

Mémoire d'Habilitation à Diriger des Recherches

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Recherches participatives pour une gestion durable des territoires forestiers

Participatory research for sustainable forestland management

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Summary/résumé

Communities who live in or near a forest are now being encouraged more to participate in environmental management (hereafter referred to as ‘local participation’). This is to make conservation and land-use planning more sustainable, inclusive, equitable and relevant to local people. Participatory research on environmental management is a research topic, i.e., a scientific investigation conducted together with local communities to identify and solve community problems about environmental management (Cancian and Armstead 2020). It is also a research method, i.e., a set of tools used to identify and solve these problems. Participatory research has been the focus of my work for the past 25 years.

Over the years my research questions have included:

- How can local participation in conservation, land-use planning and, more generally, in environmental management be more sustainable?
- How are communities affected by or benefiting from participatory research on forests and natural resource management?

My research hypothesis is that community participation in environmental management leads to more sustainable actions if community motivation is secured. Community motivation depends on the different potential benefits a community can expect, for example, in terms of income, customary and statutory rights, a sense of worth and belonging or for the benefit of future generations.

There are 4 chapters in this document:

- 1) **Introduction** to the topic of participation in environmental management, from a research perspective;
- 2) Presentation of the **theoretical background**, using the literature developed on the topic;
- 3) Presentation of the **conceptual framework** I have been using during my research;
- 4) Description, through **case studies**, of the four periods in my research on local participation.

To answer the research questions and verify the hypothesis, I organised my work in four periods of research activities: 1) I studied the way local communities perceived and understood their environment; 2) I studied the role local people could play in forest conservation, using participatory research; 3) I scaled up my findings on conservation to include the broader topic of participation in land-use planning; and 4) because monitoring is an essential part of environmental management, I studied the role local people could play in monitoring forest cover, biodiversity and carbon in their territory.

I illustrate these four objectives with 13 case studies based on research projects implemented throughout my career, first as a PhD and postdoctoral student, then as a scientist with Agricultural Research for Development (CIRAD) and the Center for International Forestry Research (CIFOR). I worked on these case studies during my assignments in Indonesia (18 years), Ethiopia (4 years) and France.

Based on these case studies, some results and recommendations can be shared. In essence, local community involvement in decision making can lead to more sustainable environmental management because ethically, economically and ecologically it makes sense to involve communities living in or near a forested area in any decisions concerning its management. Land-use planning, a significant component of environmental management, cannot be successful in the medium or long term without the direct involvement of local communities.

Local participation is needed, but with certain conditions. In environmental management, local participation should not be taken for granted. Decision makers need to understand under what conditions local people should participate in decisions on land management. Local people need to benefit from their participation, economically, politically (in terms of land tenure or land-use) and spiritually. Participatory research can help to integrate local perspectives, perceptions and agendas into decision making. However, before considering local community participation in an environmental management project, the project proponents, i.e., government and non-government organisations and scientists need to:

- a) Conduct a feasibility study that assesses the motivations of local communities and the kind of local involvement required. This type of study can be conducted in addition to the more conventional feasibility studies, such as the analysis of economic, legal, gender, tenure and livelihood situations.
- b) Look for alternative non-participatory approaches that spare local communities from wasting time in training, monitoring and project management where participation is not necessary.
- c) Discuss with the local communities how the project proponent considers local participation relevant and how the approach can benefit them.
- d) Make sure the local communities are empowered to refuse to participate. Participation can sometimes be imposed because it bears high political and social costs. Government and non-government organisations and researchers often do not take 'no' for an answer. Local communities should, however, be able to refuse to participate. If they are involved, it should be from the very beginning of the process, during the project design and they should be able to revoke their decision to participate at any time.

Only under these conditions can local participation be considered appropriate. If appropriate, then all the other stakeholders (local government, conservation organisations and civil society) need to collaborate with the local communities to achieve more effective and sustainable land-use, biodiversity conservation and the management of forestland. This research is still ongoing and future activities, e.g., on landscape restoration or autonomous conservation, should provide additional input on the topic.

La participation des communautés vivant dans ou à proximité d'une zone forestière à la gestion de l'environnement, appelée « participation locale », est de plus en plus utilisée pour que la conservation et la planification de l'usage des terres soient plus durables, inclusives, équitables et pertinentes pour les populations locales. La recherche participative appliquée à la gestion de l'environnement est un sujet de recherche, c'est-à-dire une activité scientifique menée en collaboration avec les communautés locales pour identifier et résoudre les problèmes que rencontrent ces communautés lors de la gestion de l'environnement (Cancian et Armstead 2020). C'est aussi une méthode de recherche, c'est-à-dire l'ensemble des outils utilisés pour identifier et résoudre ces problèmes. La recherche participative a été au centre de mon travail au cours des 25 dernières années.

Pendant cette période, mes questions de recherche ont été :

- Comment rendre plus durable la participation des communautés locales à la gestion environnementale ?
- Comment ces communautés bénéficient-elles de ou sont-elles affectées par la recherche participative sur la gestion des forêts et des ressources naturelles ?

Mon hypothèse de recherche est que la participation des communautés à la gestion de l'environnement conduit à une plus grande durabilité de l'action si la motivation des communautés est assurée. Cette dernière dépend des différents avantages potentiels auxquels elles peuvent s'attendre, par exemple en termes de revenus, de droits coutumiers et légaux, de sens des valeurs et de sentiment d'appartenance, ou pour les générations futures.

Il y a 4 chapitres dans ce document :

- 1) **Introduction** au thème de la participation à la gestion environnementale, selon une perspective de recherche ;
- 2) Présentation du **contexte théorique**, en utilisant la littérature développée sur le sujet ;
- 3) Présentation du **cadre conceptuel** que j'ai utilisé lors de mes recherches ;
- 4) Description à travers d'**études de cas** des quatre périodes de ma recherche sur la participation locale.

Pour répondre aux questions de recherche et vérifier l'hypothèse, j'ai organisé mon travail en quatre périodes d'activités de recherche : 1) j'ai étudié la façon dont les communautés locales percevaient et comprenaient leur environnement; 2) j'ai étudié, en utilisant la recherche participative, le rôle que les populations locales pourraient jouer dans la conservation des forêts ; 3) j'ai élargi mes conclusions sur la conservation au sujet plus large de la participation à la planification de l'utilisation des terres; et 4) parce que le suivi est un élément essentiel de la gestion de l'environnement, j'ai étudié le rôle que les populations locales pourraient jouer dans le suivi du couvert forestier, de la biodiversité et du carbone sur leur territoire.

J'illustre ces quatre objectifs avec 13 études de cas basées sur des projets de recherche mis en œuvre tout au long de ma carrière, d'abord en tant que doctorant et post-doctorant, puis en tant que chercheur au CIRAD (La Recherche Agronomique pour le Développement) et CIFOR (Centre de Recherche Forestière Internationale). J'ai

travaillé sur ces études de cas lors de mes missions en Indonésie (18 ans), en Éthiopie (4 ans) et en France.

Sur la base de ces études de cas, certains résultats et recommandations peuvent être partagés. L'association des communautés locales à la prise de décision peut conduire à plus de durabilité dans la gestion de l'environnement parce qu'il fait sens, d'un point de vue éthique, économique et écologique, d'impliquer les communautés vivant dans ou à proximité d'une zone forestière dans toute décision concernant sa gestion. L'aménagement du territoire, une composante importante de la gestion environnementale, ne peut réussir à moyen ou long terme sans la participation directe des communautés locales.

La participation locale est nécessaire, mais sous certaines conditions. Elle ne doit pas être tenue pour acquise, et les décideurs doivent comprendre à quelles conditions les populations locales peuvent participer aux décisions sur la gestion de leurs terres. Les populations locales ont besoin de bénéficier de leur participation, économiquement, politiquement, en termes de régime foncier ou d'utilisation des terres, et spirituellement. La recherche participative peut aider à mieux intégrer les perspectives, les perceptions et l'agenda des populations locales dans la prise de décision. Mais, avant d'envisager la participation des communautés locales à un projet de gestion de l'environnement, les initiateurs du projet, c'est-à-dire les organisations gouvernementales et non gouvernementales, et les scientifiques, doivent :

- a) Mener une étude de faisabilité qui évalue les motivations et le type d'implication nécessaire de la part des communautés locales. Ce type d'étude peut être fait en plus des études de faisabilité plus conventionnelles, telles que l'analyse des situations économiques, juridiques, de genre, du régime foncier et des moyens d'existence.
- b) Utiliser si possible des approches alternatives non participatives qui évitent aux communautés locales de perdre leur temps dans la formation, le suivi et la gestion de projets, dans les cas où leur participation n'est pas nécessaire.
- c) Clarifier avec les communautés locales, lorsque la participation locale est jugée pertinente par l'initiateur du projet, la manière dont l'approche peut leur être bénéfique.
- d) S'assurer que les communautés locales peuvent refuser de participer. La participation est parfois imposée car elle a un coût politique et social élevé. Les organisations gouvernementales et non gouvernementales, et les chercheurs n'acceptent souvent pas un « non » pour réponse. Les communautés locales devraient cependant pouvoir refuser de participer. Si elles sont impliquées, cela devrait se faire dès le début du processus, dès la conception du projet, et elles devraient être en mesure de révoquer leur décision de participer à tout moment.

Ce n'est qu'à ces conditions que la participation locale peut être considérée comme possible. Le cas échéant, tous les autres acteurs (gouvernement local, organisations de conservation, société civile) doivent collaborer avec les communautés locales pour parvenir à une utilisation des terres, une conservation de la biodiversité, et une gestion des terres forestières qui soient plus efficaces et durables. Cette recherche est toujours en cours et mes activités de recherche futures, par exemple sur la restauration des paysages dégradés ou la conservation autonome, devraient apporter une contribution supplémentaire au sujet.

1. Introduction

In the French educational system, the accreditation to supervise research (*Habilitation à Diriger des Recherches*, HDR) is a university qualification that has been in place since 1988. It serves to recognise the scientific achievements of the HDR candidate, the originality of his/her scientific approach in a particular field, throughout their career and their ability to mentor PhD students.

To obtain accreditation, a candidate must present a synthesis of his/her scientific activities showing their experience in their given field.

Here I present a summary of my scientific activities for the past 25 years on **the role and place of local people in forestland management**. When using the term ‘local people’ I am referring to people, indigenous or migrants, who live in or near tropical forests and whose livelihoods largely depend (but not necessarily exclusively) on forest resources and ecosystem services.

I consider this topic to be crucial for the sustainable use of forests because the global community is the primary beneficiary of tropical forests. If local communities are the primary users, they are often not seen as the main benefactors of the forests. According to the global community, local people should not use the forest as they wish because such utilisation can jeopardize global needs. But forests are also a source of food, energy and income for local people. The global community cannot manage these forests without including the local people in the decision making process. The challenge is to find ways and clear benefits for local people to participate.

To address these challenges of participation and benefits, I propose two main research questions:

- How can local participation in conservation, land-use planning and, more generally, in environmental management, be more sustainable?
- How are communities affected by or benefiting from participatory research on forests and natural resource management?

My research hypothesis is that community participation in environmental management leads to more sustainable actions (i.e., local community involvement in the longer term) if community motivation is secured. Community motivation depends on the different potential benefits a community can expect, for example, in terms of income, customary and statutory rights, a sense of worth and belonging or for the benefit of future generations.

Answering these questions and testing this hypothesis became progressively central to my research on local people’s management of the environment, through three steps. The links between the research sub questions and the three research steps are presented in Figure 1.

Figure 1. The relationship between research sub questions and research steps

Research questions

1. How can local participation in conservation, land-use planning and, more generally, in environmental management, be more sustainable

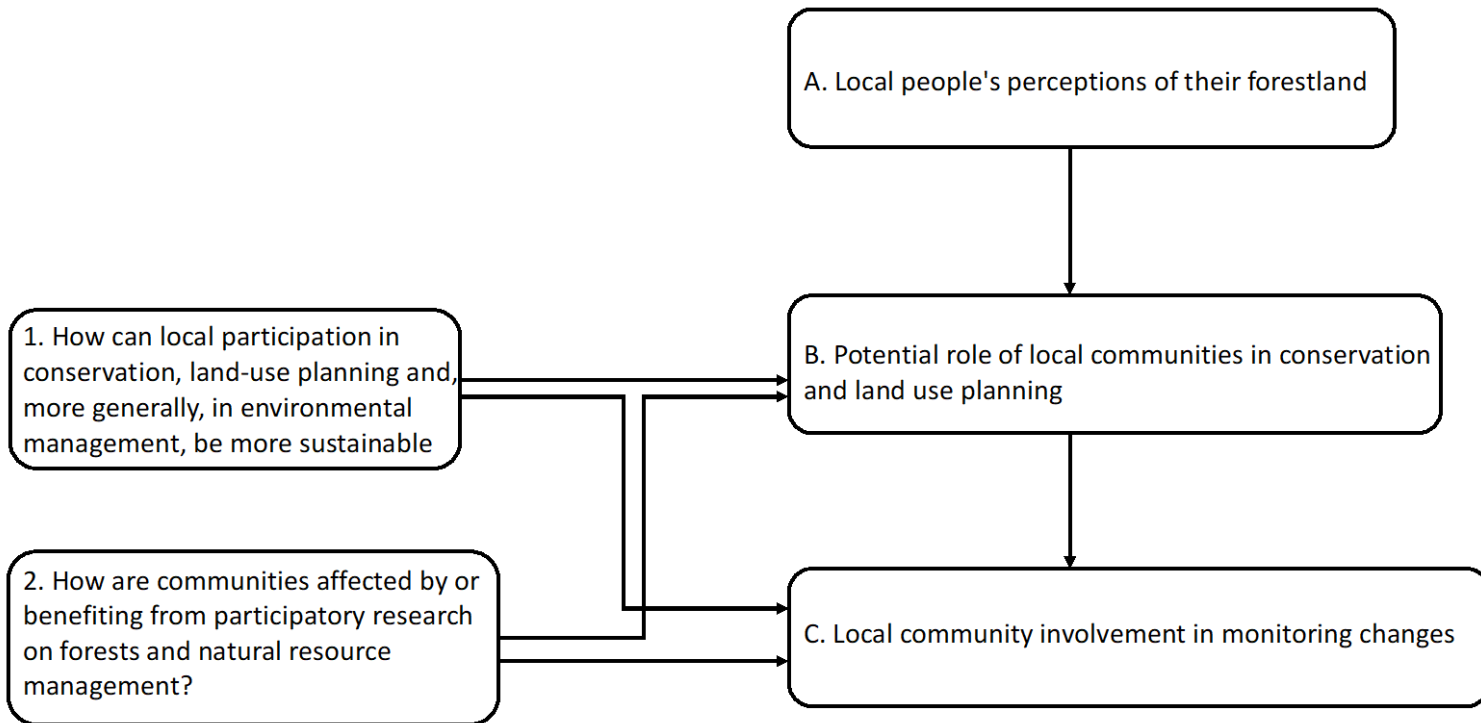
2. How are communities affected by or benefiting from participatory research on forests and natural resource management?

Main research steps

A. Local people's perceptions of their forestland

B. Potential role of local communities in conservation and land use planning

C. Local community involvement in monitoring changes



One approach I used was to study local people's perceptions of their forestland, including the way they managed it as a significant source of livelihoods. This initial research activity was an ethnobotanical study and did not focus on participatory natural resource management (PNRM) nor did I use participatory research methods (PRM). The methods I used were open-ended interviews, participant observations and biophysical surveys (i.e., vegetation analysis along transects and plots).

I also applied a different approach after my doctoral and postdoctoral research. I analysed the potential role of local communities in forest conservation, then realised that local participation in conservation needed to be considered on a larger scale, i.e., at the level of a territory, because it cannot be disconnected from other land-uses. I therefore analysed local people's priorities in land-use planning.

In the third and last step, I took into account the fact that if local communities are involved in land-use planning, they should contribute to monitoring changes, i.e., the way land-use affects land cover. Monitoring can be a tool used by local communities to control the access to a territory or to learn and adapt. It is also a way to regularly assess whether management actions have the expected outcomes and if new management plans are needed to correct undesired outcomes. During the more recent part of my research, I studied the role of local communities in monitoring not only biodiversity and carbon, but also forest changes, to empower local communities in forestland management. I also studied the way local communities could contribute to reporting changes in forest cover to higher levels of governance and the benefits they could receive in return.

The present document is organised in 6 sections. Section 1 is the introduction. After presenting the theoretical background on participatory approaches (section 2) and the conceptual framework I used for my research (section 3), I provide case study examples (section 4). In section 5 I discuss the possible direction my future research activities might take and in the last section, the conclusion, I suggest some answers to the three main research questions.

2. Theoretical background

In this section, I provide information on the concept of participation, including its definition and historical background.

Thompson et al., (2020) provide a literature review on indigenous participation in environmental monitoring. They found that local participation refers, in general, to data collection and that a power imbalance is the main challenge when trying to achieve meaningful environmental management. Reed (2008), in a literature review on local participation in environmental management, provides a typology and history of participation and defines participation as “...*a process where individuals, groups and organisations choose to take an active role in making decisions that affect them...*” (Reed 2008, p.2418).

From my perspective, as a researcher, ‘participation’ has three meanings: 1) it is a **research topic** by studying, for example, the way local people take part in decisions on land-use planning, forest conservation and management, 2) it is a **research method**, that gives power to the research participants, e.g., the local communities, to control “...*the research agenda, the process and actions...*” (<http://participatesdgs.org/methods/>) in this situation the term ‘participatory approaches’ is often used and 3) it is a **way of managing a research project** in a decentralized manner for the co-production of knowledge. The team members then have the responsibility for their research design and the team manager acts as a facilitator rather than a leader.

‘Participation’ as a research topic doesn’t automatically imply the use of participatory research methods. Direct observation, for example, can be a way to study local people’s participation in environmental management. But exploring all the aspects of local people’s participation often requires a multidisciplinary research design, e.g., using methods from the social sciences, geographic information system mapping (GIS) or human ecology.

Based on these definitions, I analysed the concept of participation as it is used in environmental management projects. I explain the way, historically, the term ‘participation’ became an essential tool for land management.

During the colonial period, especially over the last 100 years, the term ‘participation’ was liberally used in various countries as a way to make the colonial system sustainable (Cooke 2003). The idea was to give indigenous people some limited control over their destiny to prevent possible social unrest and pro-independence political movements. Starting from the 1950s, the Bretton Woods Institutions¹ (i.e., the World Bank and International Monetary Fund) used the term to promote a liberal economic system that decreases the role of the state in local development. Having, to some extent, local communities on board also helped these institutions to keep a status quo in the local power balance/imbalance. Elites, working together with the colony’s administrator, then had the final word on what should be done for their community. Participatory

¹See https://en.wikipedia.org/wiki/Bretton_Woods_Conference, the objective of the Bretton Woods conference in 1944 was to regulate the international monetary and financial order after the Second World War.

approaches used in environmental management and community development have been inherited from this system.

Participatory research has been used in the education system since the 1970s. It is still widely used in medical research (Cornwall and Jewkes 1995; Chandanabhumma et al. 2020), agroecosystem analysis (Conway 1985) and agricultural and extension research (Chambers, Pacey, and Thrupp 1989; Chambers 1994b; Snapp, DeDecker, and Davis 2019; Hellin et al. 2008). Since the 1990s, projects and literature related to community development and natural resource management have primarily used the concept of participation to include local communities in decision making regarding their land. Robert Chambers has been the champion of these approaches, developing the principle of Rapid Rural Appraisal (RRA) and Participatory Rural Appraisal (PRA). Moving from RRA to PRA represented a shift from data collected by outsiders to local people's empowerment and participation. From extractive, then eliciting mode, the shift to PRA required sharing information with local communities and empowering vulnerable people.

Table 1 gives a summary of the main participatory approaches described in the literature and their achievements from the late 1960s until the present.

Table 1. The origins of participatory research: from education, health to rural development and forestry

Note: the list of authors is not exhaustive and is meant to provide a sample of publications that illustrate a selection of participatory research.

Approach	Short description	Authors
<i>Participatory research in education (1975)</i>	In his 'pedagogy of the oppressed', Freire proposed an education system developed WITH the oppressed (instead of FOR) to help them gain freedom from their situation without becoming oppressors.	(Freire 2000) <i>original 1968</i>
<i>Participatory Action Research (PAR)</i>	Research in local communities should also provide changes in collaboration with these communities. Fals-Borda and Rahman understand PAR as a science that liberates local people by providing autonomy, self-reliance and decentralization.	(Fals-Borda and Rahman 1991)
<i>Rapid rural appraisal (the late 1970s and 1980s)</i>	Methods for staff from government and non-government organisations to learn about rural life and conditions while reducing long questionnaires and laborious surveys. These were intended to be cost-effective and a learning process (tapping into Indigenous Technical Knowledge).	(Chambers 1981; Belshaw 1981)
<i>Participatory research in health, Rapid Assessment Procedure (the 1980s)</i>	Methods for rapidly assessing health behaviour patterns to collect data on a specific disease, including whether respondents use modern or traditional services. Community-Based Participatory Research (CBPR) is generally used to promote health and reduce health disparities by working with local communities.	(Scrimshaw and Hurtado 1987; Bentley et al. 1988; Minkler and Wallerstein 2011)

<i>Agroecosystem analysis</i> (1985)	Promoting a holistic and multidisciplinary approach to agricultural development. Farmers, with their knowledge at the crossroads of different disciplines, should be involved in agricultural development as a complement to experts. To some extent, they should also be involved in decision making.	(Conway 1985)
<i>Farming system research</i> (the 1980s)	Systematic methods for understanding the complexity of farming systems. Farmers' participation is encouraged in agricultural research.	(Gilbert, Norman, and Winch 1980; Farrington 1998)
<i>Participatory Rural Appraisal</i> (1992)	The term 'participatory' for rural appraisal was introduced during the Khon Kaen International Conference in 1985 (KKU 1987). It later became known as PRA, a method developed by Chambers, Cornwall and other scientists supporting much more local community involvement. PRA is an approach that is supposed to benefit and empower local communities directly. The role of the researcher is as a facilitator.	(KKU 1987; Chambers 1994a; 1994b; Holland, Blackburn, and Chambers 1998; Cornwall and Jewkes 1995; Mukherjee 1993)
<i>Multidisciplinary landscape assessment</i> (2000)	The use of multidisciplinary methods (biophysical and social sciences) to capture the perceptions and priorities of local people regarding forest landscapes.	(Sheil et al. 2002)
<i>Participatory forest management</i> (the 1990s and 2000s)	Participatory methods to engage and empower local people in biodiversity monitoring and forestland management (including patrolling and decision making).	(Danielsen et al. 2007; Arnold 2001)
<i>Participatory Action Research, Planning and Evaluation</i> (2013)	Multidisciplinary approaches to "engage people and mobilize evidence in [a] complex setting involving multiple stakeholders".	(Chevalier and Buckles 2008)
<i>Adaptive Collaborative Management</i>	Using flexible and collaborative approaches to sustainable forest management, with increased local participation in priority setting and problem solving.	(Colfer 2010)

During the 1990s, Chambers gave a framework for the different uses of participatory approaches:

"Participation' has three uses and meanings: cosmetic labelling, to look good, co-opting practice, to secure local action and resources, and empowering process, to enable people to take command and do things themselves" (Chambers 1994a, p.1).

Chambers sees three ways to use the concept of local participation:

1) One is opportunistic and cynical, used in top down and donor driven projects, because participation is requested.

2) Another is to reduce the cost of field measurements: local people participate in the scientists' activities. This way has been used recently for local participation in forest monitoring and carbon assessment. Monitoring costs less when conducted by local communities than by groups of experts, but with comparable data quality.

3) The last way identified by Chambers is meant to empower local people, who are seen as poor marginalised groups, looking for recognition for their role in land and natural resource management.

In my view, the perception of local people's participation as proposed by Chambers describes the way local participation can be done to the benefit of the researcher, not the communities. Even the third way, empowerment, is based on the assumption local people are necessarily poor, marginalised and in need of recognition. This assumption is not always correct.

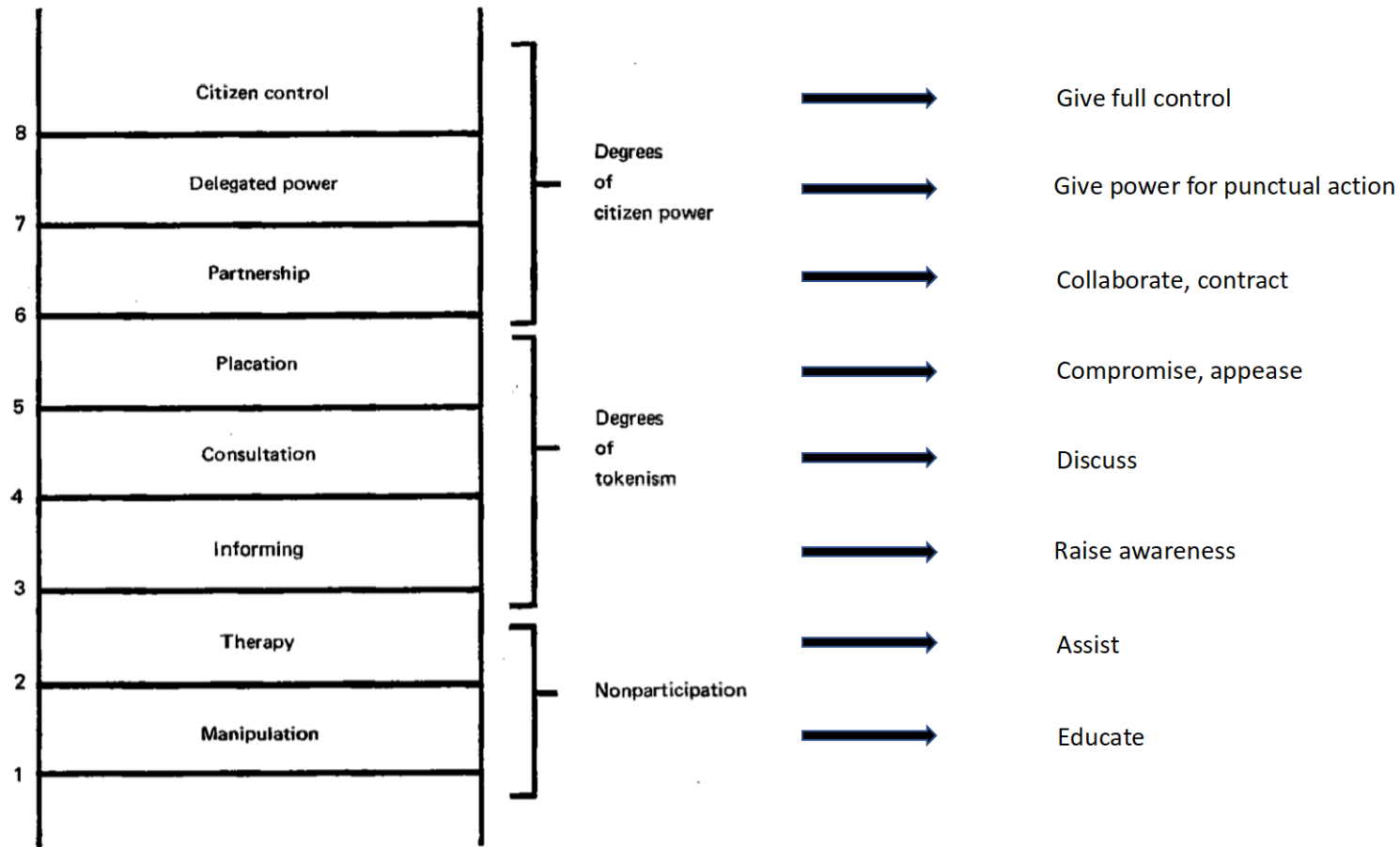
Participation can be a buzzword used by NGOs, local government or international institutions to talk about involving local people in different environmental management programmes (Cornwall 2008; Collins and Ison 2006; Ward, Stringer, and Holmes 2018). Cooke and Kothari (2001) questioned the limitations of local participation. They looked for the lessons learned from this participation, in terms of inclusion versus exclusion, resistance to the imposed participatory models and the way participation may affect multiple communities differently.

Looking back to the late 1960s, Arnstein developed a ladder of citizen participation in public policymaking (Arnstein 1969), with a focus on power relationships. Her model is one of the most famous for characterizing citizen participation and the categories she proposed have been, and still are, widely used. According to Google Scholar, the article has been cited more than 21,000 times. Of all the citations, 25% were cited in the last 5 years. I have adapted Arnstein's model to the concept of participation in environmental management or research activities (see Figure 2).

The 'nonparticipation' part of Arnstein's ladder refers to programmes in which citizens are only recipients of the action with no active role in the decision making. Translated into environmental management language, 'manipulation' can be understood as 'education', e.g., to provide local people with information regarding the benefits they could receive from a conservation policy that would then encourage them to favour the policy. 'Therapy' can be understood as 'assistance', e.g., to assist local people through a development programme for poverty alleviation.

Many development programmes fall under the category of 'tokenism' on the Arnstein's ladder, which suggests symbolic participation. In such cases, programmes just need to show some level of local community involvement. 'Informing' can then be understood as 'raising awareness' (e.g., about environmental degradation) and 'placation' as 'finding a compromise'. An example of placation is when social scientists have to explain their research activities during village meetings to be authorized by the villagers to conduct the research. They tend to present their activities in a way that satisfies local communities and prevents conflict.

Figure 2. Arnstein's (1969) ladder of participation (on the left) adapted for environmental management (on the right)



Only the upper part of the Arnstein's ladder describes real participation. Three categories are mentioned there: 1) 'Partnership' means establishing a contract and agreement with local communities, for example, for the management of a protected area, 2) 'delegated power' is about the devolution of responsibilities and decisions to local people in the context of activities with clear limitations in length and purpose and 3) the highest level of participation is 'citizen control'. From a researcher's perspective, it means giving full power to the local communities on the research design, agenda, implementation and results. The research contributes then to a project entirely under the control of the local people. This kind of participation rarely happens. Arnstein's ladder adapted for research on environmental management is interesting because it highlights the power relationship existing between communities and researchers, something that any scientist working with local communities has experienced.

Thompson et al. (2020) have recently published a review of local community participation in environmental monitoring that also considers power relationships as key to the success of community engagement. According to the authors, power relationships between local communities and other external stakeholders (e.g., the scientific community, civil society, government) is a challenge that needs to be addressed. Otherwise, it will be difficult to avoid a disconnection between participatory monitoring and the resulting environmental management.

According to Cornwall (2008), the most frequent form of local people's participation is to meet a project's objectives and for cost efficiency, but not for local people to be considered as decision makers. Local people rarely develop contact with donors or governments to obtain resources and seek technical assistance in a development or forest conservation programme. This kind of participation would be called 'self-mobilization' (Pretty 1995), or 'autonomous local monitoring' in the context of natural resource management (Danielsen et al. 2008). The nature and level of 'participation' depends on the intentions of those initiating it. For example, 'instrumental participation' is used as a means to achieve a project objective, while 'transformation participation' makes participation a means to achieve local empowerment or control in decision making (Cornwall 2008). Similarly, in her typology of participation, Agarwal (2001) characterises the different levels of participation, from passive to interactive, the latter involving empowering (Table 2). But once again, this typology suggests a graduation from low to high participation that does not reflect the complexity of local participation.

Table 2. Typology of participation
Source adapted from Agarwal (2001)

Form/ Level of participation	Characteristic Features
Nominal participation	Membership of a group
Passive participation	Being informed of decisions ex post facto or attending meetings and listening to the decision making, without verbally interacting
Consultative participation	Being asked an opinion on specific matters without any guarantee of influencing decisions
Activity-specific participation	Being asked to (or volunteering to) undertake specific tasks
Active participation	Expressing opinions, whether or not solicited, or taking another kind of initiative

Interactive (empowering) participation	Having voice and influence in a group's decisions
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The limits of Arnstein's ladder of participation and Agarwal's typology of participation lie in the fact they focus on a single dimension of power and assume a hierarchy. Arnstein suggests that higher up the ladder is better, the lower rungs being 'no participation' (Collins and Ison 2006; Reed 2008; Reed et al. 2018; Tritter and McCallum 2006). Agarwal (2001) uses a similar model.

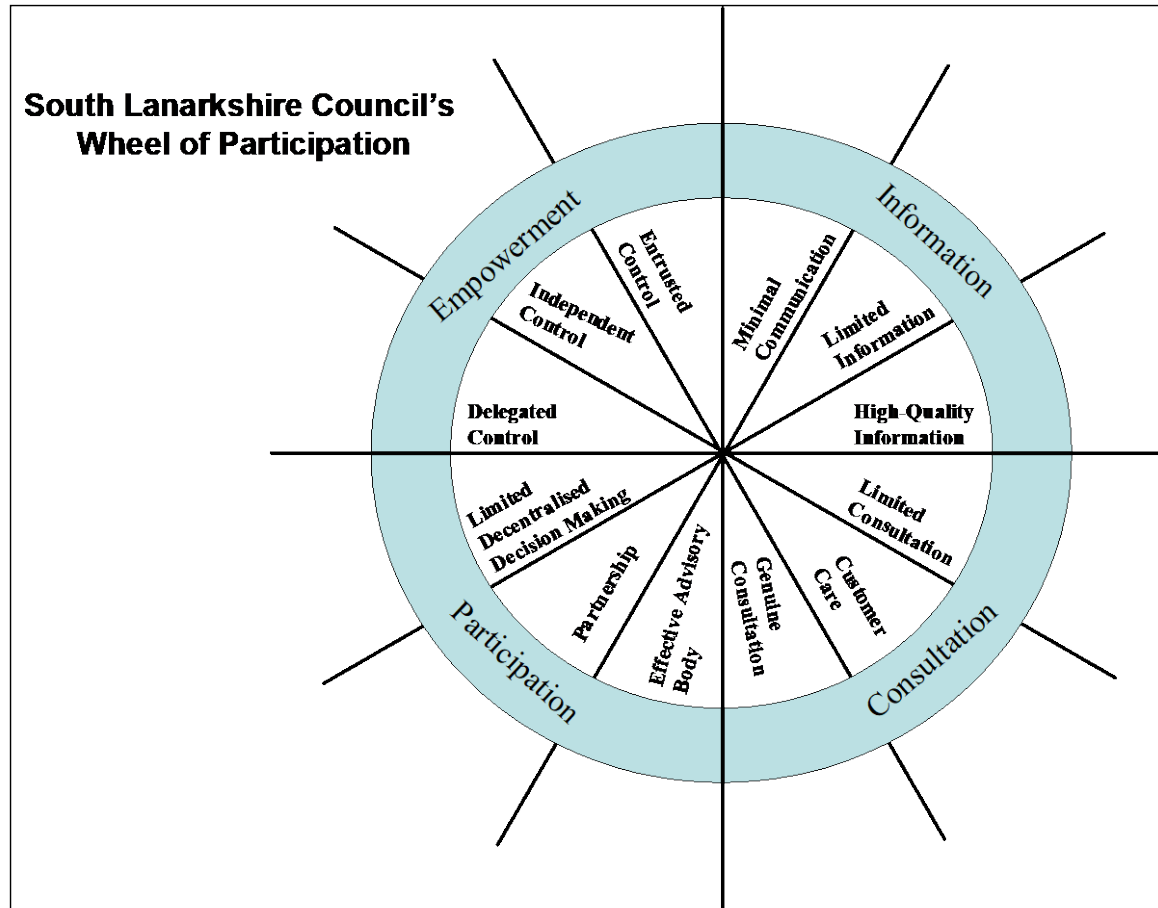
Power relationships are indeed a key element to understanding local people's participation, but it is not the only one. Other models reflect the complex reality of community engagement depending, for example, on power relationships, community interest and an expected level of knowledge required. One of the models is Davidson's wheel of participation, although not as widely used as Arnstein's ladder. It considers four approaches to community involvement in the planning system, through: 1) information, 2) consultation, 3) participation and 4) empowerment (Davidson 1998). The first approach, 'information', requires limited involvement but high-quality information and good communication skills (Figure 3). The second approach, 'consultation', has limited local involvement but targets the community's needs and future actions reflect the results of the consultation. The third approach, 'participation', involves building partnerships with communities to solve problems together and allow communities to make their own decisions. The fourth and last approach, 'empowerment', is a delegation of control of the entire project, in which other stakeholders (e.g., the scientists) act only as facilitators and service providers. Local communities then become the decision makers.

The underlying principle behind the wheel of participation is that local people's engagement should be adapted to the needs of a project and does not follow a graduation pattern, as in Arnstein's ladder. The four approaches are relevant to different situations that require more or less participation. In some projects, it is enough to follow a simple but strong consultation process, in other projects, partnerships are needed and some cases require local people's empowerment.

"The wheel promotes the appropriate level of community involvement to achieve clear objectives, without suggesting that the aim is always to climb to the top of the ladder" (Davidson 1998, p14).

In the next section, based on these general considerations about the development and use of participatory research, I present my interpretation of a conceptual framework, which I used during my research activities.

Figure 3. South Lanarkshire wheel of participation
Consulted https://mercury.org.au/wp-content/uploads/1_pages/downloads/Wheel-of-Participation.pdf



3. Conceptual framework

In this section, I present a conceptual framework of participation used in the case studies (section 4). I also define some terms used during my research studies.

Figure 1 shows the link between my research questions and the different phases during my career. During the first phase, i.e., the study of local perceptions of forestland and resources, I did not use participatory research questions as presented in the figure. The focus on local people's participation in environmental management came after I started to work with the Agricultural Research for Development (CIRAD) and the Center for International Forestry Research (CIFOR).

Figure 4 is a schematic representation of the way I perceive local community participation in environmental management, based on the experience accumulated during my different research projects. I consider environmental management to be the use and conservation of forestland through planning and actions.

The definition of 'local community' needs to be clarified. In the literature, local communities are considered in spatial, socio-cultural and economic terms (IIED 1994). In spatial terms, they live in the same place and generally use the same territory for their livelihoods. In social and cultural terms, community members are linked through marriage, kinship, shared knowledge, beliefs, laws and customs. In economic terms, they share control over strategic natural resources. Kiss (1990) proposes a definition of communities based on the social organisation, with community members giving up some of their individuality to the group. Agrawal and Gibson (1999) describe communities as a 'small spatial unit', a 'homogenous social structure' and 'shared norms'. The authors investigated the political role of communities in resource management, e.g., the multiple interests of community members and the way they influence decision making.

In the context of the anthropology of rural societies, Gossiaux (1992) defines 'community' as a social unit, whose economy is secured within a territory that provides most of its livelihoods.

I focused on a spatial definition of the communities because my research studies have always been about communities having strong bonds with their land. In Figure 4, local communities are the people (migrants or indigenous) living in or near forestland in which a project is taking place, who use forest resources for their livelihoods and claim land-use rights to that territory. Because my studies took place in villages, which is a social and political construct, but also connected to a territory, I often use in this document the words 'village' and 'community' interchangeably.

Figure 4, based on 25 years of observations and analysis, shows the activities for which community participation is needed, the interactions between the different stakeholders and the primary role of tenure and rules. It shows that local communities can be involved in decision making at the local level, to use forest resources and control access to these resources. Local communities can also take part in assessing changes in resource availability and management. They can be involved in reporting when a

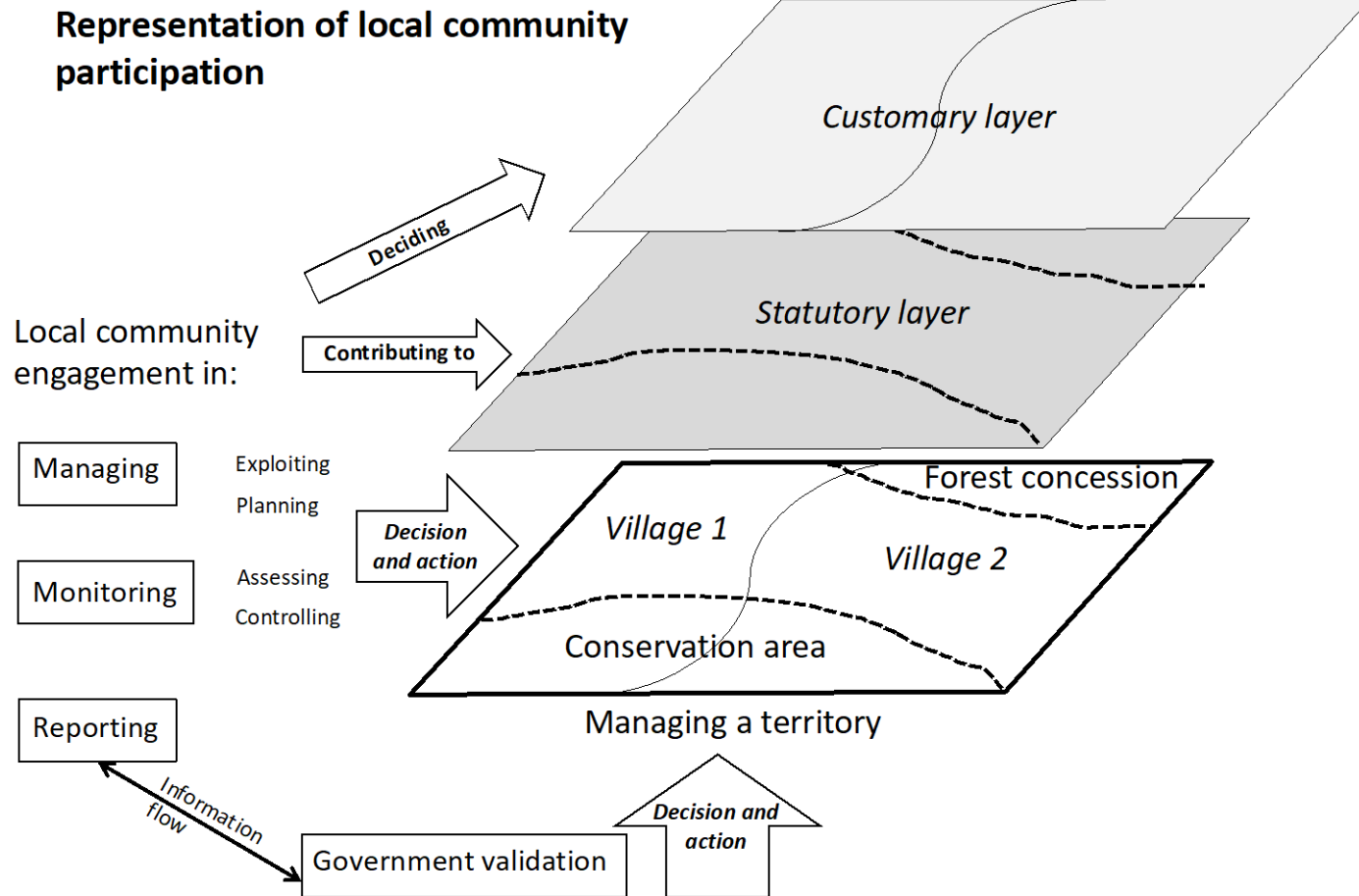
reporting system is in place from local to district, regional/provincial and national levels.

Local communities frequently live in places with customary and legal/statutory rules and the two systems tend to overlap. For example, the extractive activities of local communities are undertaken in places often controlled by the government or the private sector, through a protected area or a concession. Sometimes, local communities are unaware of the legal designation of their territory and conflicting land-use (e.g., between an oil palm concession and a protected area) can take place in the same territory. In the case of Indonesia, for example, the government is currently developing a one-map system that should reconcile all the different land-uses, for all the different sectors and should include traditional land rights. Participation in forestland management, including monitoring, needs to take into account these different layers.

Social science surveys, for example, include key informant interviews, household surveys or focus group discussions. Interviews can be structured or not, open-ended or closed. Other methods belong to participatory research, for example, participatory mapping was used not only to represent the spatial knowledge of a community, but also to discuss possible land management options. Participatory maps can be overlapped with and compared to maps developed using Geographical Information System (GIS) (see case study 13). A Venn diagram is another method used to understand the way local communities perceive the connections between different institutions and activities in a village. Participatory mapping is often used in the context of focus group discussions. They are used to obtain information from a specific group(s) of villagers, e.g., young women, older women, young men, older men or professional groups on their perceptions of forest resources or development issues (see case study 3, Figure 7).

This research study is still ongoing, but the case studies presented in the next section provide elements to answer the research questions and test the hypothesis formulated in the introduction. In section 5 ‘future research’ and section 6 ‘conclusion’, I discuss what is still missing to answer the research questions and test the hypothesis.

Figure 4. Community engagement



4. Case studies

This section describes a selection of case studies that illustrate the way participatory research became central to my research topics. Figure 5 shows the distribution of my publications since 1999 according to the four different research topics presented as case studies: 1) local knowledge and local perceptions as a foundation for research on local participation; 2) research on participatory approaches to conservation; 3) research on participatory approaches for land-use planning; and 4) research on local participatory monitoring (biodiversity and carbon). Table 3 provides a key for the different publications in Figure 5.

During my PhD in the 1990s, I studied traditional ecological knowledge and local people's perception of forestland. This first study was important to understand that people living in and managing a forest play a key role in transforming it. However, during this step I did not use participatory research. My research study was mostly extractive, trying to understand how a local community managed its territory and natural resources. At this point, I did not study the way local communities could play a bigger part in decision making regarding environmental management, as I did in remote Papuan villages of Mamberamo (e.g., case study 9) where they were the sole land managers. I have continued to study community perceptions until the present because the way local people participate in projects and interact with experts or government organisations is also primarily based on their perceptions and priorities. Local perceptions influence the construction of a territory's history, its myths and stories, the names of places, the local management systems (e.g., the different farming systems, the presence of protected forests, the settlements) and the ecological knowledge (names, ecological functions and uses) of plants and animals.

Figure 5. Publications according to the topic

Note: The key for the numbers is given in Table 3 below. One publication can appear in more than one box (e.g., 12, 20, 24).

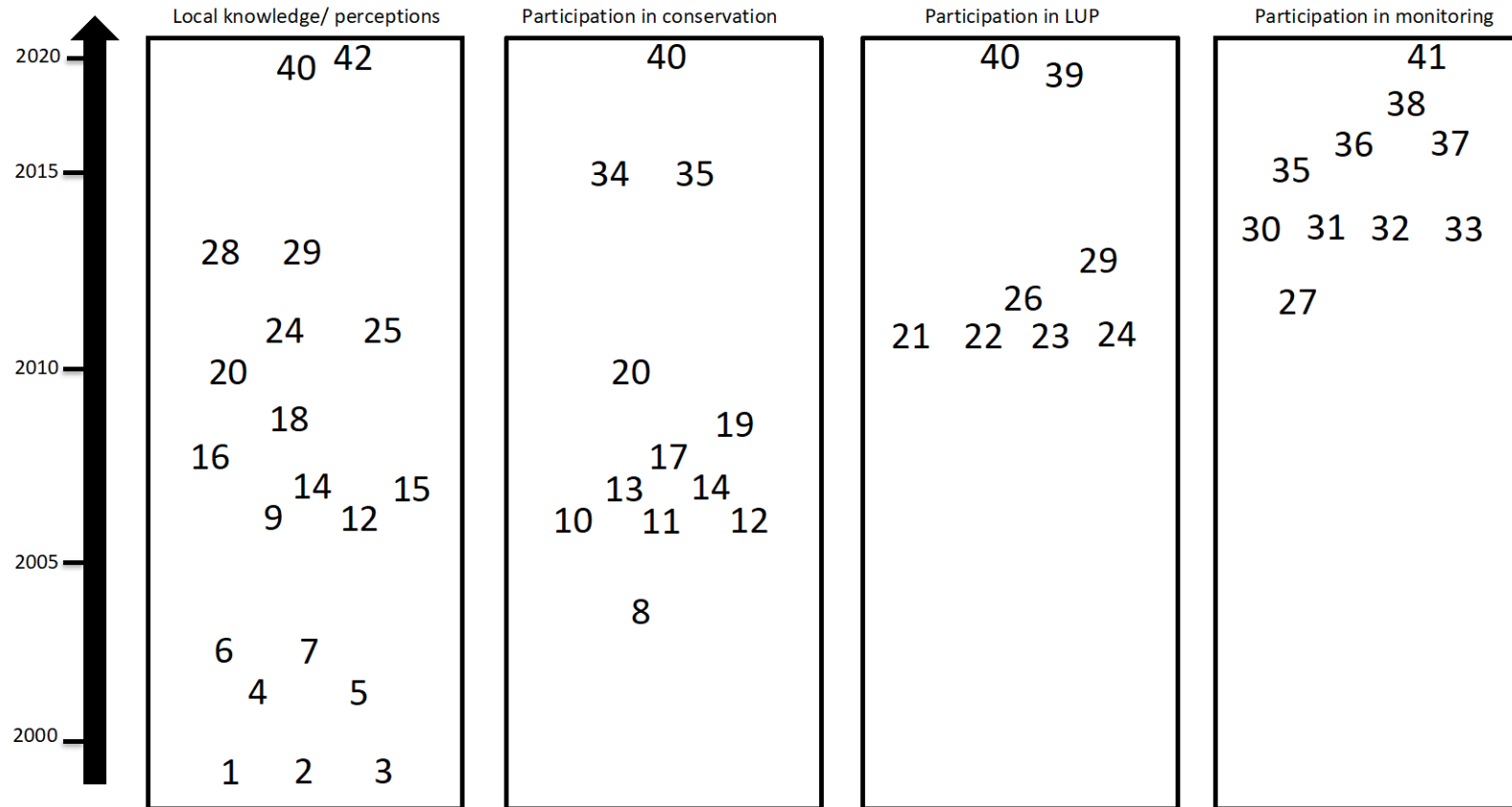


Table 3: legend for Figure 5

Nb	Year	Author(s)	Title	Journal/livre
42	2021	Boissière M.	The making of a montane taro garden	Journal of Tropical Ethnobiology
41	2021	Boissière M. et al.	Perspectives on the socio-economic challenges and opportunities for tree planting: a case study of Ethiopia	Forest Ecology and Management
40	2020	Boissière et al.	Developing small-scale bamboo enterprises for livelihoods and environmental restoration in Benishangul-Gumuz Regional State, Ethiopia	International Forestry Review
39	2018	Boissière et al.	Technical guidelines for participatory village mapping exercise. CIFOR, Bogor, Indonesia. 19pp (English and Indonesian)	CIFOR technical paper
38	2017	Boissière M. et al	The feasibility of local participation in Measuring, Reporting and Verification (PMRV) for REDD+	PLOS ONE
37	2016	Beaudoin G. et al	Completing the picture: importance of considering participatory mapping for REDD+ Measurement, Reporting and Verification (MRV)	PLOS ONE
36	2016	Hawthorne, S. et al	Assessing the Claims of Participatory Measurement, Reporting and Verification (PMRV) in Achieving REDD+ Outcomes: A Systematic Review	PLOS ONE
35	2015	Sheil D. et al	Unseen sentinels: local monitoring and control in conservation's blind spots	Ecology & Society
34	2015	van Heist, M. et al	Exploring Local Perspectives for Conservation Planning: A Case Study from a Remote Forest Community in Indonesian Papua	Forests
33	2014	Boissière M. et al	Suivi des émissions dans la REDD+. Impliquer les populations locales, à quelles conditions? Perspective 30, November 2014, 4p.	Perspective
32	2014	Boissière M. et al	Can we make participatory NTFP monitoring work? Lessons learnt from the development of a multi-stakeholder system in Northern Laos	Biodiversity and Conservation
31	2014	Boissière M. et al	Participating in REDD+ Measurement, Reporting, and Verification (PMRV): Opportunities for local people?	Forests
30	2014	Hawthorne S., M. Boissière	Literature review of participatory measurement, reporting and verification (PMRV)	CIFOR working paper
29	2013	Boissière M. et al	Improving the management of commercial Non-timber Forest Products in Cambodia for the benefit of local communities	Bois et Forêts des Tropiques
28	2013	Boissière M. et al	Local perceptions of climate variability and change in tropical forests of Papua (Indonesia)	Ecology and Society
27	2012	Belcher B. et al	Development of a village-level livelihood monitoring tool: a case study in Viengkham district, Lao PDR	International Forestry Review
26	2012	Padmanaba M. et al	Perspectives on collaborative land-use planning in Mamberamo raya regency, Papua, Indonesia: Case studies from Burmeso, Kwerba, Metaweja, Papasena, and Yoke	CIFOR report
25	2011	Boissière M. et al	A booming trade? How collection of war residues affects livelihoods and forest in Vietnam	International Forestry Review
24	2011	Manithaythip Thephavanh et al	Spatial changes in the use of Non Timber Forest Products in four villages of Viengkham District, Luang Prabang Province, Lao PDR	The Lao Journal of Agriculture and Forestry
23	2011	Pfund J.-L. et al	Understanding and Integrating Local Perceptions of Trees and Forests into Incentives for Sustainable Landscape Management	Environmental Management

22	2011	Watts J.D. et al	Information Flows, Decision making and Social Acceptability in Displacement Processes	Chapter in "Collaborative Governance of Tropical Landscapes"
21	2011	Colfer C.J.P. et al	An introduction to five tropical landscapes, their people and their governance.	Chapter in "Collaborative governance of tropical landscapes"
20	2010	Boissière, M. et al	Researching local perspectives on biodiversity in tropical landscapes: lessons from ten case studies	Chapter in "Taking stock of nature: participatory biodiversity assessment for policy planning and practice"
19	2009	Boissière M. et al	Can engaging local people's interests reduce forest degradation in Central Vietnam?	Biodiversity and Conservation
18	2009	Boissière, M.	How does migration affect ethnobiological knowledge and social organization in a West Papuan village	Chapitre in "Local landscape, process and power"
17	2008	Boissière M., C. Doumenge	Entre marginalisation et démagogie: quelle place reste-t-il pour les communautés locales dans les aires protégées	Cahiers d'Outre-Mer
16	2008	Boissière, M.	Techniques et usage du billon chez les Yali d'Irian Jaya	Chapter in "Agricultures Singulières"
15	2007	Boissière M., Y. Purwanto	The agricultural systems	Chapitre in "Ecology of Papua"
14	2007	Boissière M., M. Sassen	Mesurer l'importance de la biodiversité pour les sociétés forestières des pays du Sud. Une méthode d'investigation pluridisciplinaire	Nature, Science et Société
13	2007	Boissière M. et al	People priorities and perceptions. Toward conservation partnership in Mamberamo	CIFOR Report
12	2006	Boissière M. et al	Biodiversity and local perceptions on the edge of a conservation area, Khe Tran village, Vietnam	CIFOR book
11	2006	Liswanti N., M. Boissière	Keanekaragaman hayati menurut masyarakat Mamberamo	Tropika Indonesia
10	2006	Sheil D., M. Boissière	Local people may be the best allies in conservation	Nature
9	2006	Boissière M., N. Liswanti	Biodiversity in a Batak village of Palawan (Philippines): a multidisciplinary assessment of local perceptions and priorities	CIFOR report
8	2004	Boissière M. et al	Pentingnya sumberdaya alam bagi masyarakat lokal di Daerah Aliran Sungai Mamberamo, Papua, dan implikasi bagi konservasi	Journal of Tropical Ethnobiology
7	2003	Boissière, M.	Techniques et pratiques de la chasse chez les Yali d'Irian Jaya, Indonésie	Journal of Tropical Ethnobiology
6	2003	Boissière, M.	La mémoire des jardins: pratiques agricoles et transformations sociales en Nouvelle-Guinée	Annales de la Fondation Fyssen
5	2002	Boissière, M.	The impact of drought and humanitarian aid on a Yali village in West Papua	Asia Pacific Viewpoint
4	2002	Brutti L., M. Boissière	Le donneur, le receveur et la sage femme: échange de porcs à Oksapmin (PNG)	Journal de la Société des Océanistes
3	1999	Boissière, M.	Ethnobiologie et rapports à l'environnement des Yali d'Irian Jaya (Indonésie)	PhD dissertation
2	1999	Boissière, M.	Gestion d'un terroir forestier par des cultivateurs Yali (Irian Jaya, Indonésie)	Chapter in "L'homme et la forêt tropicale"
1	1999	Boissière, M.	La patate douce et l'arachide, transformation d'une agriculture yali	Journal d'Agriculture Traditionnelle et de Botanique Appliquée

It was only in the 2000s that I began to study the current and potential role of local communities in forestland conservation. My recruitment by CIRAD in 2002 and secondment to CIFOR in 2003 were the catalysts for conducting participatory research. Environmental management that integrates development issues and local wellbeing is a research priority for both CIRAD and CIFOR. My knowledge of the way local people perceive important natural resources and forestland was a preamble to study the role of local people in local conservation and how to improve it.

Because conservation is part of a broader management system—land management—I also studied local participation in land-use planning during the 2010s. I included other essential stakeholders, such as the local government and the private sector, who were taking part in land-use planning. At this point, participatory research was already central to my studies. I focussed on the conditions for the sustainable participation of local communities because they are the primary forest users and managers.

Tropical humid forests are in general dominated by the strong *de-facto* presence of local communities in forest management, predominantly overlapping with *de-jure* state-owned land management (Agrawal and Ostrom 2001; Felker et al. 2017). Despite their presence, local communities generally have weak rights when confronted with centralised forest policies and management decisions. Sustainable participation means participation that is not limited in time by a government or non-government led project. Local community participation will continue after the project has finished if they are motivated to do so and if financial resources remain available to support continued participation. Motivation depends on the attractiveness of being involved in land-use planning. Attractiveness can depend on cost and benefits for the local communities in terms of time, income generation, strengthened governance and land-use rights (Poulsen and Luanglath 2005; Boissière et al. 2009).

Local community participation includes participation in monitoring (Hawthorne et al. 2016; Boissière, Beaudoin, et al. 2014; Danielsen et al. 2008; Danielsen, Burgess, and Balmford 2005). Monitoring changes in forest products, biodiversity, carbon and forest cover is key to land-use planning, conservation and the implementation of REDD+ activities (Boissière et al. 2017; Padmanaba et al. 2012; van Heist et al. 2015). REDD+ is an international mechanism aimed at “*reducing emissions from deforestation and forest degradation and the role of conservation, sustainable management of forests and enhancement of forest carbon stocks in developing countries*”². REDD+ supposes that carbon emissions and sequestration are monitored (GOFC-GOLD 2014). Measurement, Reporting and Verification (MRV) is a tool to monitor and report carbon sequestration and other non-carbon data (e.g., biodiversity, livelihoods, drivers of deforestation, forest degradation) (Hawthorne et al. 2016). Monitoring helps to assess the changes that follow land-use decisions. Participatory monitoring represents my latest topic, starting in the 2010s and continued until recently.

² <https://unfccc.int/topics/land-use/workstreams/redd/what-is-redd>

A significant part of my research between 1995 and 2014 took place in New Guinea (essentially West Papua - Indonesia, but also briefly in Papua New Guinea). Figure 6 illustrates where and when I was working in this region. Hereinafter, West Papua - Indonesia will be referred to as Papua.

Figure 6: Main locations of my fieldwork in New Guinea (Papua New Guinea and West Papua)



The following subsections illustrate, through case studies, the four milestones of my research on participation: 1) understanding local knowledge and perceptions, 2) analysing participation in conservation, 3) scaling up local participation to land-use planning and 4) monitoring (see Figure 1).

I. Local knowledge and local perceptions as a foundation to research on local participation

I studied local community perceptions of the forestland in Papua and Papua New Guinea during my PhD, post-doctoral and other research activities as a CIRAD scientist (see Figure 6).

As explained earlier in section 3, there are various definitions of ‘community’. I chose to use a spatial definition of the communities because, in my research sites, communities have strong bonds with their land. But the term ‘community’ is also a social construct (Gossiaux 1992; Kiss 1990). It brings together a group of individuals, each with his/her agenda, expectations and perceptions. Local communities often live together in a legal unit called a village. I will, therefore, use the terms ‘local people’, ‘local communities’ and ‘villagers’ interchangeably. I also recognise that government organisations, NGOs and scientists often use the generic term of ‘communities’, when referring to local people and assume that they are speaking with one voice about their future, which is not always correct.

My research assumed that the way local people perceive their village’s territory determines the way they manage it. A village’s territory is not only a legal unit but also a cultural construct, i.e., a land shaped by the perceptions and livelihoods of its inhabitants (Boissière 1999a). When studying the local perceptions of forestland and resources, I also analysed:

- the history of the place, including the ethnicity, migratory streams, the myths and legends,
- the perception of space through the mapping of the territory, including the names of places. Places are named for historical reasons, recent events or the presence of important features and
- the way local beliefs, taboos, traditions and rituals influence land management.

The way a local community manages its environment also depends on the ethnic groups that compose the community. For example, in the district of Mamberamo Raya (Papua), villages can comprise 2 to 3 different ethnic groups, each with its own language, traditions, beliefs and history (Boissière et al. 2007; Padmanaba et al. 2012). Villages with multiple, coexisting ethnic groups are common in Papua, especially in the district of Mamberamo Raya. The district has approximately 20,000 people who belong to at least 50 ethnic groups³ (Silzer and Heikkinen 1984) and share a 2.3 million hectare territory. While in the highlands of Papua, I worked in the village of Holuwon, which has two ethnic groups with different histories (Boissière 1999a).

The following case studies give a sample of the diversity of communities and local perceptions of natural resources and forestland. They provide an example of the way local perceptions can influence land management. The case studies took place in Indonesia, Papua New Guinea, Laos and Cambodia.

³ Silzer and Heikkinen identified 80 languages in 1984 at a time the district of Mamberamo Raya was part of the larger district of Jayapura (about 6 million hectares before the district was split into smaller districts).

Case study 1: local perceptions of the natural resources and territory in the Heluk valley (Papua) (Boissière 1999a; 2003; 2009; 1999b).

The main research question was: what relations have the Yali of Holuwon (a village located in the Heluk valley, Papua) developed with their forestland. To answer this research question, I studied the way the community manages its territory, including the use and names of space and land and the utilisation of forest resources. Environmental (e.g., climate, topography, soils), economic (e.g., markets) and cultural factors influence the way local communities manage their land. During my study, I focused on the cultural factors, showing that local perceptions, ethnicity and local ecological knowledge influence the type of livelihood activities local people conduct in their territory, including their forestland. These findings came from using ethnobotanical research methods. The people of Holuwon village, in the Heluk valley, belong to two ethnic groups: the Yali and the Hupla. The Yali is the dominant group and most villagers have adopted their traditions. The Holuwon villagers manage their territory by moving their settlements every few decades within geographical limits and easy reach of their large gardens at the heart of their land (Boissière 1999a, 1999b). These gardens (*yabuk humon* in Yali) are central to the village's territory and a provider of food for the community. Space is organised around these gardens and the forest, mostly forest regrowth of different ages, and managed accordingly. Each part of the territory has a name linked to a story or a legend. Names can also reflect a specific ritual (historical) conducted in the area. The act of naming a place is a way for the Yali society to attribute a function to that place. There is not a single part of the land that is not named. For example, *Alukwanduk* forest (*Alukwan* hill) refers to a witch, *Alukwanhwe*, who hides in the forest and kills men passing by. A cave nearby is called *Apandeng* (femur) because an older man died there and only his femurs remained.

People belonging to both ethnic groups in Holuwon recognise and name all the plants in their forestland. Some plants play a key role in their livelihoods for food, firewood, construction or rituals. They can be cultivated plants growing in their gardens or wild plants in the forest around the village. People from Holuwon recognise and know the names of more than 700 species of trees and herbs (Boissière 1999a). Hundreds of these plants are used for medicine, construction, tools, food and rituals. Although many have no known use for the villagers they still name these plants following a complex nomenclature, primarily based on the shape and size of the leaves and texture of the bark (Boissière 2009). Naming that many plants shows a developed local taxonomical and ecological knowledge.

The local knowledge of the natural resources and places comes in addition to the way the Yali perceive their world, based on legends. According to these legends, mythic animals created the mountains, rivers and valleys at the time of the first human beings.

My research in Holuwon showed that when governmental and nongovernmental organisations introduce a development, conservation or aid programme to such a place, they need to understand how the villagers perceive and live in their territory (Boissière 2002). This is particularly important in order not to do more harm than good, to be careful that the programme is culturally acceptable or is adequate in terms of the situation on the ground. For example, in 1997, I was in Holuwon during an El Niño event, with dramatic consequences for the villagers (forest fires and food shortages). I witnessed the way food aid was administered without taking into account the current

situation of the villagers. It also arrived too late and at the beginning of a new planting season and became a source of dispute and destabilisation in the village (Boissière 2002).

Case study 2: local perceptions of the territory in Oksapmin (Papua New Guinea) (Boissière 2003; Brutti and Boissière 2002; Boissière 2021)

This case study provides another example of the relationship between local perceptions and land management, especially concerning the central role of gardens in land management. In the village of Oksapmin, in the highlands of Papua New Guinea, gardens play a major role in the way villagers perceive, claim ownership over and secure access to their territory.

The village consists of several hamlets separated from each other by a distance sometimes of several kilometres. This is to cover and claim the maximum amount of land possible. Sweet potato (*Ipomoea batatas*) and Taro (*Colocasia esculenta*) are staple foods. Sweet potato is subject to intense agriculture on the bottom of the valley near the settlements. Taro, a more ancient crop, was moved to higher ground, on the slopes and tops of the mountains surrounding the village. Oksapmin villagers often move taro cuttings and gardens around their territory to strengthen their claim to the land (Boissière 2021).

Case study 3: local perceptions of natural resources and forestland in Mamberamo (Papua) (Sheil et al. 2002; Boissière et al. 2007)

Case studies 3 and 4 use a multidisciplinary method to explore the way local communities perceive their forestland types in Indonesia and Laos. The importance, according to the local people, of the different forest products as sources of livelihoods influences the type of forestland management, e.g., for extractive activities, for protection or hunting. This shows the direct link between perceptions and environmental management.

Starting in 2004, with a team of scientists from CIFOR, we studied the local perceptions of land types in several villages and ethnic groups in the district of Mamberamo Raya, in Papua. This study included understanding the way local communities claim a territory, using a multidisciplinary approach called the Multidisciplinary Landscape Assessment (MLA) (Sheil et al. 2002). The MLA explores the perceptions of local communities of their natural resources, including the forest. The study focused on the importance of different land types (e.g., natural forest, secondary forest, rivers, settlements, mountains) for different categories of use (e.g., food, medicine, light and heavy construction, firewood).

To understand local perceptions, we used a method called the Pebble Distribution Method (PDM). Participants put pebbles on cards representing a land type to indicate its importance for a particular activity (Sheil et al. 2002; Boissière and Sassen 2007).

For example, Figure 7 shows the importance of forest, on average and across a few villages, e.g., for medicine, construction, tools, firewood and rituals. In Figure 7, the groups of villagers involved in the exercise explained that rivers were considered as important for firewood because a considerable amount of deadwood could be found on

the riverbanks. They scored 19.3 for river for fuelwood, in the third position after garden and forest.

Figure 7. An example of PDM exercise in a village in Mamberamo watershed (Papua)

Note: Source: CIFOR 2004.

	Food	Medicine	Light construction	Heavy construction	Boat construction	Tools	Firewood	Basketry/cordage	Ornament/ritual	Marketable items	Hunting tools	Hunting place	Recreation	Future
<i>Village</i>	10.8	14	5	9	3.5	6	2.5	1.5	8.5	10	7.5	0.5	24.5	13.3
<i>Old village</i>	6.8	5.8	6.5	3.3	0.8	1	3.8	4.3	4	3	9.5	4	0	4.3
<i>Sago garden</i>	11.5	5	5	10.3	0.3	9.8	5	2.3	2.5	11	2.8	4.3	0	14
<i>River</i>	10.3	11.3	5	3.3	18.3	16.3	19.3	8.3	4	14.8	8.8	24.8	22	9.8
<i>Swamp</i>	7	6.3	4.5	3.5	3.5	3.3	2.5	6.3	2.8	3.5	3.5	2.3	0	4.5
<i>Sago hamlet</i>	11.5	5.8	13.3	16	0.5	11	5	4	9.3	10.5	2.8	6.8	0	13.8
<i>Lake</i>	9.3	10.5	4	2.8	15.5	7	4.5	9.5	4.3	15.5	1.8	19.5	6.5	7.8
<i>Garden</i>	15	10.8	6.3	3	4.8	4.8	25.3	2.8	0	10	6.3	1.3	10.5	7.3
<i>Old garden</i>	4.8	7	19.3	15.3	4.5	4.5	11.5	7.8	6.8	2.3	5.8	3.8	0	4.8
<i>Forest</i>	13.3	23.8	31.3	33.8	48.5	36.5	20.8	53.5	58.0	19.5	51.5	33.0	36.5	20.8
<i>Total</i>	100	100	100	100	100	100	100	100	100	100	100	100	100	100
<i>Unlogged forest</i>	28.3	35.3	40.3	37.0	64.5	43.5	30.5	43.5	53.8	46.3	43.8	51	51.8	27.0
<i>Damar forest</i>	10.5	10	8.8	0	8.3	10.5	5.5	15	6.75	7.5	7	7.5	8	20.3
<i>Mountain forest</i>	12.8	16.5	21	9.25	15	16.3	12.8	12.8	17.3	22	13.8	17	20	18
<i>Swamp forest</i>	10	8.5	5.25	11	6.5	7.5	5	7	7.5	8.3	8	8	6.5	10.5
<i>Secondary forest (Old sago)</i>	24.5	14.8	9.5	29.3	0.5	8.5	6.5	9.8	4.5	10.8	8.9	9.3	6	9.8
<i>Secondary forest (Old garden)</i>	14	15	15.3	13.5	5.3	13.8	39.8	12	10.3	5.3	18.8	7.8	7.8	14.5
<i>Total</i>	100	100	100	100	100	100	100	100	100	100	100	100	100	100

Case study 4: local perceptions of biodiversity and livelihood changes in Viengkham (Laos) (Pfund et al. 2011; Thephavanh et al. 2011)

In Luang Prabang Region, Viengkham District, in Northern Laos, with a team of researchers from CIFOR and the National Agriculture and Forestry Research Institute (NAFRI), I studied the local perceptions of forestland and biodiversity and livelihoods monitoring with the participation of local people. My research on monitoring in Laos and other countries will be presented in another section. Villages, in the district are located around and sometimes inside a protected area. The villages lie in a mosaic of land types, a result of long-established swidden cultivation, free grazing and extractive activities, e.g., the collection of Non-Timber Forest Products (NTFP). The local communities have a good knowledge of the changes in forest cover because of the different land-uses, including gold mining.

Local people also understand how biodiversity in forests is affected by human activities. Local communities, in Viengkham District, generally consider the forest as essential for its role in biodiversity conservation or as the provider of key forest products. However, this perception differs according to the location of the human settlement. Villages closer to the natural forest will perceive forests as important for the

collection of economic NTFPs, such as cardamom (*Amomum* sp.). In contrast, villagers located further from the forest will value the forest for conservation. Future environmental management plans have to take into account these differences in perception.

Case study 5: local perceptions of forest products in Cambodia (Boissière et al. 2013; Mulcahy and Boissière 2014)

This case study provides additional evidence for the role of local perceptions in forest management. In this case, the perception of important forest resources may have resulted or not in decisions and actions regarding environmental management.

I assessed, in four regions of Cambodia (Kampong Thom, Kampong Chhnang, Rattanakiri and Mondulakiri), the benefits that local communities receive and could potentially receive from NTFPs. I also studied the way it affects their perception of the forest around their settlement.

An International Timber Trade Organisation (ITTO) project looked at improving the market of NTFPs for the benefit of local communities, through community forestry management (CFM). In some places, local people were interested in using and transforming NTFPs into marketable products because the infrastructure allowed transportation to nearby markets. In other places, I observed a gap between the activities offered by the project and local people's expectations in terms of development and natural resource management. They sometimes perceived the project activities as intrusive and disruptive for their daily activities. Villagers had to spend time in community meetings without clear benefits for them and without always understanding what was expected of them.

The project did not spend enough time securing the villagers' trust. No dialogue took place between the villagers, project proponents, government organisations and local NGOs during the project objective setting. It was, therefore, difficult to select the NTFPs, which villagers considered necessary for their livelihoods, or which, according to them, had the potential to generate an economic return.

The project could not successfully link NTFP sustainable management and forest conservation to the development of value chains and income generation for the villagers. Discussion was missing between the local people and project proponents at an early stage of the project development concerning their priorities, to ensure their interest and participation in this resource management project.

This case was my first attempt, with limited success, to translate my findings of local people's perceptions and priorities into a development action.

Lessons identified

The way local people perceive their forestland and resources influence the way they manage these forestlands, e.g., as a place for shifting cultivation (case studies 1 and 2), as a source of forest products essential for addressing the local people's basic needs (case studies 3 to 5) or as a space for which boundaries need to be marked. In case studies 1 and 2, villagers socially mark their land through the location of their

settlements (e.g., villages, hamlets, camps) and the activities they conduct (e.g., hunting, fishing, agriculture). Some projects (e.g., case study 5) may try to get local people's participation in project activities, believing it to be to the benefit of the local community. Nevertheless, as case study 5 shows, their participation should not be taken for granted. Local people need to be motivated and for there to be clear benefits for participating in the project. The benefits could be economic (e.g., from NTFPs) or non-economic (e.g., land tenure).

As shown in Figure 1, this first research step focussed on perceptions of forestland and is important to understand local land management. It was not directly linked to the main research questions on local community engagement in environmental management, although it could be indirectly connected to the research questions. For example, the aim of the last case study (5) was community development. This first step can be considered a basis on which other studies on land use involving local communities can be developed.

The next section describes case studies on engaging local communities in conservation projects.

II. Research on participatory approaches to conservation

Conservation using national parks or reserves is generally top-down and prevents human activities within certain boundaries, e.g., a core zone or an entire protected area. This type of conservation usually requires the presence of rangers to control the activities inside the protected area. In Eastern Indonesia, especially, there are too few rangers responsible for large protected areas and local communities often do not know that they are living in the middle of a protected area. To give an example, in 2019, about 440 staff were tasked with monitoring 10 million hectares of protected areas in Papua and West Papua compared to 1,600 staff monitoring 780,000 ha of protected areas in Java. If we include the population density in the calculation, one staff member is in charge of the monitoring and protection of 24,000 ha of forest in Papua and West Papua compared to 470 ha in Java. But the same staff will manage an area with a population of 2,100 people in Papua and West Papua compared to 5,000 people in Java. Because of the low human resources it has become increasingly difficult to protect vulnerable, and sometime hard to reach, forest ecosystems without the contribution of local communities (Kartikasari 2008). Several publications show that local communities hold most of the burden and the cost of top down conservation (Poudyal et al. 2018; D. Wood 1995; Colchester 2003) and should play a more direct role in conservation and receive benefits from it.

Since 2004, through 3 case studies, I assessed the conditions under which local communities could better participate in conservation. The main research question was: what is or could be the role of local communities in the management of a protected area.

Case study 6: Community Conservation Agreement in Mamberamo (Papua) (van Heist et al. 2015; Boissière et al. 2007)

Between 2004 and 2006, with a team of CIFOR scientists, I studied the importance of forestland and resources, according to different land-uses, for local communities living in Mamberamo. The research question was: what information is there on local environmental management that supports conservation agreements between local communities and local government.

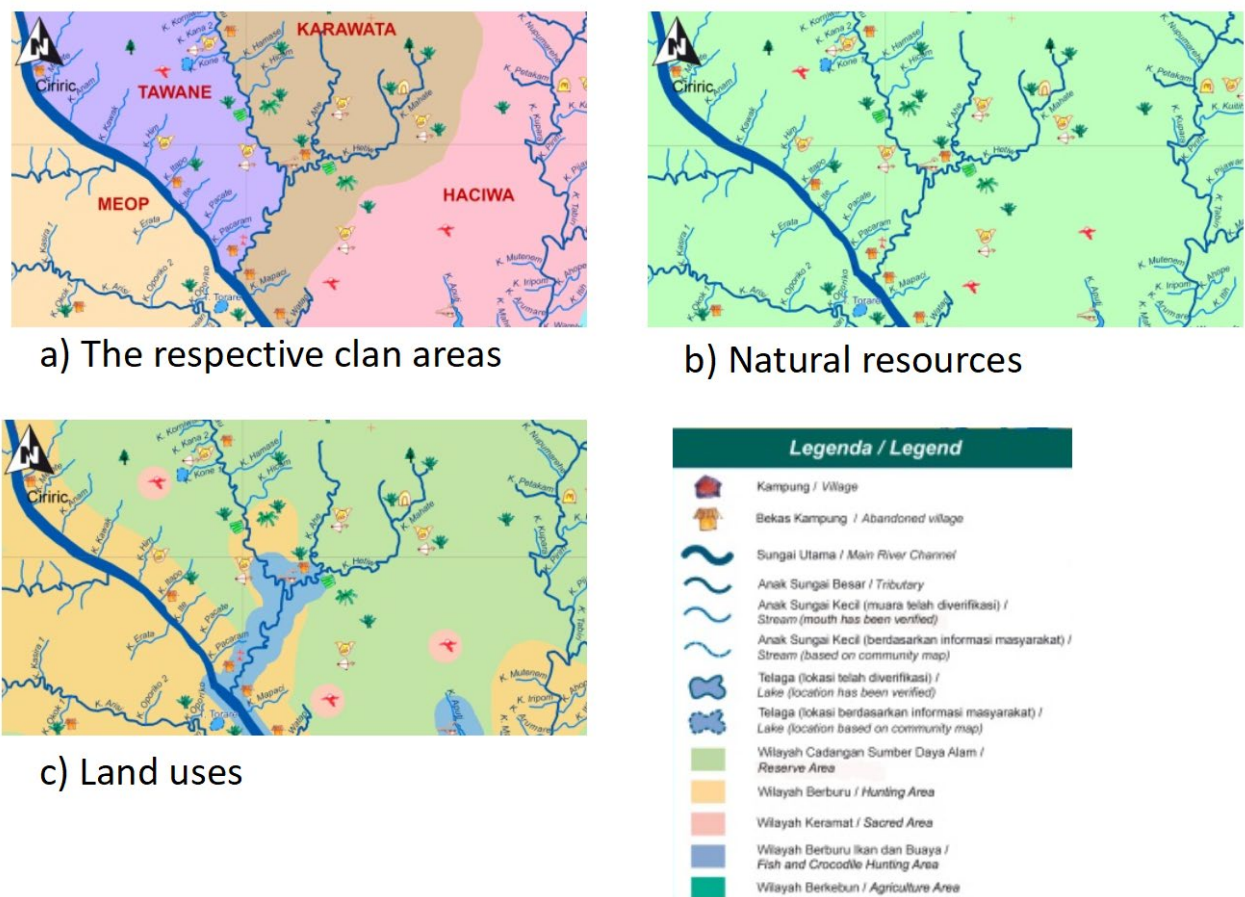
Maps developed with local communities helped to map the forestland and resources, based on local community perceptions. Important places, for hunting, fishing, as a reserve or because they are sacred, were mapped. I then focused on understanding the local people's priorities for conservation, in comparison to other land-uses (e.g., settling, gardening, hunting). Participatory mapping and scoring exercises generated useful information to combine conservation with the local people's development priorities. Conservation International (CI), CIFOR's partner in Mamberamo during this research project, used the maps to draft 'community conservation agreements' (CCA). The CCA was developed in order for the local government to formally approve traditional land-use (van Heist et al. 2015). While CCA has great potential to include local community views on conservation, the local government in Mamberamo has never used it. A possible explanation is that the NGO developing the CCA discontinued pushing for this kind of agreement. This shows that the effectiveness of conservation efforts was hindered by something not related to local participation. The role of participation in determining the success of a conservation initiative also depends on a

lot of other factors, such as funding, technical support, political willingness to push forward a conservation agenda or the relevance for local communities.

Figure 8 gives an example of mapping land rights across a village's territory (Figure 8.a) and locations of critical natural resources (Figure 8.b). Figure 8.c is an example of mapping different local land-uses and includes places reserved for future use and sacred sites. These places could be part of the core zone of a future national park. These types of maps provide information that is relevant to local people (e.g., land use rights) and to conservation (e.g., areas that could be protected for the benefit of local people and biodiversity).

Figure 8. Participatory maps showing: a) the way a territory is shared among clans; b) the location of the natural resources; c) the traditional land-uses

Source: (van Heist et al. 2015)



This case study shows that it is possible to include local priorities and perceptions into conservation plans, but it still needs commitment from the decision makers and civil society who can facilitate discussions between local people and decision makers.

Case study 7: Local and autonomous conservation in Mamberamo (Papua) (Sheil, Boissière, and Beaudoin 2015)

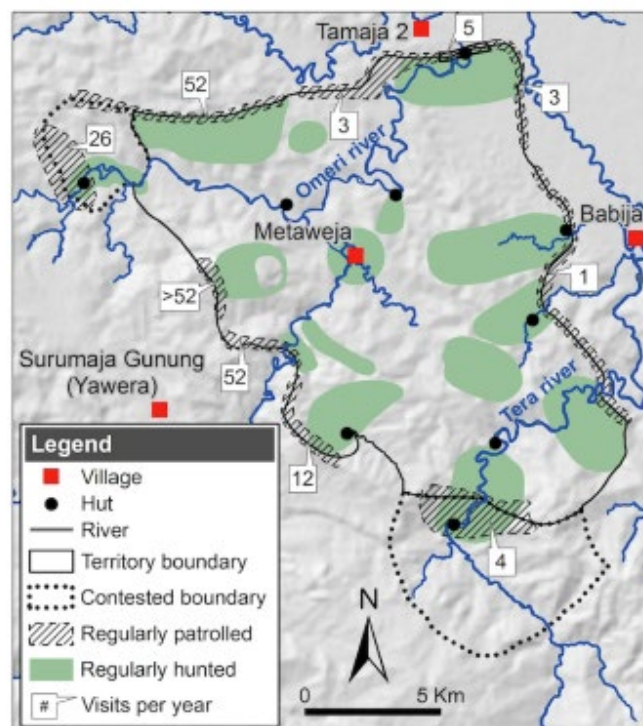
Local communities are capable of conservation efforts for their own benefit without external intervention from the state or NGOs. This case study provides an example of local community conservation without outsider intervention. The research question

was: what are the approaches local communities use to control resources and locations and can we observe a variation from one site to another. This type of local conservation, i.e., resource and forestland control, exists independently of any legal system and is sustainable because it is embedded in the local management of natural resources.

The mapping exercises and interviews conducted during case studies 3 and 6 were used to identify and compare conservation strategies among three communities in Mamberamo. These three villages, with little contact between each other, are located in different ecosystems: mangrove, swamp and mountain. In each village, different ethnic groups are present. Villagers have, however, developed similar ways to control outsiders entering their territory. The first village, located in the inner part of a swamp, generally sends a family to control access to specific lakes, which are rich in fish and crocodiles. They settle at locations with good visibility over the entire lake, stay there the whole year and control any intruders. Intruders are asked what they are doing there and brought to the village head if caught collecting natural resources. The second village, located in a smaller territory at a higher altitude, has a network of huts and semi-permanent camps located near the village's boundaries. These camps serve as a base for hunting, but also to mark the village's limits and to control people coming from neighbouring villages (Figure 9). Hunters can identify the trespasser's village from the footprints on the riverbanks, and sometimes, even identify the individual intruder. The third village, in the mangrove, similar to the first one, controls access to precious natural resources such as fish, crabs and other shellfish, by having villages strategically located in the mangrove. Some families also remotely guard access to the bigger lakes.

Figure 9. An example of local control of the access to a village territory in Mamberamo Watershed (Papua)

Source: (Sheil, Boissière, and Beaudoin 2015)



The conservation strategies observed in the three villages of this case study have been in place for generations and are still in place. It does not overlap with the legal system of protected areas and is sustainable because it was entirely developed by the local communities and follows their needs and aspirations.

Case study 8: Local communities and protected areas in Vietnam (Boissière et al. 2006; 2009)

In Vietnam, the situation is very different. Unlike Mamberamo (case study 7), the local communities must follow the government system. This can often translate into entire villages being evicted from protected areas.

In 2005, with a team of CIFOR scientists, I used the MLA methods (Sheil et al. 2002) to understand the way, in Central Vietnam, local communities perceived forest near a protected area from which they had been evicted. My research question was: how could local communities contribute to the management of a protected area. Instead of conserving the forest, evictions led to increased land degradation, loss of land rights for communities and open access for forest extractive activities. One significant source of livelihood in Central Vietnam is the collection of unexploded ordnance from the US war, sold as scrap metal. The study showed that, while looking for unexploded ammunitions in the forest, villagers sometimes spent several weeks collecting other forest resources, such as hunting game and collecting rattan and bamboo (Boissière, Sheil, and Basuki 2011).

When asked about the role they envisaged for themselves in the protected area, some villagers said they would like to contribute to the monitoring around and inside the park. Monitoring includes patrolling and controlling access to the forest. Villagers expected some financial incentive for participating. But so far, the government has not empowered them with any role in the national park management.

This type of situation is common in protected areas. For example, in Northern Laos, Hmong communities have also been relocated out of the protected area, in which the emblematic tiger is still found, to prevent hunting and other extractive activities (Watts et al. 2011). I consider this type of top-down conservation as counterproductive. Instead, local communities should be a partner in conservation, especially if they have something to gain from it, e.g., recognition of their land-use rights or direct financial benefits (Sheil and Boissière 2006).

Lessons identified

Conservation in places with local communities can succeed if they are made partners in the process or if they initiate it. They should also be informed about the protected areas at the beginning of the designation, not years after an area has been gazetted.

The IUCN has proposed several categories of protected areas (Table 4); some could potentially include local community participation. The roles and rights of local communities in protected areas, however, are still not clearly stated in these categories.

Table 4. IUCN categories for protected areas

Source: <https://www.iucn.org/theme/protected-areas/about/protected-area-categories> (Dudley 2013)

Category	Name	Definition	Primary objective
Ia	Strict nature reserve	Protected areas that are strictly set aside to protect biodiversity and also possibly geological/geomorphological features, where human visitation, use and impacts are strictly controlled and limited to ensure the protection of the conservation values. Such protected areas can serve as indispensable reference areas for scientific research and monitoring	To conserve regionally, nationally or globally outstanding ecosystems, species (occurrences or aggregations) and or geodiversity features: these attributes will have been formed mostly or entirely by non-human forces, they will be degraded or destroyed when subjected to all but very light human impact.
Ib	Wilderness area	Protected areas that are usually large unmodified or slightly modified areas retaining their natural character and influence, without permanent or significant human habitation, which are protected and managed to preserve their natural condition.	To protect the long-term ecological integrity of natural areas that are undisturbed by significant human activity, free of modern infrastructure and where natural forces and processes predominate so that current and future generations have the opportunity to experience such areas.
II	National Park	Large natural or near natural areas set aside to protect large-scale ecological processes, along with the complement of species and ecosystems characteristic of the area, which also provide a foundation for environmentally and culturally compatible spiritual, scientific, educational, recreational and visitor opportunities.	To protect natural biodiversity along with its underlying ecological structure and supporting environmental processes, and to promote education and recreation.
III	Natural monument or feature	Protected areas set aside to protect a specific natural monument, which can be a landform, seamount, submarine cavern, geological features such as a cave or even a living feature such as an ancient grove. They are generally quite small-protected areas and often have high visitor value.	To protect specific outstanding natural features and their associated biodiversity and habitats.
IV	Habitat/species management area	Protected areas aiming to protect particular species or habitats and management reflect this priority. Many category IV protected areas will need regular, active interventions to address the requirements of particular species or to maintain habitats, but this is not a requirement of the category.	To maintain, conserve and restore species and habitats.
V	Protected landscape or seascape	A protected area where the interaction of people and nature over time has produced a place of distinct character. It has significant ecological, biological, cultural and scenic values. Safeguarding the integrity of this interaction is vital to protecting and sustaining the area and its associated nature conservation and other values.	To protect and sustain important landscapes/seascapes and the associated nature conservation and other values created by interactions with humans through traditional management practices.
VI	Protected area with sustainable use of natural resources	Protected areas that conserve ecosystems and habitats, together with associated cultural values and traditional natural resource management systems. They are generally large, with most of the area in a natural condition, where a proportion is under sustainable natural resource management and where low-level non-industrial use of natural resources compatible with nature conservation is seen as one of the main aims of the area.	To protect natural ecosystems and use natural resources sustainably, when conservation and sustainable use can be mutually beneficial.

Category Ia strictly forbids any human activities. Most of the other categories are inclusive of various human activities, more or less regulated. Category Ib allows, to

some extent, indigenous and local community activities but prioritises strengthening the protection of biodiversity. Category V is particularly interesting because it equally recognises the importance of biodiversity and human practices. In Mamberamo, for example, a wildlife reserve (*suaka margasatwa*), (*cf* category Ia or Ib), should forbid or limit local community activities, such as gardening, hunting, harvesting forest products and even protecting their territory against outsiders. The district government of Mamberamo Raya is trying to redesignate the wildlife reserve as a national park (category II). As a national park it could allow some participation of local communities in its management. The local people's participation could be an opportunity to draw the core and buffer zones of the park according to traditional land-uses (see an example in Figure 8).

Conservation planning is an element of land-use planning in addition to infrastructure development, forest management and farming. To scale up and understand the bigger picture of community-based land management, I studied the conditions for collaborative land-use planning.

III. Research on participatory approaches for land-use planning

In the previous section, I analysed the role of local communities in conservation and other land-uses without looking at ways to translate this role into land-use policies.

By studying local community participation in land management, on a larger scale, I explored ways to reconcile local community priorities with regional government policies. One way is to find an understanding between villagers and local authorities regarding conservation objectives, by using the maps developed with villagers (Wood et al. 2014). Conservation International (CI) and other conservation NGOs used this type of agreement called a Community Conservation Agreement (CCA) (Grantham et al. 2013). But CCA was not successfully applied in Mamberamo because CI discontinued working on them (van Heist et al. 2015; Boissière et al. 2007). However, there are other ways to increase local participation in conservation. Among them, using existing government policies, such as land-use planning, can give more visibility to local community priorities.

In Indonesia, government organisations, especially the district (*Kabupaten*) and regional authorities, have to develop a land-use plan (LUP) that includes current and future land-uses (Ardiansyah, Marthen, and Amalia 2015). LUPs are designed and developed for a period of 20 years and revised every five years. I hypothesise that involving local communities in the preparation of LUPs is a way to ensure regular interactions between all the actors (at least for the five-year revision plan), decisions that are relevant to local people and with sustainable actions. The following case studies contribute to the testing of this hypothesis.

Case study 9: collaborative land-use planning in Papua (Padmanaba et al. 2012)

Between 2010 and 2012, I contributed to a CIFOR and Conservation International (CI) project in the district of Mamberamo Raya to support the formulation of a collaborative land-use plan taking into account local development needs and conservation objectives (Padmanaba et al. 2012).

Using participatory mapping, interviews and focus group discussions, we asked villagers from 8 villages in the district about their needs in terms of development, services, conservation, land rights and access to natural resources. For each village, we compared future land-use plans, from a community point of view, with current land-use. Local needs concerned infrastructure (roads, ports, airstrips), services (education, health centres) and also other land-uses, such as protecting forests and lakes, developing plantations and using the forest for hunting and gathering.

After obtaining written consent from the villagers, the participatory maps were shared with the district government. A workshop took place gathering government staff, representatives from local communities, civil society organisations and donors to discuss future district land-use plans. The workshop supported the development of a district-level spatial plan. Spatial planning (*Rencana Tata Ruang Wilayah–RTRW*) has the objective to "...provide directions for the possible future layout of the land. Land-use planning is formulated according to the regional development vision and mission, concerns, and development potential, as well as strategic issues that have been deliberated and adopted by the various stakeholders. The regency vision and mission

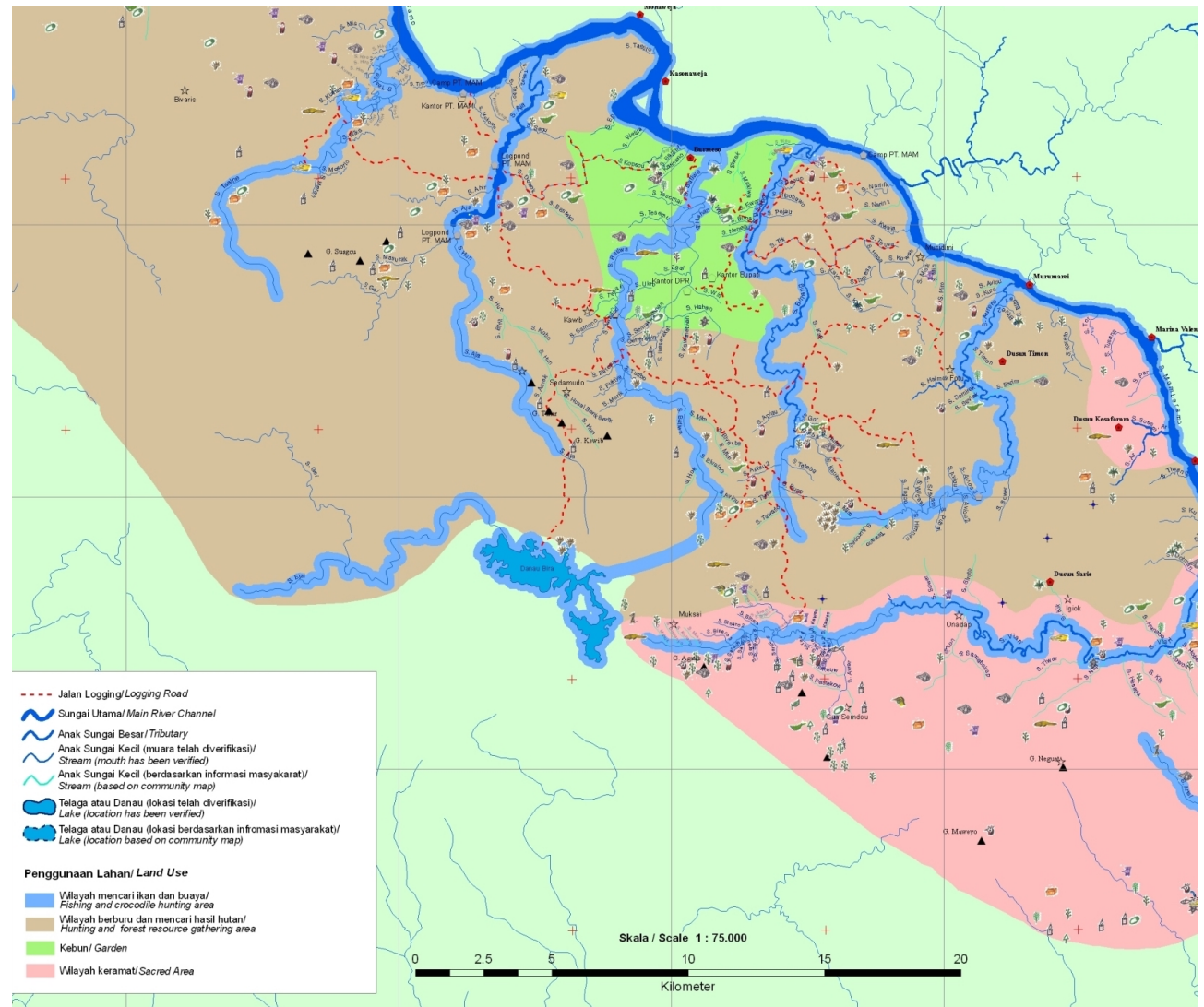
for development should be aligned with that of the province..." (Padmanaba et al. 2012, p.3).

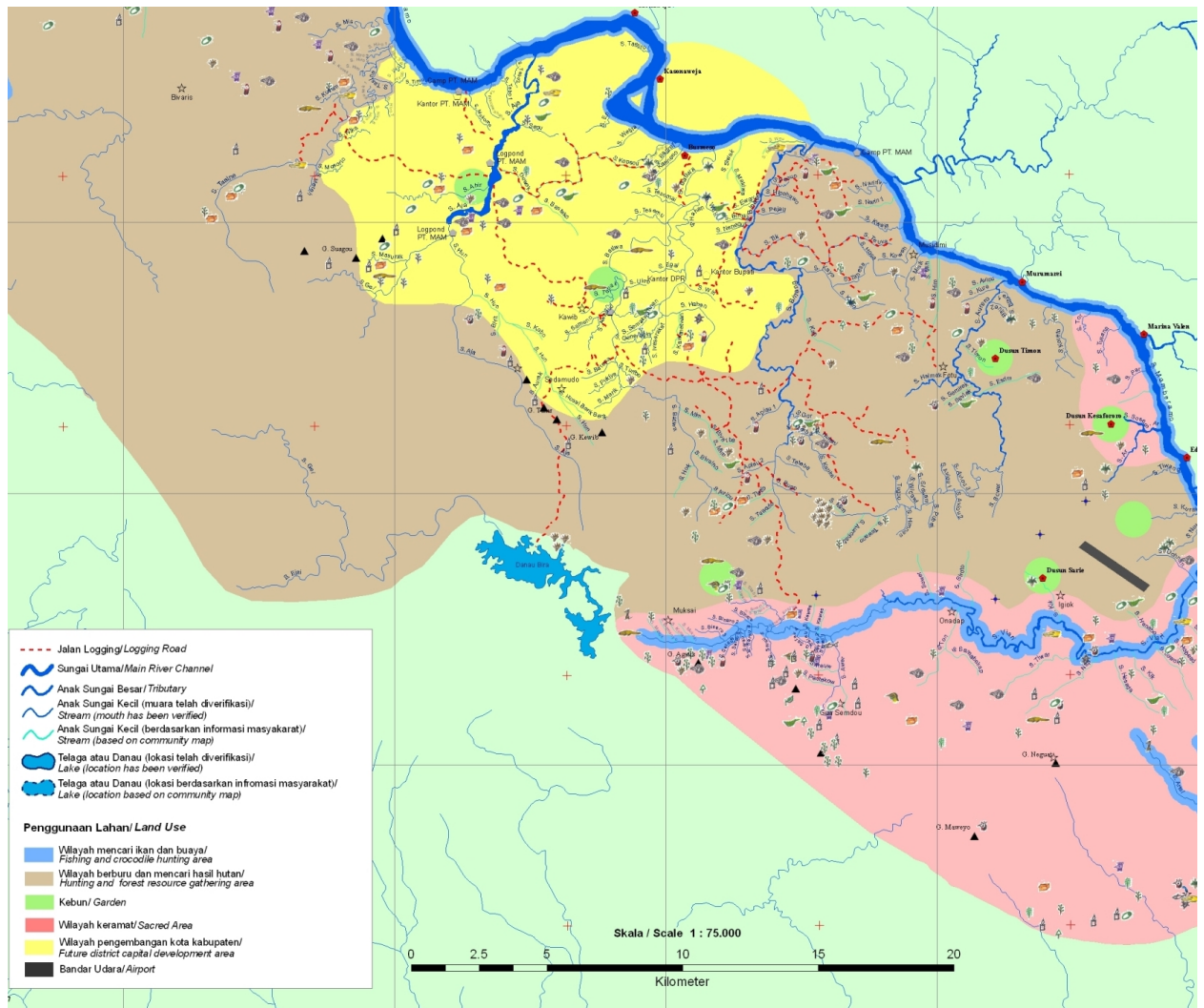
During the workshop, village representatives and local government staff discussed the feasibility of different proposals from the villagers. Discussions were also about addressing the local people's concerns on big development projects, such as oil palm plantations, coal mining, dam construction, logging concessions and urban development. Figure 10 shows an example of current and future land-use maps developed for one of the villages. The biggest difference identified by villagers between current and future land-use was the government's plan to move the administration of the district capital to that particular village.

After the workshop, the local government expressed its interest in using our participatory mapping tools in all the 50 villages of the district. The government objective was to gain a sense of the local needs and perspectives for development purposes and environmental management. At the request of the district head, we built the capacity of a group of local government staff on participatory mapping, using a method we developed at CIFOR (CIFOR CIRAD CI 2012). The scale of an official district spatial plan is 1:50,000 in Indonesia. We used the same scale for the village mapping activities to make it easier to overlap the two maps.

Most villages in Mamberamo Raya welcomed the activity because they felt the locally elected district government would help them meet their development aspirations if a map of the traditional territory and land use could be prepared together with the local people and given to the local government. Unfortunately, because of the high turnover of local government staff, the team members, who the project trained, were assigned to new tasks and departments in the district and were never able to conduct the participatory LUP in the remaining villages of Mamberamo Raya. Local support and building capacity of local government staff are important steps for sustainable action, but this is not enough if there is no clear commitment to carry on the action (here participatory LUP) until its completion.

Figure 10. Current and future land-use using participatory mapping in a part of Mamberamo Raya district (Papua, Indonesia).
Source (Padmanaba et al. 2012)





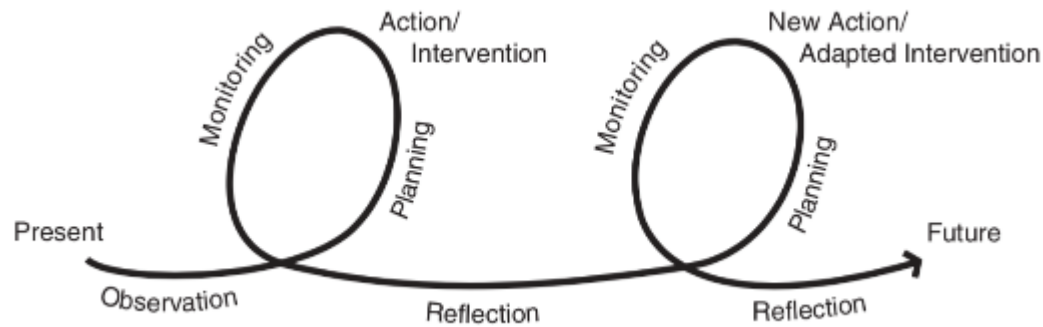
Case study 10: population relocated in Northern Laos (Watts et al. 2011; Pfund et al. 2011)

Another useful application of participatory land-use planning is when a village faces being relocated by local authorities. This was the case in 2007, when I contributed to a CIFOR-NAFRI project on local environmental management and biodiversity monitoring in Northern Laos, in the rural district of Viengkham (province of Luang Prabang). In this district, local livelihoods are based on irrigated and rainfed rice cultivation, the latter uses swidden agriculture, livestock management and extractive activities in patches of secondary forest.

During the project, we used an approach called ‘participatory action research’, where ‘action’ requires the researcher to provide inputs concerning key local management issues (Kinson, Pain, and Kesby 2007; Khanlou and Peter 2005). CIFOR used action research during the Adaptive Collaborative Management (ACM) project (<https://www.cifor.org/acm/>). In ACM a management loop is used as shown in Figure 11 below.

Figure 11. The adaptive management loop

Source (Kusumanto 2005)



Our project intervention was primarily at the planning and monitoring stages. At the planning stage, we used participatory approaches to discuss with the villagers the current and future land-uses.

In one of the villages, the government planned to resettle a Hmong ethnic group. One of the reasons for this resettlement was to improve access to infrastructure (roads) and services (education and healthcare). Another was the merger of villages into clusters to reduce the number of poor villages in the country and, by extension, the poverty rate. The village was also located inside a national park. The government, with conservation NGOs, wanted all human settlements to be relocated outside the protected area (see case study 4). The local government took the decision to relocate the village during our project implementation. This relocation could have potentially harmed the villagers, as was the case in many other places in the country (Baird and Shoemaker 2005; 2007). We facilitated discussions between the villagers from both the village to be relocated and receiving village and the government officials. These discussions took place after the district authorities had officially closed the village and villagers were about to be moved to a location not suitable, according to those being moved. We discussed, using a 3D map (Figure 12), the implications, for land-use, of merging with another Hmong village near the road and if there was enough space for the two villages to maintain sustainable livelihoods. The discussion went on until the two villages agreed to the terms of the move, with approval from the local government.

This case study is another illustration of local participation in the preparation of a LUP in a very concrete and dramatic case study. A few months after the project ended, in 2011, the merger looked like a success, however, I have not received any further information regarding the merger to date.

Figure 12. Discussions in Northern Laos on the current and future land-use in a village's territory using 3D models

Photo: Manuel Boissière



Lessons identified

While working on land-use planning, I realised that the gap between research and more direct engagement (action research) was narrowing, in comparison with the study of local perceptions of the forestland and resources, for example. First, because the topic of land-use planning addresses issues that are closer to local people's needs; second because the researcher needs to take into account the risks for local people when the research results are translated into government policies.

The two case studies, from Papua and Laos, had to address issues of sustainable livelihoods, development and conservation needs. The project team used participatory approaches as a tool to facilitate a negotiation process between different stakeholders. The projects helped the stakeholders to understand the way local people envisaged their future, the importance of the forest as a source of livelihood(s) and the way they were affected by government decisions. This was the case, for example, with the relocation and merging of villages, the construction of an airport, a new district capital and concessions granted to private companies in a community's territory.

While there are many benefits to be gained from mapping exercises it should be stressed that there are also associated risks. For example, the government, army and the private sector in Papua, could use a participatory map with local names of rivers, lakes and mountains to invest, track villagers or undertake illegal or unscrupulous activities, detrimental to the local communities and the area.

For these reasons, strong ethics are needed by systematically and regularly informing local communities about the risks of sharing a research outcome. The researcher(s) needs to ask for authorisation to use the research results with an explicit mention of the context of their use (conference, journal article, report) and accept that the local communities can revoke such authorisation at any time. He/she also needs to limit or remove any sensitive information before the maps are published.

IV. Research on local participatory monitoring (biodiversity and carbon)

Monitoring the changes in forest cover is an essential part of local environmental management as it helps local communities to track their achievements. It provides data for local communities to manage their natural resources (Figure 11). A common assumption government and non-government organisations, at international and national levels, make is that engaging local communities in monitoring is a way to empower them, to build ownership of natural resource management by regularly assessing achievements in environmental management. In the following case studies, I investigate this assumption.

Several scientific publications have presented the technical aspects of engaging local communities in monitoring, e.g., in terms of the need for capacity building, the data quality and covering the financial costs of monitoring (Torres and Skutsch 2015; Danielsen et al. 2007; 2008; Danielsen, Burgess, and Balmford 2005). Few publications have addressed the limitations of such monitoring and the conditions under which local communities could participate (Singh et al. 2014; Garcia and Lescuyer 2008). Among these conditions are the time local people have available and their direct interest and motivations to participate.

Through three case studies in Laos and Indonesia, presented below, I discuss the importance of considering local people's motivation for securing their participation in monitoring environmental changes.

In Laos, I developed and tested a tool for biodiversity monitoring with communities, especially focussing on Non-Timber Forest Products (NTFP), economically important for them. I then contributed to the development of a livelihood-monitoring tool, but without the active participation of the communities in its design. While in Indonesia, I coordinated research activities looking at the local motivation for "participatory measurement, reporting and validation" (PMRV) of forest carbon between 2013 and 2015, in the context of REDD+.

These three case studies show that involving local communities in monitoring biodiversity, livelihoods and carbon is not easy and not always necessary.

Case study 11: biodiversity monitoring in Laos (Boissière, Bastide, et al. 2014)

With a team of researchers from CIFOR and NAFRI, I coordinated a research project in Northern Laos (see case studies 4 and 10). The project's focus was the development and the use of participatory monitoring tools as a support for local decision making on forestland management. Using participatory mapping, community meetings, group discussions, interviews and household surveys we worked with local communities and government to identify the main NTFPs which had economic, cultural and conservation value. The criteria used for selecting the NTFPs are explained in Table 5.

Table 5. Criteria used for NTFP selection.

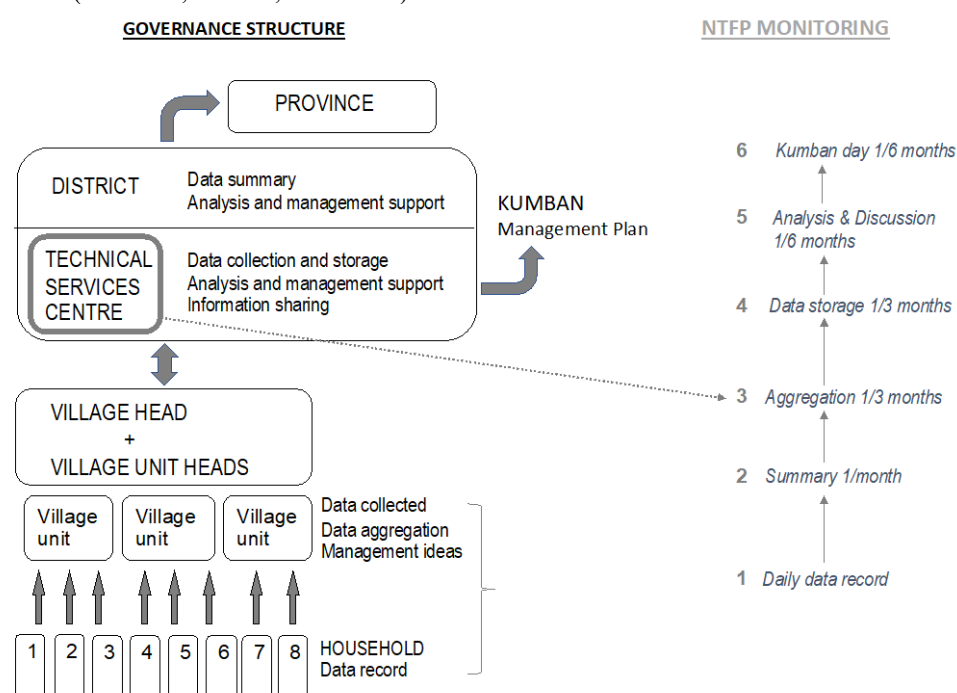
Source (Boissière, Bastide, et al. 2014)

Criteria	Justification
Distance	Resources located too far from the settlement would be too time-consuming for volunteers to monitor. We emphasise resources close to the village.
Availability	If an NTFP is rare, it is more difficult to monitor. We therefore selected resources available in the territory.
Accessibility	Easy access and topography should support the selection of the resource.
Easy identification	This is a universal criterion for the selection of biodiversity indicators.
Biodiversity value	The team assessed the criteria (rare, endangered, protected species) because villagers do not always consider biodiversity in the same way.
Market demand and price	The economic value of a resource is a crucial factor for villagers' motivation in monitoring.
Gender	We favoured as much as possible resources that involved both men and women in its collection.
Multifunctionality	We gave preference to species important for more than one use.
Most selected	Species that a large number of people considered important were selected.

The results helped provide a list of 9 key NTFPs for the project's seven pilot villages. We proposed a simple and cheap way to monitor them using schoolbooks. We then accompanied the process during the first few months after it was designed. Based on the results of this monitoring trial, we proposed a system of reporting to a higher level overlapping the existing governance system used for reporting village management issues, as shown in Figure 13, in order to make the reporting of NTFP monitoring easier to implement.

Figure 13. The monitoring system proposed in Northern Laos

Source (Boissière, Bastide, et al. 2014)



We identified several issues during the project implementation. We could not conduct the participatory monitoring trial for more than the last eight months of the project. This time constraint was out of our control and limited the relevance of *ex-post* analyses of the monitoring outcomes. Additionally, the monitoring system could not be embedded in significant land management policies, such as the national land-use plan, which limited its potential use and scaling-up.

At the time of the project, a national land-use plan was being developed countrywide, but the project missed the opportunity to include its newly developed monitoring system. Unfortunately, the latter was developed just after the finalisation of the national land-use plan. If included in this national land-use plan, it would have helped local communities to regularly communicate with the local government about the management of key forest resources and led to possible improvements in the management and to the recognition of local practices. After the project ended, local communities lacked the motivation to continue the monitoring or expand it to other forest resources. The fact that local communities stopped monitoring the selected NTFPs shows that the tool was not relevant enough or that we lacked time to prove that it could benefit them.

Case study 12: livelihood monitoring in Laos (Belcher et al. 2013)

Within the same research project (case study 11), we explored the potential of monitoring local livelihoods. Based on the five capitals (financial, physical, natural, human and social) used by Ellis (1999) for studying livelihoods, we identified simple indicators for each capital and tested them in the project's six pilot villages. The livelihood-monitoring tool used information collected during group discussions about local community aspirations for conservation and development.

We designed an easy-to-use tool by following simple but reliable indicators. The end-users were expected to be land-use planners and natural resource managers at the village level. To this end, a team of experts designed the tool, but this did not involve the local people. It was then tested only once in all the pilot villages.

This kind of monitoring is what Danielsen describes as "...externally driven with local data collector[s]..." (Danielsen et al. 2008, p.4). In such monitoring, local motivations are unclear or unaddressed. The tool could be useful for village planning but still needs to show that it addresses villagers' needs in terms of livelihood improvement and that it strengthens local governance and natural resource management.

Case study 13: participatory MRV in Indonesia (Hawthorne et al. 2016; Boissière, Felker, et al. 2014; Dharmadi Hawthorne and Boissière 2014; Boissière, Beaudoin, et al. 2014; Boissière et al. 2017)

The opportunity for this research with CIFOR on Measurement, Reporting and Verification (MRV) came from the high global interest in REDD+. REDD+ hinges on the idea of 'additionality', i.e., proving that efforts to reduce deforestation and forest degradation do result in less deforestation and forest degradation compared to the baseline condition. To prove this additionality, experts established MRV systems, which are conceived as top-down monitoring systems conducted by experts and controlled by central governments.

At the same time, the idea of climate justice also gained global interest (Schlosberg and Collins 2014). Climate justice means that local people have more control over the use of the forests that they manage for climate mitigation purposes. Climate justice supposes strengthening social safeguards to ensure clear benefit sharing from REDD+.

This situation provided me with the opportunity, with a multidisciplinary team from CIFOR, to investigate the feasibility of forest MRV with the participation of local communities. We tried to understand the reasons local people might participate in REDD+ MRV. The reasons why local communities should participate in REDD+ MRV are not obvious, although community engagement in monitoring and reporting has been encouraged in the United Nations Framework Convention on Climate Change (UNFCCC) decisions (see Decision 4/CP.15 article 3, 2009). Participating in MRV (PMRV) is time consuming when local people are already busy with their daily activities. To participate, they need to see clear financial or non-financial benefits—they need motivation.

Our primary research question was: what do we need to know if PMRV is to be feasible and sustainable. We then divided this question into a subset of questions:

- What would motivate local people to participate in MRV?
- How can local communities be part of a REDD+ verification system?
- What existing organisations can support PMRV and what can we learn from current and past organisations?
- How can the lessons learned from other existing MRV systems, not related to REDD+, be used in the context of REDD+ MRV?
- What scale of deforestation and forest degradation can be measured using spatial data? How can we overlap spatial data and data collected by or with local communities?

The study took place in 7 villages of Indonesia, located in 3 provinces: Papua, West Kalimantan, and Central Java, with different forest covers, demography and infrastructure (Figure 14).

Figure 14. General characteristics of each site

Source (Boissière, Beaudoin, et al. 2014)

SITES	NATURAL FORESTS	DEMOGRAPHY	ACCESSIBILITY	ECONOMIC PRESSURE	COMMUNITY FORESTRY
Papua (Mamberamo Raya)	++	-	-	+	-
Kalimantan Barat (Kapuas Hulu)	+	+	+	++	+
Java (Java Tengah and DIY)	-	++	++	++	++

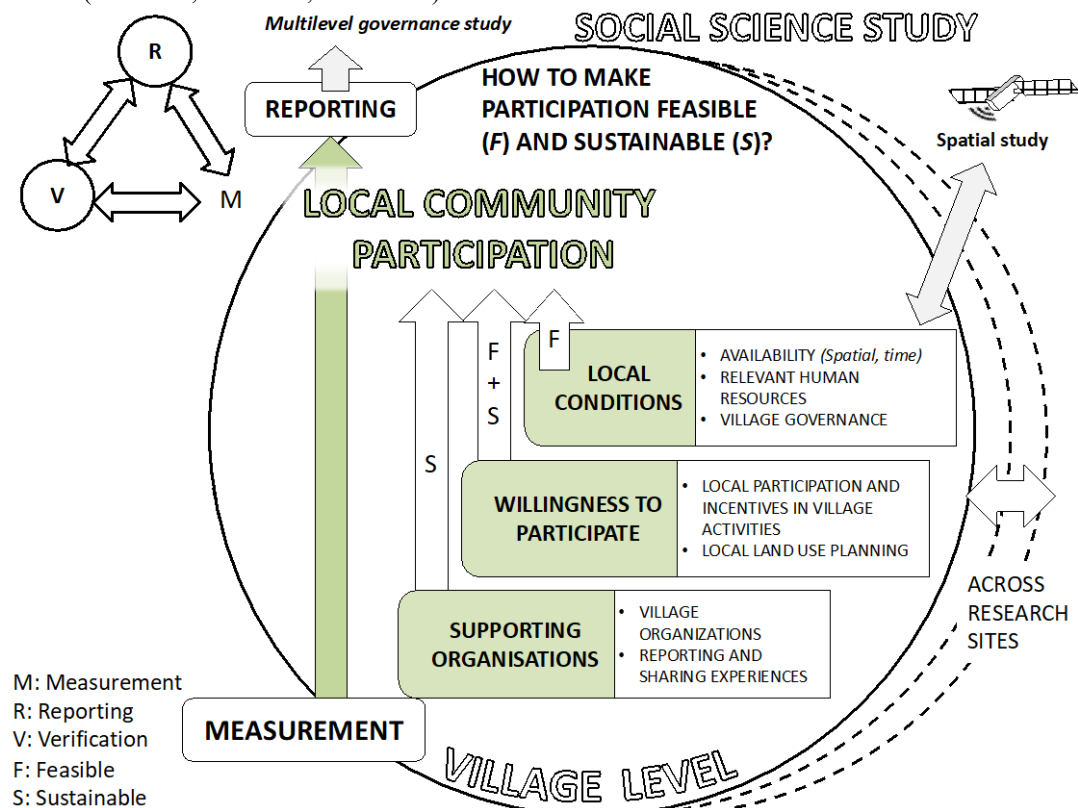
Note: ++ high importance, + medium importance, - low importance

Three sub-teams of researchers addressed these questions: one specialised in social surveys, one in governance studies and one in GIS. Figures 15, 16 and 17 show the way each of the sub-teams designed their research and interacted with the others.

During the project, one of my objectives was to improve the research team members' participation. To do so, each sub-team had to develop their research design and answer the research questions specific to their topic. My role was, as a facilitator, to make sure that the main objectives of the project were addressed and that each sub-team took full responsibility for their activities. Team building took about six months to achieve. The team members were from different academic backgrounds, levels and nationalities. Up to 20 researchers designed their research together to understand the importance of each sub-team's topic. Only after some time could each sub-team work in smaller groups on a more in-depth set of methods. The overall research was designed in a way that emphasised interactions. Figures 15, 16 and 17 illustrate these interactions. Figure 15 shows the way the social science sub-team studied the participation of local communities in measurement activities, looking at the local conditions for participation, the willingness to participate and the local organisations that could support measurement activities. It shows the part of MRV on which the social science sub-team was focussing and the interactions with the two other sub-teams (governance and spatial).

Figure 15. The social study research design

Source (Boissière, Beaudoin, et al. 2014)



In Figure 16, the governance sub-team investigated the local participation in reporting, based on existing reporting systems in two different sectors: the health sector, with the presence of integrated healthcare posts (*posyandu*) at the village level and the forestry sector. In both sectors, the reporting structure was explored, including data validation and the way practitioners perceived the sustainability of the systems.

Figure 16. The governance research design

Source (Boissière, Beaudoin, et al. 2014)

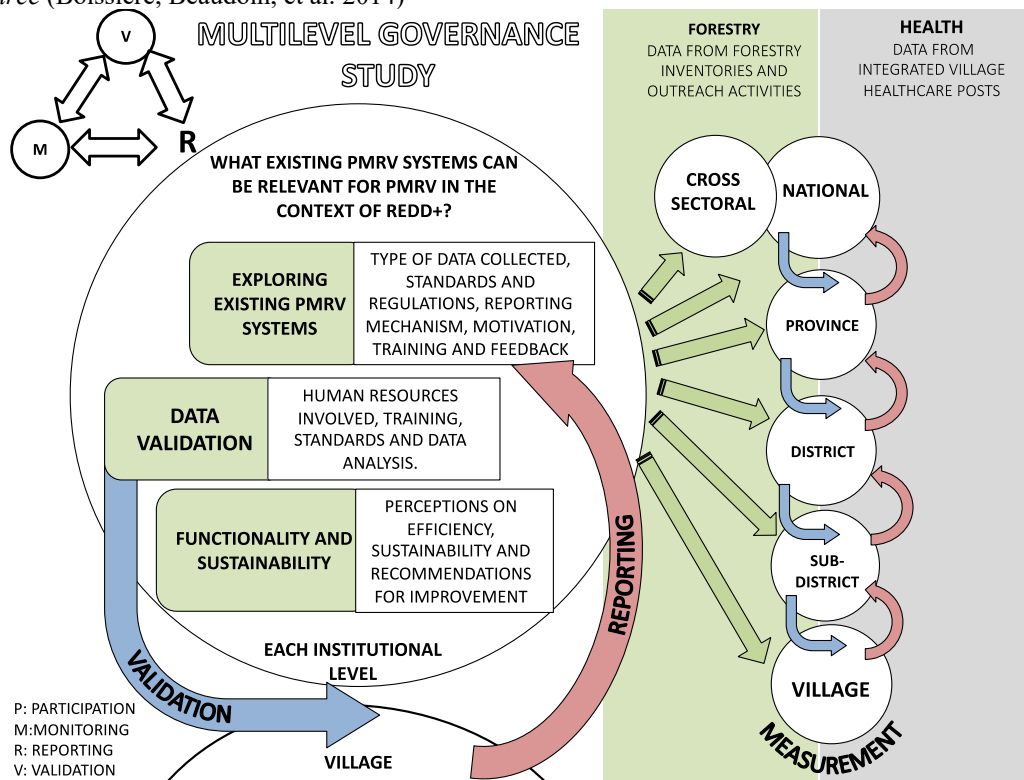


Figure 17 illustrates the way remote sensing and GIS were used to select sites for carbon measurements, to measure forest degradation and deforestation and to explore participation in verification. In REDD+ programmes, verification is generally made by independent evaluation bodies using GIS and does not involve local communities.

A way to engage local people in verification could be to overlap maps developed using remote sensing with participatory maps.

For example, remote sensing experts and local communities in Central Java did not have the same interpretation of land cover. Figure 18 illustrates the way this difference of interpretation can be used for verification. Figure 18c is the results of overlapping remote sensing-based (Figure 18a) and community-based maps (Figure 18b), where all the areas in red indicate discrepancies between the two interpretations. Instead of verifying information about land cover randomly or systematically, we can narrow down the ground check to the areas in red. As a result, the whole process of verification can become a reconciliation of all users' interpretations of land cover.

Figure 17. The GIS/remote sensing research design
Source (Boissière, Beaudoin, et al. 2014)

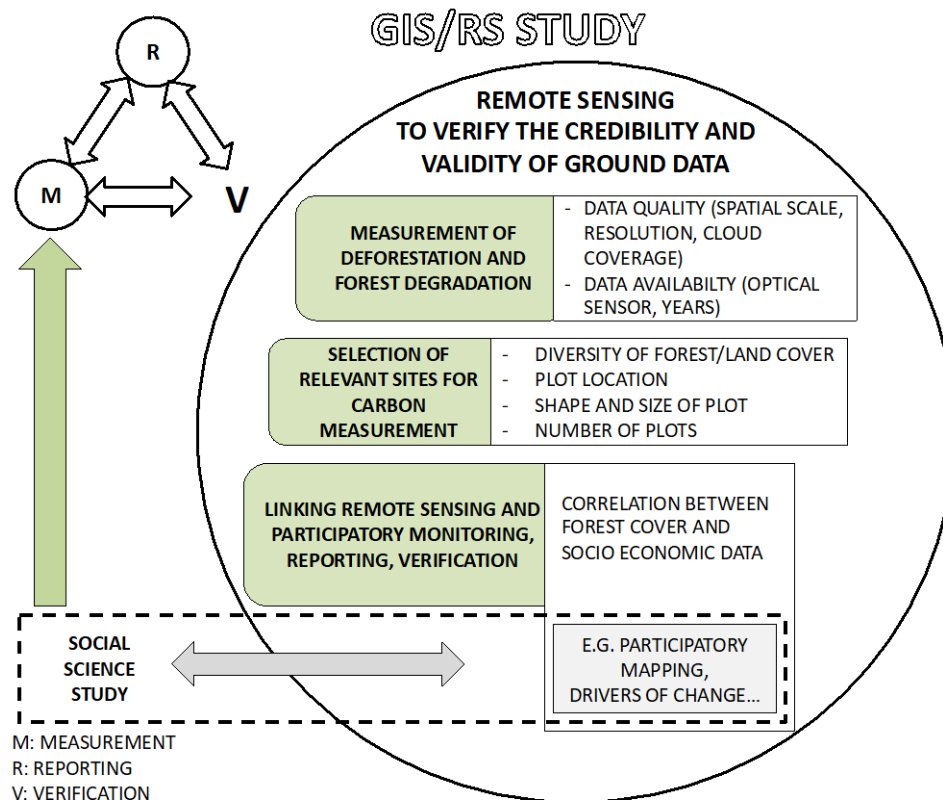
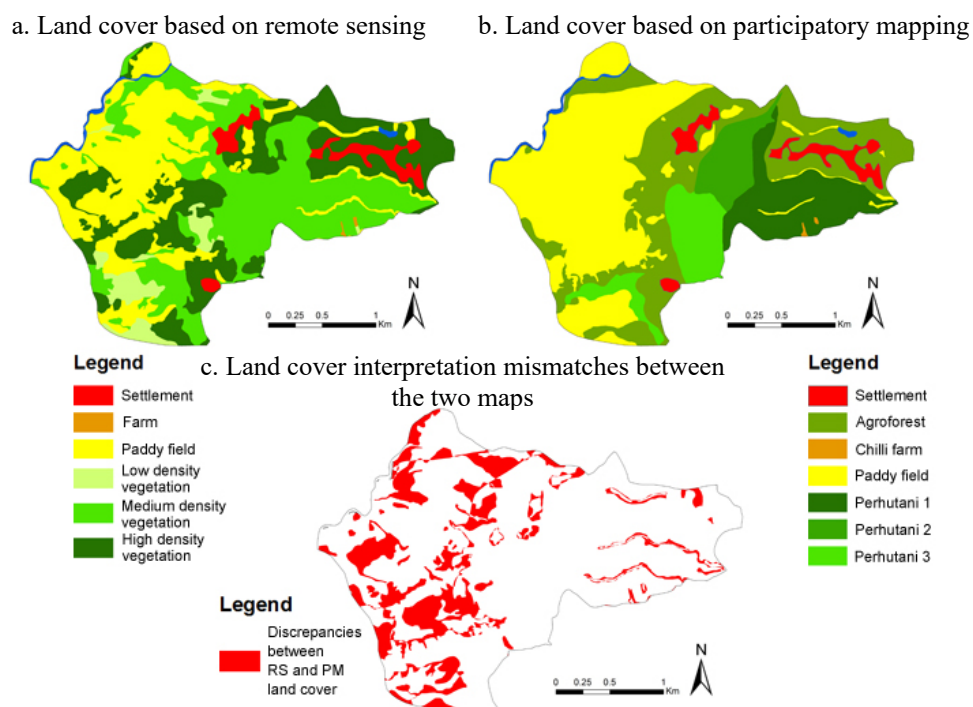


Figure 18. Illustrating differences in land cover interpretation between remote sensing (RS) and participatory mapping (PM)
Source (Beaudoin et al. 2016)



Based on this study, several key messages can be proposed regarding the feasibility of PMRV (Boissière et al. 2017):

- As it is now, MRV is too technical and far from local people's concerns and needs in terms of local forest management.
- A part of MRV concerns the measurement of non-carbon data. Non-carbon data are challenging to measure because they refer to qualitative data, including perceptions and local knowledge.
- Carbon and non-carbon data collected by local communities need to follow the same standards across all sites. Local people's technical capacity to collect these qualitative data needs, therefore, to be strengthened.
- MRV is also about reporting. Involving local communities in reporting is difficult because appropriate and sustainable reporting structures need to be developed.
- We can learn from other sectors' successful examples in building a reporting system for PMRV, e.g. the health sector, which involves local communities in monitoring child and mother's health (Ekowati et al. 2016).

When it comes to the research team's involvement, participation in the production of information requires the coordinator to accept that the research ownership goes to the team. The team members are, therefore, empowered to contribute equally and take over the project activities and outcomes. Publication authorship reflects that equity and is based on real contributions, not just data collection. In this case study, the results of the project were published as a collection for PLOS ONE (<https://collections.plos.org/redd>), for which I was a co-guest editor. The young researchers, who had never published before the project, led or co-authored the six publications in the collection, after the project was completed. This shows that the shift in power during the project encouraged the team members to commit to successfully publishing their results in a peer-reviewed scientific journal. The project's results are available on a project website (www.cifor.org/pmr/home.html). I presented some of them during the 53rd Annual Meeting of the Association for Tropical Biology and Conservation (ATBC), in 2016 (Boissière et al. 2016).

Lessons identified

In the introduction of this section on participatory monitoring, I presented the assumption that engaging local communities in monitoring is a way to empower them and to build ownership on natural resource management.

Is participatory monitoring a way to empower local communities?

Case study 13 shows some level of local empowerment. Through monitoring carbon and forest cover changes, local communities are given some responsibilities in REDD+ related activities. In this way, they play an active role in REDD+ and can expect to receive benefits from it. Local communities play an active role and contribute to measuring changes in forest cover, providing information to the national level and verifying the reported data, including data collected by GIS experts. But it is still necessary, before any participatory MRV implementation, to conduct a feasibility study to: confirm whether local participation is desirable or not; see if there is a project to support this participation; check if it really empowers local communities or just uses them as labour and to select the most suitable approach for the local context. A feedback

mechanism needs also to be put in place so that local communities can benefit from their reporting to national levels, in terms of land tenure, access to nationally available data or improved forest management.

Is participatory monitoring a way to strengthen local ownership of NRM?

Monitoring biodiversity can be a way for local communities to secure ownership of natural resource management (NRM). However, they will only be interested in monitoring if there is a direct benefit for their village, for example, in negotiating land use rights or for the economic benefits they can gain from NTFP management.

In case study 11, the project was not long enough to demonstrate if local adoption of the monitoring tools was possible or not (Boissière, Bastide, et al. 2014). There is always a risk that participation fades after the project ends, because of the communities' lack of interest and availability for long-term commitment.

Another example of how monitoring can strengthen a local community's ownership of natural resource management was highlighted in case study 7, in which local communities took the initiative of monitoring and controlling access to important natural resources, without being influenced or helped by experts (Sheil, Boissière, and Beaudoin 2015).

5. Conclusion and future research

1. Answering the research questions

In section 1, introduction, I presented two main research questions that structure this document:

- How can local participation in conservation, land-use planning and, more generally, in environmental management, be more sustainable?
- How are communities affected by or benefiting from participatory research on forests and natural resources management?

I briefly summarise, in conclusion, some initial answers to these questions, considering that participatory research needs to be designed in a way that contributes to both the environment and the local people, by protecting biodiversity, improving local livelihoods and securing land use rights.

a) How can local participation in conservation, land-use planning and in environmental management be more sustainable?

Through thirteen case studies and different projects, I studied the way local communities, living in or near tropical forests, are involved in decision making for the management of these forests. I also studied the conditions for which this involvement in forest management could be more sustainable.

I have described local forest management (case studies 1, 2 and 3) and have proposed methods to involve local communities in conservation (case studies 6, 7 and 8), land-use planning (case studies 9 and 10) and other environmental management systems (e.g., monitoring in case studies 7, 11 and 13).

Project implementers and researchers are increasingly using participatory research in their projects (see section 2, theoretical framework). However, they should first determine if participatory research is always necessary or, in some cases, more classical methods are enough, e.g., using a team of experts for the assessments and measurements of forest cover change and carbon sequestration. Involving local people in activities such as monitoring can be too far from their concerns and needs in terms of forestland management (case study 13). Their participation should, therefore, be considered only when no other option is available and when it clearly benefits the local people. Sometimes, a team of technical experts, local government staff, project staff or extension officers can do the job without burdening the local communities. In the example of MRV, a part of the activities involves measuring tree height and diameter, taking note of the results and reporting the data to a higher level. Local communities do not necessarily want to be part of these activities, even if, for ethical reasons, they should be informed about the details.

In general, local communities want to be part of activities that have a direct impact on their lives, their livelihoods and their rights. For example, it can be for conservation (case study 7) or land-use planning (case study 9). In case study 9, local communities from some of the villages where the project was taking place explicitly asked us to

develop with them the maps that would allow them to negotiate land-use rights with the local government, neighbouring villages and private companies (Padmanaba et al. 2012). In such a case, once an agreement has been reached between local communities and other stakeholders, the research activity can include bottom-up monitoring of the results and actions and increase their sustainability.

The decision-makers and the scientific community too often consider the local communities as people to be empowered, a target group, whose capacity to better manage and monitor their natural resources needs to be built (Constantino et al. 2012). This type of empowerment corresponds to the ‘informing/raising awareness’ parts of the Arnstein’s ladder (Figure 2), for which participation is minimal. As part of local community empowerment in sustainable forest management, researchers often consider local people as cost-effective labour for monitoring biodiversity (Danielsen et al. 2000; Holck 2008; Danielsen, Burgess, and Balmford 2005).

But real empowerment of local communities supposes giving them full power, not just during the design of a research project, but also during the implementation and the interpretation of the outcomes (Figure 2). In the projects I contributed to, even if local communities never took part in the research design, I did not take their participation for granted. As early as possible in the project’s life, during the many community meetings and informal discussions I organised, I clarified my research objectives for the local people and asked their permission before starting the study (e.g., case studies 6, 9, 10). Sometimes, permission was not granted and the research team had to leave the village. When it was granted under certain conditions, e.g., in case study 13, the project team had to explain to the villagers, during a presentation, the meaning of carbon and why it was important. A poster was prepared and used for that purpose (the poster can be viewed at this link: https://www.cifor.org/fileadmin/subsites/pmr/v/documents/poster_carbon.pdf). After clarification was given about carbon, the villagers granted us permission to conduct our research activities. But in all cases, the researchers still had the control of the activities and research outcome(s).

b) How are communities affected by or benefiting from participatory research on forests and natural resource management?

In the projects I led or contributed to, I was never really accountable for the project’s impact on local communities’ livelihoods. At best, I returned to the research sites and gave back to the local communities the maps (case studies 6 and 9), reports translated into the national language (case study 9), dissertation (case study 1), or posters (case study 13) resulting from the research project.

Local communities are often impacted by participatory research, even after free prior informed consent (FPIC). They can have the feeling of being pushed to do something they would not normally do, e.g., monitoring forest cover. They may sometimes accept to participate in an activity that provides no benefit for them because they hope that their contribution will gain the decision-makers’ attention regarding their situation. They can also expect rewards that do not come, which can lead to misunderstandings regarding the reasons behind the agreed activity.

When local community participation in environmental management is sought, researchers and decision-makers should emphasise and clearly communicate the concrete outcomes that could be of benefit to the local communities. This recommendation is based on the results from most of the case studies I presented (See case studies 4, 6, 8, 9, 10, 11 and 13).

Benefits can be financial (i.e., direct payments for labour) or non-financial (e.g., recognition of land-use rights). For example, participatory monitoring can be used in community forestry if the data collected directly helps the local people manage their forest. Cornwall explains that there is a difference between engagement and giving a voice to local people (Cornwall 2008). According to Cornwall, it is not enough to promote local people's participation; they need to be able to influence the entire process, to make a decision that may contradict a project's objectives. In a place like Mamberamo in Papua (Indonesia), villagers elect their local government and closely monitor how public funds are being spent. Providing tools such as participatory maps, e.g., in case study 9, will support their engagement in environmental management, their negotiations with local government or the private sector to receive compensation for the exploitation of natural resources and the control and monitoring of their territory.

Participatory research can help to ensure that local communities are on board, that their rights to land and resources are respected and strengthened. But it is not necessarily a panacea. If not considered carefully in terms of social safeguards and benefit-sharing, it can cause more harm than good with no real benefits, be counterproductive and lead to 'participation fatigue'. When time and funding are a constraint, few researchers can go through all the necessary steps while developing partnerships with local communities. For these reasons, we need to take a step back in promoting local participation and rethink the entire process; how and when to do it. Projects using participatory research should secure enough time to build relationships, trust and long-term commitment with local communities. Researchers should work in association with a local NGO, one that has a permanent presence in the project site(s). They should encourage the local communities to participate or join the project during the research design and implementation and make sure that the project's outcomes directly, or at least indirectly, benefit the local people.

In some countries, the political context can influence the perception and use of participatory research. In Indonesia, for example, the government is increasingly recognising the rights of local communities to forestland. The use of participatory research can become a way to communicate with local stakeholders and involve them in land management.

In other countries (e.g., Laos, Vietnam, Ethiopia), the control of the state is observable until the village level. Government officials consider participation as a way to make villagers follow local government rules and policies and contribute, sometimes with free labour, to government programmes. Participatory research is then irrelevant because in such situations the government does not accept the idea that power needs to be shifted to the local people (Cornwall and Jewkes 1995).

II. Future research

In this section, I list the gaps in my research in order to answer the research questions, so far and I propose ways to fill those gaps. As explained in the previous section (i.e., in the conclusion, **I. Answering the research questions**), my research focussed on the conditions for sustainable, local participation in environmental management and on the impact of participatory research on local people's livelihoods, but aspects regarding effectiveness, inclusiveness of perceptions and legitimacy still need to be addressed.

The main gaps in my research are as follows:

- **Effectiveness:** an evaluation of the effectiveness of participatory environmental management through different scenarios is needed by comparing situations where:
 - only local communities manage with no external intervention
 - the government or an NGO manage with community involvement
 - the government or an NGO manage without any community involvement.Evidence is needed to show whether local environmental management alone leads, or does not lead, to better and more sustainable natural resource and land management. This would be in comparison to environmental management conducted by government organisations alone or together with local communities.
- **Perceptions:** I studied the perceptions of local communities about their participation in environmental management. The perception of all the other stakeholders needs also to be more systematically studied in order to obtain a full spectrum of perceptions about local participation. These other stakeholders include local and national governments, nongovernmental organisations and the private sector.
- **Legitimacy:** my research did not address the angle of rights and legitimacy of local people. In-depth and longer-term research projects in sites where local participation in environmental management is taking place should be conducted in order to determine if participation **strengthens the rights** of local communities in the long term.

In the future, I will continue to study local participation in conservation and more generally in land-use planning (LUP) in Indonesia, by conducting long-term participatory research in pilot sites and by addressing the gaps in that context.

One way to assess the **effectiveness** of participatory environmental management is by looking at existing practices that have been in place for generations in local communities and compare them with places where no such practice exists. One of these local practices can be called 'local autonomous conservation' (e.g., case study 7), referring to local community conservation without any external intervention, e.g., from governments or NGOs. This type of conservation is supposed to exist in many countries with tropical forests but has been rarely characterised. Our initial study shows that autonomous conservation in Papua is used for the direct benefit of the local communities, allowing them to control access to their land and important natural resources (Sheil, Boissière, and Beaudoin 2015). I believe that there are other locations where such autonomous conservation should be observed. Autonomous conservation often evolves according to the local people's development needs. In some locations it is still in place and in others, sometimes not far from the former area, it does not exist anymore for environmental, economic or political reasons. Comparing the two

situations can provide information on the effectiveness and resilience of these practices facing local and global changes. I want to characterise this particular form of conservation through a systematic study across multiple sites and time periods and explore the way it can be used in more conventional conservation. An initial study will help to design the research methods and test them in pilot studies. In the longer term, I will apply them to other places where such autonomous conservation has been seen in Indonesia and elsewhere.

Addressing the gaps in knowledge about stakeholders' **perceptions, rights and legitimacy** can be achieved through research on participatory land-use planning (PLUP). This could be a follow-up from previous studies of PLUP, e.g., in case studies 9 and 10. The stakeholders targeted in this study will be the local people, the local government, civil society, the private sector and provincial and central/national-level governments. All these actors need to be included in the LUP development to put into action the decisions taken by/with local communities (see Table 6). They will be involved in setting the objectives of the PLUP project, planning the activities and monitoring the outcomes. An observatory will also be proposed to monitor the way environmental, economic and political changes affect rights and legitimacy of local communities in environmental management in the long term.

Table 6. Long term observatory of sustainable land-use planning (LUP)

Institution type	Current role in LUP	Potential role in LUP
Local communities	Direct users, no role so far in developing the LUP	Be part of the initial design of the LUP, agree with local government on the designation of protected areas and other land uses, play an active role in controlling access to the land and resources, be a partner in the project implementation, including monitoring the outcomes of the project
Civil Society Organisation (CSO)	Develop micro-projects, work on community development, sometimes in coordination with local governments	Become the facilitator in negotiations, discussions between the different actors, from national to local, make sure that local community priorities are taken into account and that local communities are part of the decisions on LUP
Local government	Plays a significant role in developing LUP, in charge of the technical aspects of LUP, in charge of the implementation of the plans	Becomes the key government institution to engage in discussions with local communities and contributes to the collaborative LUP observatory
Regional/provincial government	<ul style="list-style-type: none"> Decides laws, regulations and policies at the regional/provincial levels Synchronises the laws developed at the level of central/national/federal government Synchronises the different local land-use plans 	Makes sure that the LUP is prepared with local communities and follows provincial/regional and national regulations and plays a role in monitoring the outcomes of the project
National government	Prepares the national laws, monitors their implementation, designs protected areas at the national level	Makes sure that the decisions made at the local level are integrated into national regulations and that development and conservation plans prepared at the national level do not hamper local land management

Private sector	<ul style="list-style-type: none"> • Manages its own business plan (e.g., logging, plantations), with some involvement of local actors through social forestry or development programmes (e.g., building infrastructure). • Sometimes, the local government hires private consulting companies to prepare the LUP on its behalf 	<ul style="list-style-type: none"> • Becomes a partner in the process, looking at the landscape scale, negotiating where development activities should take place, where the companies could operate and under what conditions • Restores the forest around/inside the concession, with local communities • Develops business plans that do not harm local communities and the environment. • Compensates for any loss the local community may have experienced in the past from the private sector activities
Scientific community	Implements research activities that are not always locally relevant but still limited by funding and research permits	<ul style="list-style-type: none"> • Makes sure that all stakeholders receive the technical data, including a description of the ecological systems and the participatory approaches most suited • Develop long-term research activities on LUP involving local communities starting from the research design • Develop long-term observatory to monitor the environmental, economic and political impact on local community rights and legitimacy in environmental management.

Moving from the second to the third column of Table 6 can take time, especially when it comes to engaging with the different stakeholders mentioned in the table. This is why, in the long-term, I am planning to link the different levels of actors in the development of land-use plans, using not only participatory but also a jurisdictional approach. Jurisdictional approach "...*highlights the critical role of government and the need for wall-to-wall, holistic approaches to forest and land-use governance across a defined territory as key components of any realistic effort to protect forests and reduce land-use emissions at scale...*" (Boyd et al. 2018, p1). Jurisdictional approaches recognise the crucial role of the subnational governments and the participatory approaches of the central role of local communities. By complementing participatory research, it will help to address the issue of land-use rights.

This long-term research will start in Indonesia, where spatial planning is becoming a major objective for the provincial governments. My approach will be bottom-up, involving local communities from the start of the activities and seeking long-term commitment from the decision-makers and donors.

This research on local participation in environmental management is ongoing and future activities should bring additional input or a different perspective on this issue.

Annex 1. Candidate's curriculum vitae

I hold a Bachelor and Master's degree in the biology of organisms and populations (University Paul Sabatier / Toulouse), a DEA in geography-landscape management (University of Mirail / Toulouse) and a thesis on biology (1999), specialising in ethnobotany (University of Sciences and Techniques of Languedoc / Montpellier).

Following a postdoctoral study in Papua New Guinea (2001), where I studied local agricultural systems, I was recruited in 2002 by CIRAD (Agricultural Research for Development in the Forestry Department, Natural Forest Programme) under a Contrat à Durée Indéterminée (CDI), as an ethnobotanist.

My multidisciplinary academic background (geography, ecology, botany and ethnobotany) has allowed me to place myself at the interface between human sciences and life sciences.

After a few months in Montpellier, CIRAD assigned me, in 2003, to CIFOR (Center for International Forestry Research), the headquarters of which are in Indonesia. At CIFOR, I worked in a multidisciplinary team that was interested in local perceptions of forestland and natural resources.

During my collaboration with CIFOR, I was interested in several aspects of the role of communities in the management of their forest resources and territories: first in the management of territories (protected areas and management plans), then in climate change mitigation.

During my time in Indonesia (2003 – 2015), I worked not only in Indonesia but also in four other countries in Southeast Asia (Vietnam, Laos, Cambodia and the Philippines).

In 2015, I moved to Ethiopia, still within the agreement between CIRAD and CIFOR. Until August 2019, I worked in Ethiopia on issues concerning the role of local communities in climate change, forest landscape rehabilitation and sustainable forest management.

In August 2019, I returned to France, to the CIRAD Montpellier office, to work with my CIRAD research unit (UPR 105: forests and societies) and prepare new projects.

Annex 2. Reference list – my publications

Publications with a star have been published in collaboration with students I supervised (BSc, MSc, and PhD), the name of these students are in **bold**.*

Articles published in peer-reviewed journals with impact factors

Boissière M., Atmadja S., Guariguata M.R., Kassa H., Sist P. 2021. Perspectives on the socio-economic challenges and opportunities for tree planting: a case study of Ethiopia. *Forest Ecology and Management* Vol 497, 10p. <https://doi.org/10.1016/j.foreco.2021.119488>

Ngo Bieng M.A., Oliveira M.S., Roda J.M., Boissière M., Hérault B., Guizol P., Villalobos R., Sist P. 2021. Relevance of secondary tropical forest for landscape restoration. *Forest Ecology and Management* Vol 493, 10p. <https://doi.org/10.1016/j.foreco.2021.119265>

Boissière M. 2021. The making of a montane taro garden. *Journal of Tropical Ethnobiology* 4 (1): 1-20. <https://doi.org/10.46359/jte.v4i1.44>

*Boissière M., S. Atmadja, **S. Benmakhlouf**, M. Beyessa, H. Kassa, T. Hunde and F. Assefa. 2020. Developing small-scale bamboo enterprises for livelihoods and environmental restoration in Benishangul-Gumuz Regional State, Ethiopia. *International Forestry Review* 22 (3): 306-322.

I was a guest editor for a special issue (collection) of PLOS ONE on "*participatory monitoring for forests and climate*". This collection includes 12 articles, including an overview article that I led and 6 articles written by the team I was coordinating during the Participatory MRV project. For 2 of these articles, I am the co-author.

Boissière M., Herold M., Atmadja S., Sheil D. 2017. The feasibility of local participation in Measuring, Reporting and Verification (PMRV) for REDD+. *PloS ONE*. <https://doi.org/10.1371/journal.pone.0176897>

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Communication tools/multimedia

Blog story on REDD+ MRV in Ethiopia: Getting Ethiopia REDD+ ready

<https://forestsnews.cifor.org/62524/getting-ethiopia-redd-ready?fnl=en>

Blog story on dry forest management in Ethiopia: How do you protect what's 'everywhere but nowhere'?

<https://forestsnews.cifor.org/61625/how-do-you-protect-whats-everywhere-but-nowhere?fnl=en>

WWF Webinar: Learning Session 45: Local participation in REDD+ Measuring, Reporting and Verification (PMRV)

<https://www.youtube.com/watch?v=t2DhYP7yRuk&feature=youtu.be>

Website PMRV: including site description, methods, presentation of the results and publications.

<http://www1.cifor.org/pmr/home.html>

<http://www1.cifor.org/pmr/publications.html>

Interview published on YouTube: Manuel Boissière on PMRV

<https://www.youtube.com/watch?v=HCNFodbMVEQ>

Blog story on the Carbon poster « Carbon 101: Faced with teaching a complex topic, scientists get creative »

<http://blog.cifor.org/25533/carbon-101-faced-with-teaching-a-complex-topic-scientists-get-creative#.VW1yN6bWnIY>

Blog story on Non-Timber Forest Products in Cambodia « Web of mistrust snags forest-protection programs in Cambodia »

<http://blog.cifor.org/23890/web-of-mistrust-snags-forest-protection-programs-in-cambodia#.VW1yQKbWnIY>

Blog story on « Communities willing to mitigate climate change — with a little help, research shows »

<http://blog.cifor.org/23194/communities-willing-to-reforest-with-a-little-help-research-shows#.VW1yVqbWnIY>

Application ipad based on COLUPA project results (film, report, blog, interview). URL <https://itunes.apple.com/us/app/planning-for-better-future/id793028146?mt=8>

DVD Planning for a better future in Mamberamo, Papua, Indonesia. CIFOR, CIRAD, CI, 2013.

Boissière M., M. Padmanaba. 2012. Maps for the people: Papuans planning how their land is used. The Conversation, 20 November. URL <http://theconversation.edu.au/maps-for-the-people-papuans-planning-how-their-land-is-used-10588>

Film “Papua: Planning a better future” available in English, French and Indonesian on Youtube:

English: <http://www.youtube.com/watch?v=IjkYOj2p3mQ>

French: <http://www.youtube.com/watch?v=YMDw6E6rNLY>

Indonesian: <http://www.youtube.com/watch?v=kjov9Jz8Z14>

Interview with Radio Australia: Land-use planning important in Indonesian Papua's “lost

paradise”

<http://www.radioaustralia.net.au/international/radio/program/connect-asia/land-use-planning-important-in-indonesian-papuas-lost-paradise/1059734>

Online interview for RTCC (Responding to Climate Change): Papua forest communities offer new perspective on climate change

<http://www.rtcc.org/forest-communities-offer-new-perspective-on-climate-change-in-papua/>

A blog story published online by AlertNet/Reuter: “Climate conversations – Papua forest villagers provide fresh perspective on climate change”

<http://www.trust.org/alertnet/blogs/climate-conversations/papua-forest-villagers-provide-fresh-perspective-on-climate-change/>

Blog story: Maps for the people: Papuans planning how their land is used

English: <http://blog.cifor.org/11949/maps-for-the-people-papuans-planning-how-their-land-is-used/#.UP5gGOh8V-q>

French: <http://blog.cifor.org/13230/des-cartes-pour-la-population-les-papous-planifient-lutilisation-de-leurs-terres/#.UP5gjOh8V-o>

Blog story: Q&A: Land-use planning in northern Papua

English: <http://blog.cifor.org/13217/qa-land-use-planning-in-northern-papua/#.UP5gdOh8V-o>

French: <http://blog.cifor.org/13239/qr-amenagement-du-territoire-dans-le-nord-de-la-papua/#.UP5gheh8V-o>

Indonesian: <http://blog.cifor.org/13223/tj-perencanaan-tata-guna-lahan-di-papua-utara/#.UP5hPOh8V-p>

Blog story: New research helps map better future for Papuan communities

English: <http://blog.cifor.org/13179/new-research-helps-map-better-future-for-papuan-communities/#.UP5gfeh8V-o>

French: <http://blog.cifor.org/13233/de-nouvelles-recherches-contribuent-a-preparer-un-avenir-meilleur-pour-les-communautes-de-papua/#.UP5giOh8V-o>

Indonesian: <http://blog.cifor.org/13198/penelitian-baru-membantu-memetakan-masa-depan-yang-lebih-baik-bagi-masyarakat-papua/#.UP5hOeh8V-p>

Slideshare: Presentation to a workshop in Papua on collaborative land-use planning:

<http://fr.slideshare.net/CIFOR/perencanaan-tata-ruang-kolaboratif-di-kabupaten-mamberamo-roya-papua-indonesia>

Annex 3. A list of students I supervised for their fieldwork/internship

Name of the intern	Year	Internship for	University/school	Topic
Rodolphe Martin	2021	MSc	SupAgro	Identification of the local uses of agroforestry systems in Timor Leste and participatory mapping of local land uses
Emma Calvet	2020	MSc	University of Montpellier and AgroParis Tech	Diversity and uses of wild plants for food in West Java and Banten (Indonesia)
Pierre Ciavarella	2019	MSc	AgroParis Tech and University of Montpellier	Contribution of local populations to bamboo forest restoration in Ethiopia. A comparative study in the Benishangul-Gumuz region
Sarah Benmakhlouf	2018	MSc	AgroParis Tech and National Museum of Natural History (MNHN)	Local perceptions and representations of forest degradation: ethnoecological analysis of land-uses transformation of a bamboo forest dependent community, in Benishangul Gumuz region, Ethiopia.
Walker DePuy	2014	PhD	University of Georgia	A Feasibility Study of Participatory Measurement, Reporting, and Verification (PMRV) for Carbon in Mamberamo Raya, Papua (Indonesia)
Alice Bortzmeyer	2013	Internship (césure)	SupAgro	A Feasibility Study of Participatory Measurement, Reporting, and Verification (PMRV) for Carbon in Central Java (Indonesia)
Yudha Arif Nugroho	2013	BSc internship	University of Gadjah Mada (UGM)	Field enumerator for the Feasibility Study of Participatory Measurement, Reporting, and Verification (PMRV) for Carbon in Central Java (Indonesia)
Ana Yusriawati	2013	Internship (césure)	University of Gadjah Mada (UGM)	Field enumerator for the Feasibility Study of Participatory Measurement, Reporting, and Verification (PMRV) for Carbon in Central Java (Indonesia)
Fanny Jannah	2013	BSc internship	University of Gadjah Mada (UGM)	Field enumerator for the Feasibility Study of Participatory Measurement, Reporting, and Verification (PMRV) for Carbon in Central Java (Indonesia)
Mary Elisabeth Felker	2013-2014	Internship (césure)	University of Berkeley	A Feasibility Study of Participatory Measurement, Reporting, and Verification (PMRV) for Carbon in West Kalimantan (Indonesia)

Lina Farida Jihada	2013-2014	Internship (césure)	University of Gadjah Mada (UGM)	A Feasibility Study of Participatory Measurement, Reporting, and Verification (PMRV) for Carbon in Central Java (Indonesia)
Isack Yable	2013	MSc	University of Papua (UNIPA)	A Feasibility Study of Participatory Measurement, Reporting, and Verification (PMRV) for Carbon in Papua (Indonesia). With a research study on the local perception of MRV in the villages of Bagusa and Yoke
Pierre Bruneau	2012	MSc	Ecole des Hautes Etudes en Sciences Sociales (EHESS)	Conservation and Development Institutions in Indonesia: the case study of WALHI
Guillaume Beaudoin	2011	MSc	Institut Supérieur d'Agriculture de Lille (ISA)	Local monitoring in support to participatory spatial planning in Papua: can local monitoring support a better integration of local people priorities inside conservation area in a context of spatial planning in Papua (Indonesia)?
Imam Basuki	2011	MSc	Agricultural School of Bogor (IPB)	Participatory monitoring of soil and water quality in Laos
Michelle Roberts	2010	PhD	University of Nevada	Participatory biodiversity monitoring in Laos: How Farmers make the Decisions They Do
Aurélien Morin	2009	MSc	University Paris Sud 11	Evolution of the ecological and botanical characteristics of anthropised landscapes, a study case from the province of Luang Prabang, Laos
Melisande Liu	2008	BSc	Albert Ludwigs University, Freiburg	Review of underlying causes of forest fires
Guillaume Léotard	2003	MSc	University of Montpellier	Indigenous knowledge + local management = conservation? The case study of birds in Sumatra lowlands

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