and maintaining focus during data collection, and subjectivity and comparability during data analysis and interpretation. Developing skills in participatory research from research design to group facilitation and balanced interpretation of findings require considerable time and is often best learned through apprenticeship. We explore how experience gained through the use of participatory research tools and reflection will help in applying such tools better, improving interaction with research participants and increasing relevance of research results.

### KEYWORDS

Gender; natural resource management; participatory research methods; household surveys; focus group discussions; interdisciplinary research; research design

## Introduction

Researchers working on natural resource management issues in human-influenced landscapes need to be able to elicit both biophysical and socio-economic information and to

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explore the interaction between these realms to identify appropriate management options (Mascia et al. 2003). However, many researchers studying these multi-dimensional issues are trained in a single discipline and as such, lack skills and experience across disciplines in meaningfully studying the nexus between the different realms.

In biophysical research, it is common to adopt a realist ontology; the philosophy that a single reality exists independent of human experience and that it can be studied and understood as a 'truth'. This ontological position favours knowledge creation through testing hypotheses, perceiving stakeholders as providers of factual information, and using extractive tools. Such approaches are commonly associated with a positivist theoretical perspective according to which reality is what can be seen, touched, smelt or otherwise observed through sensory experience, and that it can be studied through rigorous scientific observation (Gray 2013). In contrast, social science research often adheres to more relativist ontologies according to which multiple realities exist. Knowledge is considered to be socially constructed: who we are and our perspectives influence the way we come to know the world (Moon & Blackman 2014). Inquiry is often based on broad, guiding questions and stakeholders are engaged in sense-making, developing research objectives and learning, rather than simply in providing information.

Different research paradigms can be complementary in studying complex issues, but an overtly positivist perspective can make it difficult to consider different types of knowledge relevant to natural resource management. This may result in narrowly formulated objectives and research questions, inappropriate research design, misleading results and their misinterpretation, limiting the overall relevance of the research (Moon & Blackman 2014). In some cases, the recommendations arising from such research can even be counterproductive – for example, they may fail to recognize the interests and needs of marginalized groups and may unintentionally restrict the rights of these groups to the resources they depend on for their livelihoods (Meinzen-Dick et al. 2011).

Participatory research methods have become popular with researchers working on poverty alleviation, sustainable rural development and social change (Lynam et al. 2007). In participatory research, the goal of the study and the research questions are developed out of the convergence of science and practice, and in best cases, both domains benefit from the research process (Bergold & Thomas 2012). When designed to be gender-responsive and used appropriately, participatory methods can increase research relevance, coverage and quality, and give voice to marginalized groups such as women and ethnic minorities (Probst et al. 2003). Participatory methods can contribute to empowering women and men – increasing their feelings of confidence, self-efficacy and self-esteem – by helping them analyse problems, understand their causes and find solutions (Tripathi & Bhattarya 2004). Such methods can also improve the sense of unity and stimulate community members to advocate together for their collective needs (Probst et al. 2003; Hegde et al., *forthcoming*).

Doing participatory and gender-responsive research is much more than just inviting men and women to participate in group sessions on predefined topics. Both social norms and practical reasons can restrict the participation of especially marginalized groups in research activities, which calls for attention to the many forms of social segregation (Mosse 1994). Time, effort and skills are required to identify stakeholders, build rapport, get representation from selected social groups and find suitable ways of organizing them into groups of participants for the research purposes. For example, traditional knowledge on shea ethno-varieties in Burkina Faso was studied among groups segregated by gender, ethnicity and

migration status but not age (Karambiri et al., [forthcoming](#)), given that younger men and women typically have more limited traditional knowledge than elderly members of community (Faridah et al., [forthcoming](#)). In Karnataka, India, participatory exercises in groups segregated by gender but of mixed caste successfully fostered recognition for the extensive knowledge of the members of indigenous communities and created a shared sense of responsibility for the forest resources surrounding the communities (Hegde et al., [forthcoming](#)).

Projects aimed at improving natural resource management and conservation increasingly recognize the need to consider socio-economic and cultural perspectives and how these shape management objectives and outcomes (Balmford & Cowling 2006). This is especially true in rural areas in lower income countries where people's dependency on natural resources is often particularly high (Barbier 2007) and where tensions exist between immediate livelihood needs and sustainable resource use over the longer term (Engel & Korf 2005). In fact, many research-for-development projects on natural resource management are specifically formulated to help resolve some of the issues related to these conflicting interests. The repertoire of social research methods used to study natural resource management processes is expanding, with more and more researchers complementing household surveys and key informant interviews with other methods and tools, often including participatory methods (Johnson et al. 2004). Nevertheless, the scientific quality and practical relevance of many such research projects continue to be limited by the researchers' lack of experience and skills in using social research methods (Moon & Blackman 2014). Difficulties in collecting, analysing and interpreting data with these methods may discourage aspiring researchers from continuing to learn and apply such methods, especially as current scientific merit systems do not recognize failures as valuable experience.

Reflexivity – the researcher's critical self-reflection on the research process – is widely practised in social science research, particularly in feminist traditions (Nast 1994). However, it remains a rare phenomenon in research on natural resource management, despite the growing integration of social research methods in such research (as an exception, see Mendis-Millard & Reed 2007). Reflexivity requires challenging conventional ideals of science that favour professional distance, objectivity and generalization over engagement, subjectivity and context-specificity (Moon & Blackman 2014). It can be a particularly useful albeit challenging exercise for researchers with a background in biophysical sciences, who may have rarely questioned their research philosophy and the diversity of theoretical perspectives before venturing into social science research.

Here, we present a reflection of the challenges encountered and lessons learned when learning to select and apply qualitative research methods in research on natural resources management. The study is a meta-analysis of the field research methodology (as opposed to the actual research findings) that was applied in the first author's (hereafter *researcher*) year-long study in five communities in Cameroon, where she used focus group discussions (FGD) and participatory research tools for the first time. The study was designed to provide complementary information on gendered knowledge and priorities in forest resource management for a broader research-for-development project that aimed to help reconcile the needs of logging companies and forest-dependent communities but where gender issues had been insufficiently considered in the initial research design. In our meta-analysis, we address the following research questions: (i) what factors affect the perceived ease of eliciting and interpreting information on local men's and women's knowledge, priorities and needs

in forest resource use when using different types of social research tools (hereafter referred to as *ease of conducting research*), and (ii) what approaches and skills helped or would have helped to conduct the research when introducing the tools for the first time.

## Methodology

### *Purpose and context of the study*

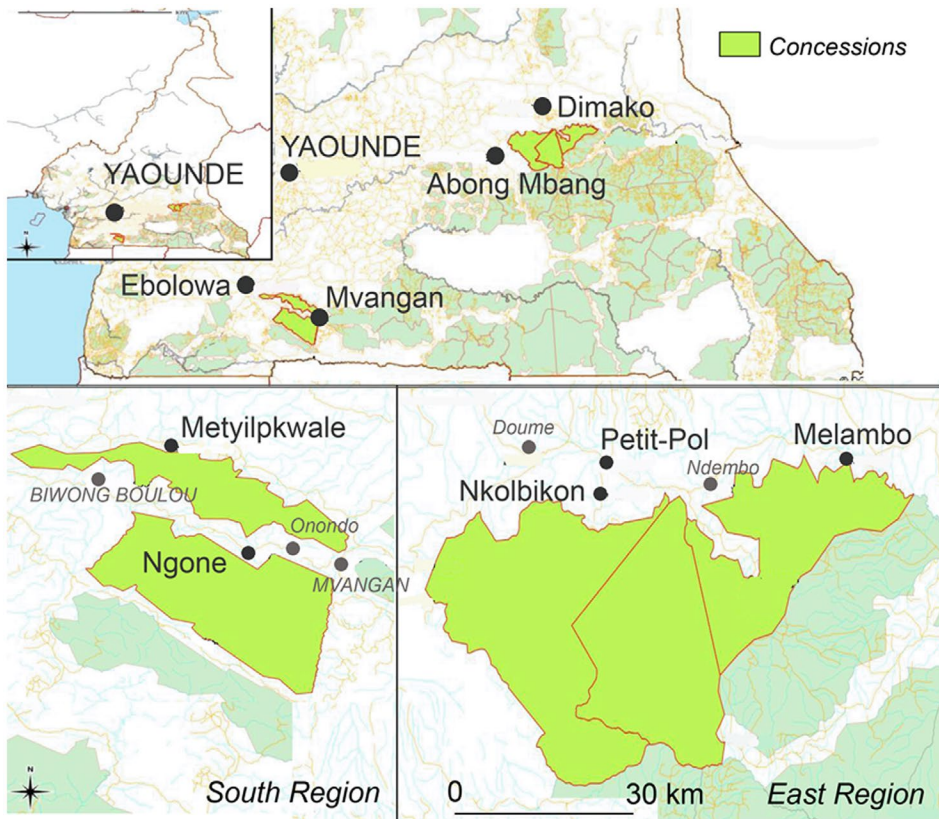
The study was conducted within the context of the project *Beyond Timber: reconciling the needs of forest-dependent people with those of the logging industry* (2013–2014). This broader project sought to help reconcile conflicts of interest between forest-dependent communities and logging companies (concessionaires) in Cameroon, Gabon and the Democratic Republic of Congo, through the development and validation of multiple-use forest management models together with both concessionaires and local community members. Most of the top 23 timber species exported in Cameroon have non-timber uses, and the timber companies are aware of the potential negative impacts of their activities on communities' livelihoods although their business is oriented towards maximizing profits. Special attention was paid on forest species that are critical to local communities for food, medicine and income, with the objective of minimizing the impacts of logging on these important resources.

Although men and women typically have different roles and priorities regarding exploitation of timber and gathering of non-timber forest products (NTFP), such gender differences were not initially considered in priority setting or targeting during project design. This omission, which is not uncommon (Johnson et al. 2004), resulted in knowledge gaps about the gendered dimensions of resource use conflicts that needed to be filled for the broader project to successfully identify effective and equitable conflict management approaches. A field study was thus implemented to gather the additional information in five of the target communities of the broader project. The study had the following objectives: (i) to identify and characterize the main subsistence and income generation activities of the local population, differentiated by gender, (ii) to assess the knowledge, skills in collection, processing, marketing and management of forest resources by men and women, and (iii) to identify the limitations faced by men and women in the collection, processing and marketing of forest resources.

The research questions and research design were developed by the *researcher*, and research participants participated as informants without decision-making power in the study. However, through the use of participatory gender-responsive tools (interactive rather than extractive methods, Rocheleau 1994), the *researcher* also intended to foster the empowerment of marginalized groups, particularly women.

### *Study site*

Research was undertaken in Cameroon from 2013 to 2014 in the vicinity of three forest concessions one in the South and two in the East Region of Cameroon (Levang et al. 2015). The study was conducted in five villages of the Beyond Timber project, located near borders of the concessions: two villages in the South (Mvila and Haut-Nyong Districts) and three in the East Region (Kadey District; Figure 1). These villages were selected based on their location (proximity to logging areas, access to roads and to markets) and composition (similar size,



**Figure 1.** Location of study sites in the East and South Regions of Cameroon.

**Table 1.** Study villages.

Region	Village	District (Sub-district)	Ethnic group	Approx. no. of inhabitants
South	Metyilpkwale	Mvila (Ebolowa II)	Bulu	350
	Ngone	Mvila (Biwong Bulu)	Bulu	700
East	Melambo	Kadey (Batouri)	Kako	500
	Petit-Pol	Haut-Nyong (Doume)	Pol	500
	Nkolbikon	Haut-Nyong (Doume)	Baka	100

different ethnic groups). In all villages, formal education for girls and boys was limited to primary school, at best (Table 1).

### Research tools

Research tools used in the study included key informant interviews, FGD and participatory tools. For this meta-analysis, we draw upon the *researcher's* experience with a subset of three qualitative research tools: FGD and the participatory tools seasonal activity calendars (SAC) and an access and control matrix (ACM). FGD aim at allowing participants, sometimes from marginalized groups of the population, to openly discuss the social questions suggested by researchers (Touré 2010). Groups are ideally composed of 6–12 members to generate an

**Table 2.** Research tools used for meta-analysis.

Tool	Type	How the tool was used	Sample size	Data collectors
Household surveys	Quantitative	Interviews with household heads, using a questionnaire with mainly closed-ended questions	20% of households in each village, total 153 respondents (136 male and 17 female)	Enumerators working on their own
Focus group discussions	Qualitative	Gender- and age-segregated groups, using interview guides	14 groups in five communities; 6–12 participants per group	One facilitator who acted as a translator when needed and a note taker
Seasonal activity calendar	Qualitative and participatory	Gender and age-segregated groups, using interview guides and visual exercises.	16 groups in five communities; 6–12 participants per group	
Access and control matrix	Qualitative and participatory	Groups reported their results back to the other groups and discussed similarities and differences in results	18 groups in five communities; 6–12 participants per group.	

interactive discussion with agreed and opposed points of view on issues. SAC are a visual method for gathering information about the patterns of seasonally varying phenomena, such as agricultural production, labour, migration or natural events over time (Brocklesby 2002). The access and control matrix tool is used to understand the differences in rights to access and control resources among social groups (Slocum 2003). ‘Access’ is defined as the ability to use a defined resource and enjoy non-subtractive benefits (Ribot & Peluso 2003), while ‘control’ includes the right to decide who can use and dispose of the resource, e.g. through sale (Ostrom 1992).

We compared the experiences with the qualitative tools with a fourth, quantitative and non-participatory tool – structured household survey (HH survey). These surveys had been conducted as part of the Beyond Timber project, with the *researcher* as one of the enumerators (Table 2). The *researcher* had also previously conducted household surveys from survey design to data analysis and interpretation, but this study was her first practical experience using FGDs and participatory tools. Research participants had participated in household surveys and FGDs during previous projects but this study was the first time they, too, experienced participatory research tools.

Household surveys were the first tool used in the study villages (apart from initial key informant interviews with other participants) and the other tools were sequenced based on the research questions for the field research, from identifying key livelihood activities (FGD) to assessing gendered knowledge on non-timber forest products (SAC) and problems faced by participants in collecting NTFPs (ACM). The qualitative research tools were used to yield information about gender roles on several different resource management issues, rather than to obtain a comprehensive account on a specific issue.

Research design, data collection and analysis with each of the tools are described in the results section of this article, as the *data* (source of experiences) for the meta-analysis on the research process and especially of what it is like to use participatory tools for the first time. A few selected findings with the tools are included for illustration purposes. For the meta-analysis, the *researcher* reflected critically and systematically upon the approaches and skills that helped or would have helped to collect and interpret information using the different research tools. In the analysis, the research process was divided into three phases: (i) research design, here referring to the adaptation of the selected tool for the research purpose (e.g. development of questionnaires or guides), (ii) data collection (facilitation or enumeration)

and (iii) analysis and interpretation of results. The reflective process was guided by a set of questions developed by the last author, which included the specific tasks conducted with each tool at each phase of the research; roles of the *researcher*, other members of the research team and the research participants; extent of and reasons for adapting research tools according to each context in which data were collected; and *researcher's* perception of the ease of conducting the tasks and satisfaction with the data and results generated. Experiences with each tool were developed into narratives, and differences across the tools were identified in Table 2.

## Results

Based on the *researcher's* field research experience involving 48 gender- and age-segregated FGDs and group sessions with different ethnic groups, we identified (i) specificity and (ii) acceptance of a tool, (iii) ease of managing social dynamics and (iv) maintaining focus during data collection, (v) subjectivity and (vi) comparability during data analysis and interpretation as key factors affecting the *researcher's* perception about the ease of conducting research with different types of social research tools. The factors are referred to in the narratives of the research process with each tool and summarized in Table 3.

### Household surveys

Household surveys were conducted as part of the Beyond Timber project (for more information, see Levang et al. 2015). Research questions and response categories were developed based on a literature review and 50 key informant interviews with 14 local hunters, 11 NTFP gatherers, two fisher folks, 10 small-scale timber milling actors, 2 community forest managers, 3 members of the forest administration, 6 with non-governmental organizations and 2 representatives of timber concession companies. The gender was not systematically recorded, but most informants were male. The majority of the questions were closed-ended (Table 3, Specificity).

Upon arrival at each household, the consent of the household head (typically male) was sought to respond to the survey. In his absence, the next senior member (typically female) who was familiar with household activities was asked to respond. Most male household heads agreed to participate in the survey. Those who refused stated that the questions were difficult or personal, the exercise tiring or time consuming or that they would gain nothing from their participation. Women typically refused to respond to the survey if the male household head was away; of the 153 census survey respondents, 136 were male and only 17 female (Table 3, Acceptance, Social dynamics).

Most men could not provide accurate information on the production and sales of and income from NTFPs and the annual crops that were typically harvested and traded by women. Neither men nor women kept records of their income or expenses and neither could provide exact figures for past income (Table 3, Specificity). The survey data were analysed statistically with the use of Microsoft Excel and the Statistical Package for Social Science (SPSS) by two MSc students (Table 3, Data analysis).





**Table 3.** Factors affecting the ease of conducting research with the different research tools throughout the research process.

Key question	Tool				ACM
	Sub-questions	Survey	FGD	SAC	
<i>1. Research design</i>					
1A. Specificity of the tool How easy is it to adapt the tool for the research purpose and context?	<ul style="list-style-type: none"> <li>• Are there guidelines or frameworks to build on?</li> <li>• Does the tool use pre-defined concepts, or generate concepts with participants?</li> <li>• How easy is it to grasp relevant social differentiation?</li> </ul>	<p>Difficult</p> <p>Questions mainly closed-ended, developed with input from several scientists, literature review and numerous key informant interviews. Survey was field tested in two villages</p>	<p>Moderately difficult</p> <p>Interview guide had to be developed from scratch, but it did not have to be as detailed as the household survey. Questions were open-ended. Interview guide was not tested</p>	<p>Easy</p> <p>The tool is designed for a relatively straightforward, specific theme and example questions are readily available, but the interview guide was not tested, but no modifications were needed during data collection</p>	<p>Moderately easy</p> <p>The tool is designed for a specific theme and example questions are readily available, but the interview guide was not tested; testing could have helped to anticipate problems in explaining the tool and facilitating the discussion</p>
<i>2. Data collection</i>					
2A. Acceptance of the tool How easy or difficult is it to explain the tool and obtain consent to participate?	<ul style="list-style-type: none"> <li>• How complex are the terms and concepts used in the tool? – To what extent did participants perceive the research as relevant to their lives?</li> <li>• How sensitive are the issues and the situations in which the data is collected?</li> </ul>	<p>Moderately easy</p> <p>The tool was easily understood as previous surveys had been conducted in the villages. Most men agreed to participate though some refused saying the questions were difficult and/or personal, the exercise time consuming or they didn't gain anything from participating. Women typically refused to respond on behalf of the male household head</p>	<p>Difficult</p> <p>Some participants had concerns about voicing their private issues in the presence of others</p>	<p>Easy</p> <p>Participatory research was new to participants which made them curious. The exercise was easily understood and accepted as the topic was unthreatening and people were knowledgeable about it</p>	<p>Difficult</p> <p>Participants asked many clarifications about the concepts related to the tool. Most difficulties were encountered in the Nkolbikong (Baka) village where the exercise was conducted with the help of a translator. The Baka people were the most sceptical about the exercise as they thought the issues were private</p>

<p>2B. Managing social dynamics</p> <p>How easy or difficult is it to facilitate the discussion?</p>	<ul style="list-style-type: none"> <li>• Is the exercise individual or conducted in groups?</li> <li>• How easy is it to maintain participant's interest?</li> <li>• How easy is it to maintain participants' focus</li> <li>• How frequent are conflicting views and how easy it is to mediate them (group sessions only)?</li> </ul>	<p>Easy</p> <p>Individual exercise, all questions and most response options pre-defined. Some commented that ended questions became tiring</p>	<p>Difficult</p> <p>Discussion diverted easily and resulted in debates, indicating within-group differences in perceptions and experiences</p>	<p>Easy</p> <p>Facilitation was easy with the help of an assistant as the topic was very focused, the exercise visual, and there was general agreement about segregation of gender roles in the activities</p>	<p>Difficult</p> <p>Within-group discussions commonly turned into debates about gendered rights and norms. Rights depend also on marital or migration status, not just gender and age, which was reflected in the diversity of responses within and among groups</p>
<p>3. Analysis and interpretation</p> <p>3A. Data analysis</p> <p>How easy is it to analyse and compare data?</p>	<ul style="list-style-type: none"> <li>• What is the depth vs. breadth of data?</li> <li>• Are the respondents' backgrounds and/or the social situation where the data was collected considered when interpreting data?</li> <li>• Are there means to aid interpretation (quantitative data, visuals, and participants' role in interpretation)?</li> <li>• How easy is it to aggregate and compare results?</li> </ul>	<p>Easy</p> <p>Very structured data, mainly statistical analysis. Possible to link responses to multiple personal characteristics of participants (e.g. age, education). Focus on 'objectivity' in data analysis – each response to a closed-ended question is interpreted the same way independent of who the respondent was</p>	<p>Difficult</p> <p>Large amount of limitedly structured, entirely qualitative and non-visual data. Interpretation complicated by debates around gendered cultural norms during the discussions. Difficult to aggregate results compared to quantitative data</p>	<p>Moderately easy</p> <p>Specific and structured data, including qualitative and visual data. The groups generally agreed with each other on the results, probably because of the straightforward and unthreatening topic</p>	<p>Difficult</p> <p>Moderately specific and structured data, including quantitative, qualitative and visual data. Women tended to view rights to specific resources more inclusively than men. Interpretation complicated because social norms restricted men from speaking freely about intra-household decision-making, and because some participants appeared to use the exercise as an opportunity to assert control over resources.</p>

**Table 4.** Perceptions of access and control over resources in Petit-Pol village by participants in different gender and age groups, as per the results of access and control matrix (on a scale 0–5 where zero denotes no access and control and five denotes full access or control).

Resource	Elder men's group				Younger men's group				Elder women's group				Younger women's group			
	Access by		Control by		Access by		Control by		Access by		Control by		Access by		Control by	
	M	W	M	W	M	W	M	W	M	W	M	W	M	W	M	W
Land	5	0	5	0	5	1	5	0	5	1	5	0	4	3	3	2
Water	3	3	3	3	5	5	5	5	5	5	1	5	5	5	5	5
Food crops	2	4	2	4	2	4	2	5	2	4	2	5	3	3	2	4
NTFP (Fauna)	5	0	2	4	5	0	5	2	5	0	5	2	5	1	5	1
NTFP (Flora)	2	4	2	4	5	1	1	5	5	1	1	5	2	5	1	5
Timber	5	0	5	0	5	0	5	0	5	0	5	0	5	1	5	1
Fish	2	4	5	0	2	4	0	5	2	4	0	5	3	3	5	3

Note: M = men, W = women.

### Tools used during group sessions

FGD and the group sessions for SAC and ACM tools were carried out during three consecutive visits to each community between April 2013 and February 2014. Before initiating the research, a meeting was organized in each village and the objective of the study was explained to the community members present, after which those interested opted to participate. Groups were segregated by gender and age (younger people: 15–35 years, older people over 35 years old), except in a few cases by gender only when participants were few (Table 2). Group sessions were conducted in French in all communities except in Nkolbikong village, where the native Baka language of the respondents was used with the help of a translator.

FGD was documented in writing by the *researcher*. For SAC and ACM, the group members chose amongst themselves those they wanted to draw the calendars or matrices, which were then drawn on large brown papers placed on the ground for everyone to see and comment. The *researcher* took notes of the discussion. At the end of the SAC and ACM sessions, each gender and age group was asked to report on its discussions to the other groups, and the groups discussed differences and similarities in their results. This step was not done for FGDs.

### Focus group discussions

The purpose of the FGDs was to understand gender roles in household income management. While the facilitator's checklists had to be developed from scratch, it was relatively easier than household surveys because the questions were open-ended and, therefore, the guide did not have to be as detailed as for the surveys. Questions were formulated the same way irrespective of the age and sex of the participants to allow for comparative analyses. Draft questions were discussed with a socio-economist and a gender specialist but were not tested with local people prior to data collection because of an omission. After the first FGD in Melambo village, two new questions were added as it was realized that these questions were important for understanding gendered roles and preferences. These questions concerned the gendered division of labour in productive and reproductive activities, including the collection of specific NTFPs, as well as seasonal availability of these NTFPs (Table 3, Specificity).

Getting people's consent to participate in the FGDs was difficult: some people were concerned about publicly voicing their opinions on issues they considered to be private, such as income management from NTFPs, and other participants were concerned about the overall relevance of the research on their lives. Older women were more vocal than men and younger women, and more vocal in Metylkwale and Ndembo villages than in the other villages. Women explained that many researchers had come and gone, without them experiencing any positive change in their community. Some women, even though they consented to participate, remained reticent during the discussions (Table 3, Acceptance). In Nkolbikong, elder women were shy to speak in front of the group as they were unaccustomed to speaking in public (Table 4, Social dynamics).

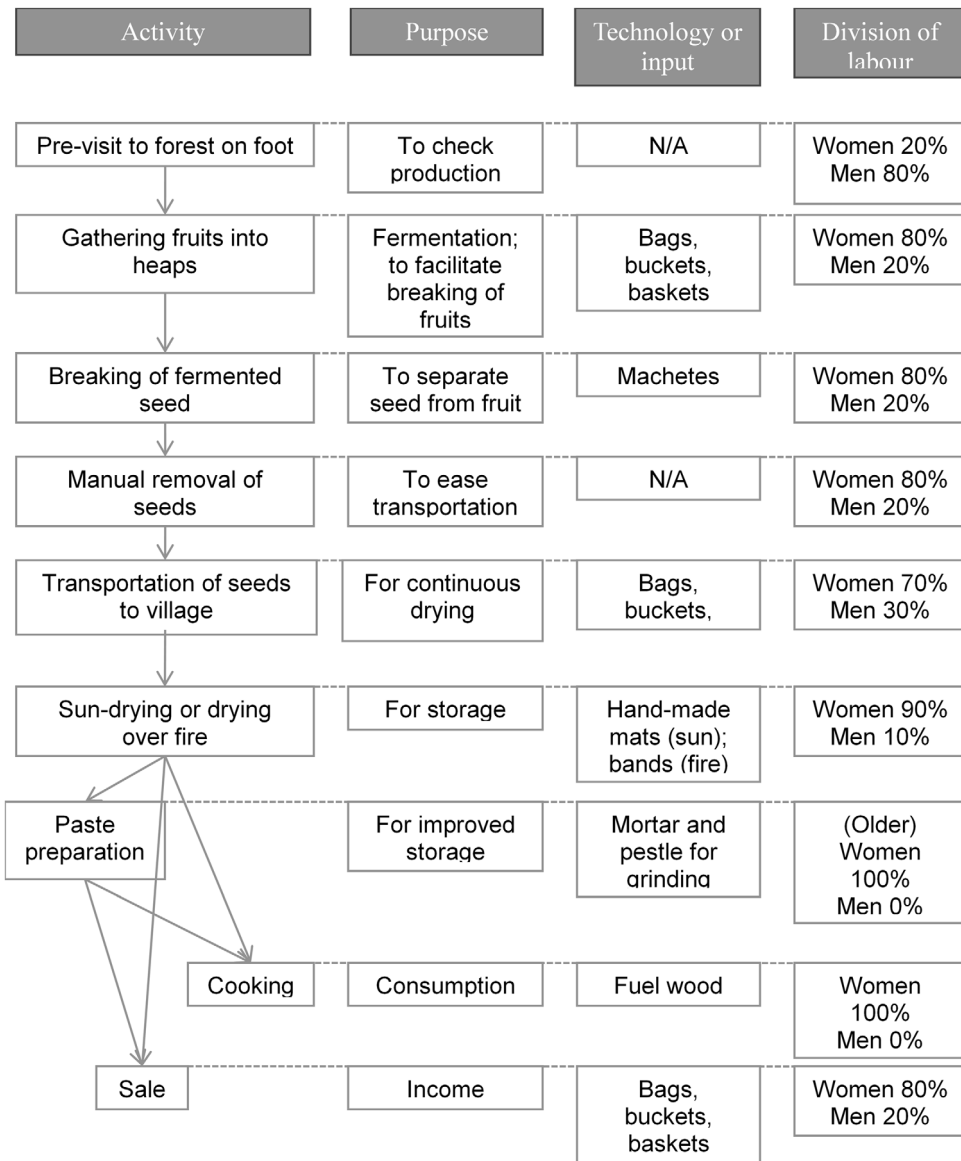
The *researcher* initially tried to conduct the FGDs alone, but facilitating and documenting the discussions at the same time turned out to be extremely difficult because of the pace at which the discussions occurred and the extent of information provided by the participants. An experienced assistant was later hired to assist in facilitation, and to act as translator of Baka language in the Nkolbikong village. Discussions diverted easily to other topics and resulted in debates about gender relations within households which differed also within the gender- and age-segregated groups. For example, when the younger men's group in Petit-Pol village were asked questions like: 'Who keeps income from sales of NTFPs and agricultural produce' and 'who decides how to spend this income?', participants started debating about whether their wives had the right to know how much money they earned. Those men who shared information about their income with their wives were considered weak by other group members and said to be controlled by their wives (Table 3, Social dynamics).

Notes were coded based on emergent themes. Analysing and interpreting FGD results were difficult because of the large amount and diversity of information generated, the difficulty in deciding which information was relevant for further analysis, and difficulty in aggregating the results. Also, the *researcher* was hesitant about the quality of the data as it was not systematically clear who said what during the discussion. The data could have been more focused and complete if the interview guides were tested with the communities beforehand to find out which relevant questions had been omitted or which questions were unclear, too generic or touched upon overly contentious issues (Table 3, Data analysis).

### **Seasonal activity calendar**

The tool was used to study the gendered division of labour during collection, processing and transformation of bush mango (*Irvingia gabonensis*), a valuable forest product for food and income generation. Once the research topics were identified, it was straightforward to adapt the SAC for the purpose of the study because the tool is designed for a specific research topic and examples of guiding questions for facilitating discussions are readily available. However, participatory research tools were new to the *researcher* who needed time to gain experience with the use of the tool (Table 3, Specificity).

As this was the *researcher's* first experience using the SAC, she felt insecure in the beginning about facilitating the group sessions. However, facilitating and documenting the discussions, with the help of a research assistant, turned out to be easy compared to the FGDs for several reasons. First, it was easy to obtain people's consent to participate in the exercise, apparently because the concept of the exercise was easily understood (Table 3, Acceptance). Then, the exercise was clearly focused, which helped participants to follow the activity and give pointed answers without diverting from the topic. Participants in all gender and age



**Figure 2.** Schematic representation of the stages and gendered labour contributions during the collection, processing and sale of bush mango based on the results of the seasonal activity calendar.

groups were also knowledgeable about the different steps involved in collecting and processing bush mango. It was easy for them to identify the different roles men and women played in these activities and they enthusiastically contributed their ideas (Table 3, Social dynamics). Older women showed more knowledge on specific stages in the product’s transformation, for example about the preparation of bush mango paste, than other participants. A sample of results with the tool is shown in Figure 2.

Overall, the exercise was more interactive than the FGDs. It was the first time such an exercise was conducted in these communities, and participants commented that they liked

the interactive and practical nature of the exercise that kept them alert during the session (Table 3, Social dynamics). When the groups reported their discussions to each other at the end of the activity, participants across groups were generally in agreement about the stages and gendered division of labour in collection and processing of bush mango. This may be because most of the work in each stage was typically handled by one gender group and men's and women's tasks were largely not overlapping (Table 3, Data analysis).

### **Access and control matrix**

The ACM tool was used to study gendered differences in land ownership and management and access to forest resources. As with the SAC, it was straightforward to adapt the ACM tool for the purpose of the study because of the specificity of the tool and availability of guidelines for using the tool (Table 3, Specificity). However, compared with the SAC, explaining the purpose of the tool and acquiring the participants' consent to respond turned out to be more difficult. The tool involved abstract concepts that were new to the *researcher*, making it difficult to explain to the participants. Participants asked many clarification questions, such as whether the notion of 'control' involved giving orders on how to manage resources or only the right to sell the products. Explaining the concepts was particularly difficult in the Nkolbikon (Baka) village where the exercise was conducted with the help of a translator, and it was not clear to the *researcher* if the translator himself understood the concepts properly and if the concepts were relevant within the Baka culture. Baka participants were also particularly reserved and sceptical about responding to the questions because, they felt the issues under discussion were private (Table 3, Acceptance).

In several cases, male and female participants scored women's control over certain resources, such as bush meat, higher than their access to this resource, which demonstrates confusion about these concepts. They explained that women were primarily responsible ('in control') for processing, preparing or selling these products but could not harvest ('access') or sell as much as they would have liked because of the unavailability of the resource, or because men used part of these products. A sample of results with the tool is shown in Table 4.

Discussions in the younger men's and women's groups were typically more active than among elder participants. This may be because access to and control over resources is affected by marital status and age. The younger, recently married or unmarried participants were experiencing or expecting to experience changes in their control over resources, and were possibly trying to assert their rights by making claims during the public discussion the exercise created (Table 3, Social dynamics; Data Analysis). When the women's and men's groups shared their results, they had conflicting views regarding access to and control over several resources. The older men's groups typically stated that they had full access to and control over resources such as land, whereas women had no access or control over it. However, the women's groups and particularly younger women tended to view access and control rights more inclusively, indicating that full access or control by one gender group did not necessarily preclude access or control by others (Table 3, Data analysis). Women claimed that they had control over several resources, partly because their husbands consulted them before making any decisions about these resources, but the men did not publicly agree. Many male participants expressed that although women may influence decision-making concerning resource management, admitting to this portrays a husband as weak and may cause him to lose respect among his peers. Access to and control over land is

particularly complex and depends on marital and migration status; hence, participants did not necessarily agree on access and control matters even within a given gender- and age-segregated group (Table 3, Data analysis).

## Discussion

In the following, we discuss the six aforementioned factors that were identified to affect the ease of conducting research with the tools (Table 3), and end with recommendations for other aspiring researchers of social aspects in natural resource management. The ease of using the tools varied throughout the research process, with some tools requiring detailed preparation and collection of large amounts of preliminary data, but being fairly easy to execute (household surveys), and others appearing easy to pick up at first glance but becoming increasingly difficult to use as the research process progressed. This was the case with FGDs and with the ACM, which involves abstract concepts and touches on social norms and agency.

Lack of experience in social research may result in researchers selecting tools that are not optimal for the research question or for the researchers' type of skills and experience. For example, considerable skill is required for formulating good open-ended questions, facilitating FGDs to obtain rich data on specific topics and for being capable of balanced interpretation – and yet, from our observations, FGDs seem to be a popular research tool used among MSc students in natural sciences. Another common problem is selecting a set of tools that are not easy to sequence, so that one set of findings could be further analysed with the next tool to deepen analysis. These problems may in fact stem from either lack of experience using participatory tools, insufficient preliminary research resulting in overly broad research questions, or both. A common example of effective sequencing is to first use community resource mapping to get an overall view of resources and their physical distribution, and thereafter conducting FGDs to explore topics of interest with research participants. The results are then used as a base for developing detailed HH survey questionnaires or checklists for subsequent participatory exercises on specific topics.

Adapting a research tool for a specific purpose requires understanding the social and biophysical context in which the research will be carried out. Our results demonstrate how overlooking gender roles during research design results in difficulties during data collection and analysis, even if the design process is otherwise comprehensive (De la O Campos et al. 2016), as was the case for the household survey. Interviewing men in half of the households and women in the other half, splitting the questionnaire to questions for male and female respondents, or modifying survey questions to specifically ask about gender roles for each activity can help better capture gender-specific access to and control over resources without necessarily increasing the number of interviews needed (Doss 2013).

For group sessions, it is important to first assess the relevant forms of social differentiation with regard to the research topic as a basis for segregating participants into groups. Although gender, age or ethnicity are perhaps the most common ways of segregating participants into groups, stakeholder analysis could reveal other factors that are equally or more important for specific research questions and contexts (Chevalier & Buckles 2008). In the field research described in this study, marital status appeared to affect access to and control over natural resources more than age and migration status.

Testing tools and interview guides when commencing field work helps to assess how the tool meets its intended objectives, whether any important questions have been omitted, and to ensure that the questions and concepts are culturally relevant and clear, including to facilitators (Chevalier & Buckles 2008). In this study, field testing was particularly important for the ACM tool, which involves abstract concepts that were new not only to the research participants, but also to the research team.

Acceptance of the tools depended largely on the research participants' previous experience with researchers. Establishing trust typically requires repeated interactions with research participants (Krishnaswamy 2004). Mosse (1994) suggests that this can be facilitated by working through organizations that are already established in the communities or working first informally with individuals or neighbourhood groups. He also recommends focusing the initial exercises on rapport building rather than on acquiring a lot of information – especially as in the absence of rapport, such information may be biased. Participatory tools may appeal to research participants because of their novelty, the social dynamics of the group exercise compared to individual exercises such as surveys, and because these tools offer participants an opportunity to showcase their often in-depth knowledge of their environment. In contrast, Mosse (1994) cautions that unfamiliar techniques may raise suspicion about the researchers' intent. Our analysis shows that acceptance of participatory tools can also vary depending on how straightforward and unthreatening the research topic is perceived to be.

Maintaining participants' focus on the research topic was generally difficult with tools that did not involve visuals to help participants concentrate (FGD), while managing conflicting views became an important issue with tools that focused on contentious topics that generated debates around gender and other social norms (both FGD and ACM). And yet, although often overlooked, the real value of FGDs and other group sessions lies exactly in the opportunity to analyse the often divergent opinions and interactions between participants to examine why participants think the way they do, as they explain their views to other group members (Oates 2000). Therefore, debates and arguments between group members which may feel distracting to an inexperienced facilitator and note taker are in fact an important part of the data gathering and of the learning experience of both participants and researchers. These interactions require skill to manage, capture and analyse meaningfully. Each group has its own dynamics that poses different challenges to the researcher. In vocal and lively groups, the pace of the conversation may be so fast that it is difficult to keep track of participants' comments and explore interesting points as they arise, or dominant members may monopolize the conversation. In contrast, in quiet and unenthusiastic groups, the researcher has to work much harder to keep the conversation going and impose more of his or her own agenda onto the discussion (Oates 2000).

As mentioned above, some research participants appeared to use the group sessions with the ACM as an opportunity to assert increased control over resources, thereby contesting existing social norms. Such situations demonstrate how knowledge – the data in social research – is socially constructed, value-laden and contextually unique, as opposed to the typical perspective in biophysical sciences that considers that an objective reality exists independent of the subject and that seeks to predict and generalize (Lynam et al. 2007; Moon & Blackman 2014). If researchers trained in biophysical sciences have not been exposed to the diversity of philosophical perspectives in social research, they may try to apply biophysical science methods to studying the inherently social aspects of natural resource use



– and experience difficulties doing so. For example, they may feel discouraged by the sense that the data gathered with social research methods are ambiguous and lacking proof or scientific rigour, as the *researcher* in this study originally did. Education providers on biophysical subjects should review whether their training programs equip students with the appropriate set of skills to contribute to solving complex problems surrounding natural resource use. Offering multi-disciplinary courses is unlikely to produce professionals who can effectively work on the interface between biophysical and social realms, if the students do not simultaneously learn about the diverse philosophical perspectives about knowledge creation.

## Recommendations

Based on the lessons learned during this study, we propose the following recommendations to help scientists with a biophysical background to embark on social science research on natural resource management:

- Consider your philosophical perspective to research: hypothesis-based perspectives typical to biophysical sciences are often too limiting to fruitfully study diverse social research questions;
- Set aside adequate time for research design, including literature reviews, interviews and field-testing to ensure that the research tools capture relevant information. Social segregation in data collection is relevant to the research questions, and the specific questions and terms need to be understandable to the research participants, facilitators and translators as applicable;
- Find a local team to assist you and ensure you work as a team – that all understand and are able to explain the terms and concepts related to the research topic, and that facilitator and note taker work together in group situations;
- Invest time in establishing trust, considering also that the ease of developing relationships with research participants depends on past research (your own and that of other researchers) in the community, and that your interactions in the communities shape local attitudes towards future researchers;
- Hone your facilitation skills through continuous practice and, where possible through apprenticeship with experienced practitioner–researchers: research skills take time to develop, and some of the tools are very difficult to use without having seen someone else perform them.

Our hope is that these lessons and recommendations will help smooth the learning curve for other aspiring researchers in transdisciplinary research, making the research process more useful and meaningful for researchers and participants alike.

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