

## Toward a land zoning negotiation support platform: “Tips and tricks” for participatory land use planning in Laos

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### ABSTRACT

Managing complex landscape mosaics in areas dominated by poverty often requires addressing conflicting objectives and managing trade-offs, such as that between maintaining/enhancing ecological functions and improving livelihoods. Laos, like many other developing countries dependent on agriculture and natural resources for the subsistence of a mostly rural population, has used land use planning (LUP) as a core policy instrument to achieve sustainable development. However, previous reviews of LUP implementation showed large discrepancies between policies and practices and between the intended goals and actual outcomes. There is a need for increased participation, improved integration of scales, harmonization of superimposed plans, and enhanced coordination between implementing agencies and other stakeholders. Consequently, former normative approaches to LUP have been gradually replaced (at least on paper) by a new paradigm. Participatory land use planning (PLUP) has recently become a central element of donor-supported programs in developing countries. However, despite the good intentions of PLUP principles, implementation remains entangled with confused practical issues that compromise effective participation. As an alternative to complex, technologically sophisticated LUP models that local stakeholders cannot use or replicate, a communication platform supporting negotiations among multiple stakeholder groups was tested in a village cluster in Luang Prabang Province in northern Laos. This innovative approach, based on a combination of role-playing games, participatory 3D modeling, GIS, and socioeconomic and environmental impact assessment, allows stakeholders to collectively explore the consequences of land use decisions and choose between alternative future landscapes.

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### 1. Introduction

Described as an activity that envisages future land arrangements (FAO, 1993), land use planning (LUP) has been recognized as a key instrument for identifying and ensuring sustainable land uses, improving the livelihoods of rural communities and thereby achieving sustainable development. LUP has evolved from an expert approach to land suitability in the 1960s and 1970s to a more integrated approach involving planning experts, decision-makers, and ordinary citizens. Incorporated into sustainable development discourses, the blending of ecological, economic, and social aspects

through hybrid lay-scientific initiatives is still relevant to ensuring locally appropriate and durable measures (Beierle, 2002; Grainger, 2010; Reed, 2008). Involving ordinary citizens in local management decisions and policy implementation was the core message of Agenda 21 signed at the Rio Earth Summit in 1992, and thus the mandate of participatory land use planning (PLUP) in achieving balance between development needs and the preservation of the rural environment (Maginnis, Jackson, & Dudley, 2004; McShane & Wells, 2004; Sayer, 2009; Sayer & Campbell, 2004). The popularity of participation in natural resources management has not declined since then (Neef & Neubert, 2011). From an ethical perspective, enhanced public participation in LUP is expected to limit the potential for a “top-down” imposition of pro-development interests in planning decisions (Rydin, 1995). Thus, collaborative management, defined as “joint decision-making by the state and communities about a set of resources” (Berkes, 2009, p. 1693), is motivated by a desire to involve in policy-making those citizens whom management decisions are likely

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to be affected (Berkes, 2009; Wagle, 2000). From an instrumental perspective, enhanced participation in planning is expected to engender wider public support and facilitate the implementation of plans (Macnaghten & Jacobs, 1997). A large range of PLUP approaches, designed to encourage sustainable resource management by local communities, have been developed and tested in many countries.

Scientific articles and gray literature that discuss the theoretical appeal of the notion usually conclude by noting the difficulties of applying it in practice and hence of achieving its ambitious goals. For example, a challenge with community-based landscape planning in developing countries is that many of the people involved have low levels of literacy (Reid, Berkes, Wilbanks, & Capistrano, 2006). It is also argued that the participation process can help reinforce the influence and interests of local elite over a silent and unheeded majority (Berkes, 2009; Wagle, 2000). Becu, Neef, Schreinemachers, and Sangkapitux (2008) wonder how to engage local stakeholders beyond passive participation where involvement usually does not go further than silent meetings and data collection. The difficulty in combining different perspectives into a collaborative management initiative is now assumed inherent in community-based planning (Wilson, 2006). Boundary objects have been promoted as an effective means of addressing transdisciplinary issues involving both experts and decision-makers through the development of tools that provide an interface between science and policy, and between knowledge and action (Cash et al., 2003; Wu & Hobbs, 2002). Such tools are characterized by their propensity to translate scientific concepts into lay language (Grainger, 2010; Olsson, Folke, Galaz, Hahn, & Schultz, 2007). The success of efforts to engage local stakeholders in negotiations depends on the boundary objects' efficiency in facilitating communication and providing a "language" common to all stakeholders involved. Cash et al. (2003, p. 8089) have developed a framework "for understanding the effectiveness of systems that link knowledge to action for sustainability". The effectiveness of the boundary object created through participatory activities depends on its capacity to be locally relevant (salience), to reflect local interests (legitimacy), and to demonstrate scientific adequacy (credibility). Nassauer and Opdam (2008, p. 635) introduced the concept of "design" in the paradigm of landscape science, which intends to provide a "common ground for technology transfer: where practitioners and scientists conceptualize landscape innovations". Addressing management issues in two developed countries, the authors demonstrate the importance of strengthening interactions between science and society through "knowledge innovation".

Despite the development of rationales to link landscape science and citizen involvement, reported cases of PLUP are characterized by deficient methodological standards that hinder the practical implementation of sustainability principles (Fox, McMahon, Poffenberger, & Vogler, 2008; Kaswamila & Songorwa, 2009; MAF & NLMA, 2009). Internationally, on-the-ground activities are usually conducted under the implementers' own interpretation, engendering a diversity of implementation pathways under the same overarching concept. Hessel et al. (2009), for example, in a case study from Burkina Faso, demonstrate that the link between spatially explicit mapping and socioeconomic data was bypassed and that, although their outputs could trigger useful discussions, the level of accuracy attained could not guarantee further use by local communities. Fox et al. (2008) describe PLUP experiences in Cambodia where planning was limited to a participatory mapping exercise with local communities. The exercise addressed land and tenure issues at a village scale, but inter-village conflicts could not be visualized. Much other PLUP-related research developed non-spatial and theoretical scenarios that were not actually intended for

implementation (Hoang Fagerstrom et al., 2003; Marchamalo & Romero, 2007).

In Laos, weaknesses in providing landscape innovations through co-management are exemplified by successive LUP policies (Lestrelin, Bourgoin, Bouahom, & Castella, 2011b). Since the early 1990s, a Land Use Planning and Land Allocation (LUP/LA) program has been implemented throughout the country. By increasing land tenure security, LUP/LA is expected to encourage agricultural intensification, to favor private investments and the development of commercial on-farm productions, and importantly, to stabilize shifting cultivation and preserve the country's forest, soil, biodiversity, and water resources (Fujita & Phanvilay, 2008; Lestrelin, 2010; Vandergeest, 2003). Through these processes, the central government formally recognizes customary rights to use natural resources, and provides local institutions with important responsibilities, such as land distribution and registration, tax collection, land use monitoring, and conflict resolution. Hence, in line with the sustainable development paradigm, greater consideration for local claims, knowledge, and institutions is expected to bring about more balanced and environmentally sound development trajectories (UNCED, 1992; WCED, 1987). However, various studies have indicated that the implementation of LUP/LA in Laos did not always achieve the success predicted by the Lao authorities (Ducourtieux, Laffort, & Sacklokham, 2005; Fujita & Phanvilay, 2008; Lestrelin & Giordano, 2007). One of the reasons for the poor outcomes is the gradually increasing complexity of Laos' LUP system, which resulted from two concurrent processes: a multiplication of the actors involved in LUP—each with its own mandates, priorities, and approaches to planning—and a sustained, yet not necessarily coordinated, effort to improve on previous policy (Lestrelin et al., 2011b).

A more positive trait is that the flourishing of new LUP instruments reflects partly a sustained effort by the government of Laos and its international development partners to improve planning approaches and, importantly, adapt them in response to reported deficiencies, emerging issues, and changing concerns. This is illustrated by the evolution of village-level LUP, where each new instrument is presented as an improvement on previous ones (Lestrelin, Bourgoin, Bouahom, & Castella, 2011a). Since the mid-1990s, the LUP/LA mandate has gradually expanded by including individual land allocation procedures and monitoring (LSFP, 1997, 2001). More recently, PLUP has emerged to replace LUP/LA in order to provide a more participatory and integrated planning process at the village cluster level (MAF & NLMA, 2009). However, the premise of PLUP in Laos, as scrutinized by Lestrelin et al. (2011a), appears to repeat the mistakes of the past with inappropriate on-the-ground practices undermining thoughtful (inter) national guidelines. The authors conclude that solely highlighting the need for more participation could neither increase local participation nor affect local land uses in pilot initiatives of PLUP. In practice, limited facilitation skills and implementation capacities of land use planners, together with the absence of constructive feedback loops, impose considerable limits on local communities' participation and inclusion of local perspectives.

Building on these findings, this paper proposes a negotiation platform capable of engaging local communities in a more participatory version of LUP in accordance with the main principles defined by the national agencies in charge of the implementation, that is, the Ministry of Agriculture and Forestry (MAF) and the National Land Management Authority (NLMA). The method is then illustrated by a case study from Viengkham District in Luang Prabang Province. Finally, lessons are drawn from this experience, and the conditions for generalizing this innovative approach to the national level are discussed.

## 2. Revisiting the principles of PLUP: participation and integration

The two Lao government agencies in charge of land management (MAF and NLMA) prepared a manual on “Participatory Agriculture and Forest Land Use Planning at Village and Village Cluster Level” to coordinate their efforts into a standardized approach to PLUP which their respective line agencies at the province and district levels could apply consistently. Building on the knowledge generated during past LUP initiatives (i.e., LUP/LA), the guidelines intend to provide appropriate adjustments in a context of strong governmental ambition to participate in globalized trade and investment through the engagement of rural areas in a market-based economy. The improved PLUP approach has been built on participation and integration principles to ensure consistent field application.

### 2.1. Participation

The manual highlights the need to improve the participatory nature of LUP and advocates that the elaboration of land use plans should be directly derived from villagers’ views. Land management activities should also be adaptive and allow for different ethnic groups to voice their needs with an equal representation of women and men at each stage of decision-making. Prior to the zoning process, village rights to exploit natural resources and modify their landscape through LUP have to be clarified for the entire village community. In fact, the main promise when involving local communities in LUP is to prevent deviant uses by local elite and other influential actors who might seek to exert control over natural resources; for example, cases of land-grabbing have been reported in conjunction with LUP implemented with the support of foreign investors (Baird, 2009). Besides, the aim is for the process to be driven by the people who will be the most affected by the outcome and who can provide knowledge that will fit into the local frame (Ericson, 2006). Participation is essential because it provides local-scale information and intends to “encourage the construction of a common vision for sustainable regional development” (Valencia-Sandoval, Flanders, & Kozak, 2010, p. 65). Furthermore, by improving villagers’ capacity to influence local processes, local participants gain the ability to negotiate with government representatives, an aspect that redesigns the power balance. Within the communities, it also gives visibility to a wider range of stakeholders and contributes to balance gender, social and economic status, and ethnicity.

### 2.2. Integration

Coping with scales, knowledge, and multiple stakeholders’ perspectives is included in the mandate of land use planners; however, although integration is recognized as an important principle, in practice, it often remains at the recommendation stage (Gunarso, Setyawati, Sunderland, & Shackleton, 2007; Lal, Lim-Applegate, & Scocimarro, 2001). PLUP therefore reaffirms the ambition to effectively translate integrative concepts into local land management plans. The sub-district perspective of PLUP is expected to mitigate inter-village conflicts and support collaborative management between villages of the same village cluster. Border conflicts between villages are often the result of past relocation policies clustering villages along the road or merging small villages into larger ones. In addition, tacit agreements over land use exist between neighboring villages, which justifies integrating LUP at multiple scales from village to village cluster and district.

The participatory nature of the process entails the integration of different types of knowledge. Indigenous knowledge, widely praised for its local relevance and the salience it provides to the

whole initiative, should be integrated with scientific expertise regarding global processes affecting land uses. The use of advanced geographic technology through Global Positioning Systems (GPS) and satellite imagery is also promoted to avoid mapping irregularities (MAF & NLMA, 2009). Knowledge integration has the potential to better inform negotiation and facilitate multi-actor landscape planning (Opdam, Steingrover, & van Rooij, 2006). However, combining hard scientific data with local expertise can be challenging, as local stakeholders might not understand the consequences of their decisions and could be manipulated by those who better understand the issues at stake, that is, land use planners and local leaders (Kitchin & Dodge, 2007; Nassauer & Opdam, 2008). Rather than using “outsourced” data likely to be locally distrusted and/or rejected, the knowledge used to make informed decisions should be generated through social interaction involving layman stakeholders. Facilitators of such collective processes have then to frame the knowledge into meaningful “boundary objects”, which become the main supports for multi-stakeholder negotiations in search of land management compromises (Jasanoff, 2007; Treu, Magoni, Steiner, & Palazzo, 2000; Von Haaren, 2002). These simple—but not simplistic—media have to be carefully designed so that they address the trade-offs between scientific/academic relevance (credibility) and the understanding/interest of local communities (legitimacy and salience) (Cash et al., 2003; Pullin, Knight, Stone, & Charman, 2004).

## 3. Case study site

In the uplands of Laos, as in many other developing countries, agriculture and natural resources constitute livelihood mainstays for the rural population. Subsistence farming by shifting cultivation is widespread because of low accessibility to roads and markets, although the government has denounced shifting cultivation as “primitive, unproductive and harmful to the environment” (Haberecht, 2009, p. 29). Ranked among Laos’ poorest districts, Viengkham District borders the nation’s second largest protected area (Nam-Et Phou Louey National Protected Area), which harbors one of the few remaining breeding populations of tigers in the country. LUP is considered a key policy instrument for helping to reconcile conservation and development objectives and prevent loss of ecosystem services (i.e., biodiversity, soil fertility, carbon sequestration) in the complex landscape mosaics found outside protected areas (MAF & NLMA, 2009). In Viengkham District, as in other remote upland areas of the country, the Government of Laos would also like to use PLUP as a way to clarify the customary tenure system and accelerate the transition from subsistence to market-oriented agriculture. Within the district, Muongmuay village cluster encompasses six villages: Donkeo, Paklao, Bouami, Muongmuay, Huaykon, and Vangkham (Fig. 1A). This village cluster was selected based on its typical characteristics of upland agriculture and relative remoteness from the main markets, hindering the diversification of agricultural activities. Most villagers subsist on local products, traditional slash-and-burn shifting cultivation prevails, and most of the cash income is generated from the sale of non-timber forest products (NTFPs) and livestock (Castella et al., 2011).

## 4. Action-research in PLUP implementation

In 2010, the researchers designed an innovative PLUP approach to apply the principles of enhanced participation and integration described in Section 2 which they tested in real conditions in the six villages of the Muongmuay village cluster, in Viengkham District (Fig. 1A). The action-research involved scientists from international (e.g., University of Queensland, Center for International

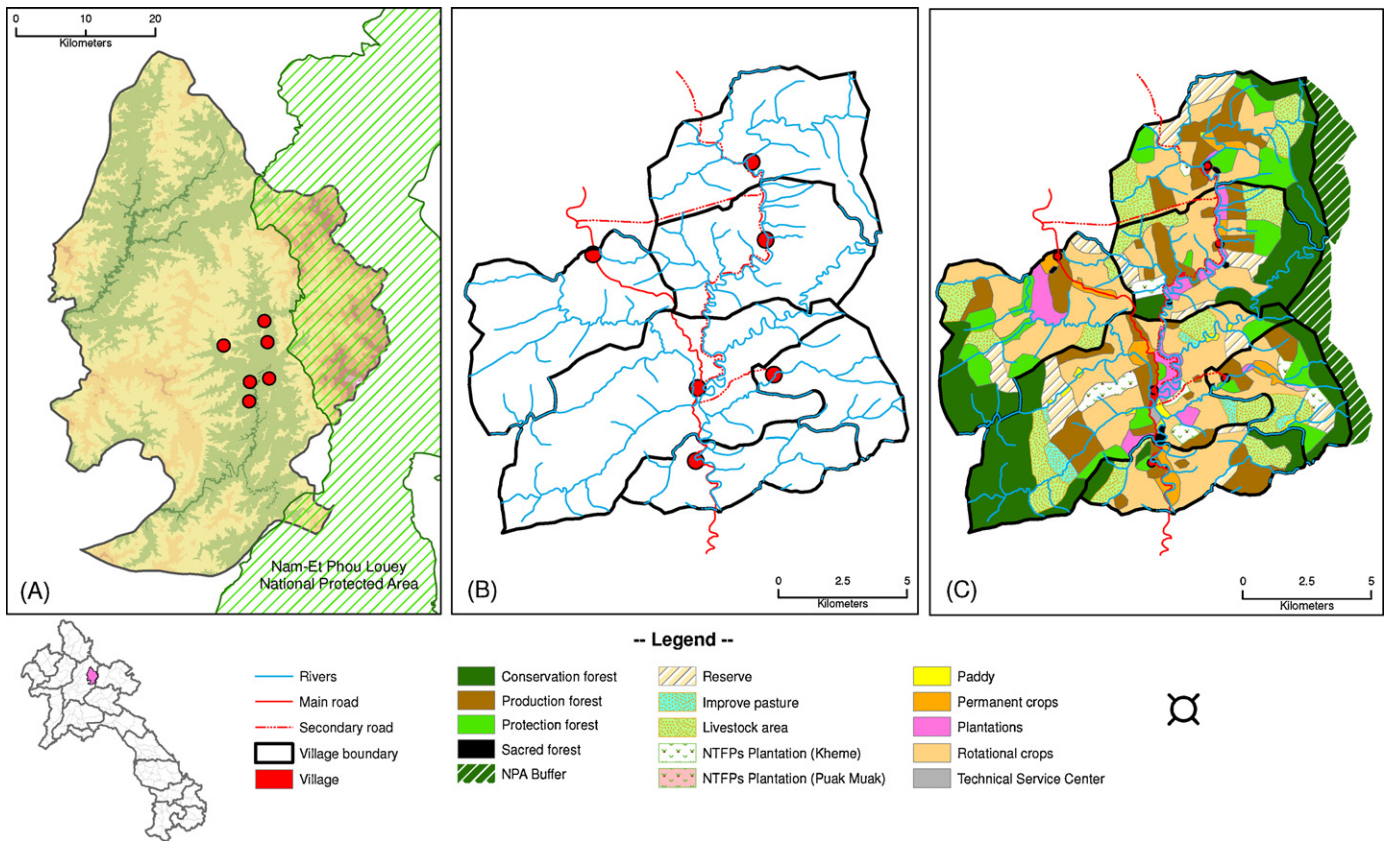


Fig. 1. Location of Viengkham District (A) and the target villages where land use planning was conducted from boundary delineation (B) to land use zoning (C).

Forestry Research, Institut de Recherche pour le Développement) and national (e.g., National Agriculture and Forestry Research Institute) research institutions, practitioners (e.g., development projects and extension agents from the District Agriculture and Forestry Office; DAFO), local authorities (e.g., land management officers and district governor's office), and village communities. A dozen people representing the national agencies took part in the implementation of PLUP over successive field missions. The end goal was to train a team of national experts capable of applying the method themselves. The overall approach presented below was developed through an adaptive process that was constantly refined during implementation in the villages.

#### 4.1. Village boundary delineation

A combination of topographic maps and high-resolution satellite imagery was used to define boundaries in one village at a time. Given the objective of addressing boundary issues for a cluster of villages, the challenge was to define a way to bring together knowledgeable representatives from all the villages concerned and delineate initial boundaries in one day. For that purpose, a participatory 3D model (P3DM) made of 4 pieces was constructed for the whole village cluster (Fig. 2C). Each block was built in one day by a team of four people using paperboard cut around the contour lines and superimposed (Rambaldi, 2010). With Geographic Information System (GIS) software and only the village-points layer available, a frame encompassing all the target villages was created and clipped with a digital elevation model (DEM) of the area. Participatory maps of the villages were used to appreciate the potential extent of villages that did not possess definite administrative boundaries.

Each village was asked to select a man and a woman with extensive knowledge on village customary boundaries. Those representatives of the six villages of the village cluster met around the blank relief model along with delegates of the National Protected Area and people from villages neighboring the target village cluster. People started to familiarize with the 3D model by adding names of places, rivers, and mountains. Then they started discussing with their neighbors the location of the boundary between their respective villages. The delineation was marked using color pins and threads and facilitated by staff from the team who speak both languages. The delineation of the six villages' boundaries finished after three hours of intense discussions and negotiations. The polygons representing the village limits were geo-referenced and digitized in ArcGIS, and then projected onto a wall to make hardcopy versions for each village.

The boundary delineation meeting involved only two village representatives for each village. Consequently, to validate the boundaries, the maps were presented in each village to a broader assembly. The two representatives explained the collective process they had gone through and the boundary delineation was collectively refined and approved after discussions. The villagers and the implementing team also discussed the location of required GPS readings to finalize sections of the village boundary that did not match any physical features (e.g., rivers, mountain ridges).

Finally, during a meeting with the village cluster representatives, the boundaries of all villages were reviewed and finalized using maps. Fig. 1B displays the result of the delineation process validated by the local authority. After ensuring that no potential territorial conflicts were left pending, inter-village boundary agreements forms were issued to all villages and approved by the district administration.



**Fig. 2.** Boundary objects support interactions between people and landscapes. (A) Land use zoning in Muongmuay village cluster on a participatory 3D model (see also Fig. 1C). (B) 3D modeling facilitates villagers' comprehension and participation. (C) A virtual landscape is used to simulate land use planning.

#### 4.2. Data collection and processing

*Socioeconomic surveys* were undertaken at different scales in each village. At the village level, the annually collected census data by the district administration provided general information about the village households on social aspects (e.g., ethnicity, position in the village, social status), financial assets, and sources of income (e.g., capital, number of parcels, livestock, and plantations). The village census was complemented by an assessment of past population trends that helped identify potential village land requirements in the future. Focus groups were organized separately with men and women to identify agricultural and forest land-related problems and opportunities that could be addressed by land management plans and village extension programs. Finally, basic information on village wildlife, as well as the location, relative abundance, and collection patterns of wood and NTFPs, was used to assist the land zoning activity.

At the household level, interviews were conducted with 30 randomly selected families in the village to characterize the household economies and create categories according to a regional typology (Castella et al., 2011). In the questionnaire, cropping and livestock systems were investigated, as was collection of NTFPs. Although of marginal importance to most households in the study area, plantations of valuable industrial trees, such as teak, rubber, and agar wood, and income from off-farm activities were also assessed, as they usually indicate a high level of socioeconomic differentiation within the village. More systematic landscape-level information was also gathered on the number, area, and location of both cropped and fallowed agricultural plots in the village. The household and land use data generated from different sources were subsequently cross-checked with villagers. This adaptive stepwise survey was used to gradually refine the PLUP knowledge base available at the village level.

Further, an *analysis framework* was required to fully appreciate the value of all the information collected. In general, most LUP teams collect a large range of data because it is a compulsory requirement in national guidelines, but then use only a limited subset of the available information. This does not suggest that implementers do not have at their disposal relevant methods to conduct LUP, but that they often rely on their own field experience and empirically built mental models to facilitate the participatory planning activities. This person-specific approach, highly dependent on individual facilitation skills, tends to impede the ability to replicate and to ensure consistency of planning methods across sites. As a result, the LUP processes become highly dependent on the experience of individual implementers and projects. The extent to which socioeconomic data collected during the PLUP are actually used for land zoning and LUP becomes highly variable at the sub-national and national levels.

In the proposed analysis framework, the first step consisted of categorizing the households into several classes. Data on income generation were compiled, with each household being

classified into different types of livelihood strategies depending on the share of their total income generated from cropping activities, livestock raising, tree plantation, NTFP collection, or off-farm activities. Dependency matrices linked household types and income-generating activities. The expert-based household typology was completed according to classification criteria generated from intensive livelihoods surveys in the northern uplands of Laos (Table 1).

#### 4.3. Land use zoning

##### 4.3.1. Setting up village land management committees

In general, important decisions made in the village are devolved to the village authority, which is composed of the village head and two (or three) deputies, heads of the elder committee, youth and women's unions, and secretary of the communist party. However, as indicated in the PLUP manual, a better balance of power within the group involved in LUP should be promoted to improve broader village community participation. To address this concern, a village land management committee (VLMC) was set up with members selected according to individual criteria: high motivation, ability to communicate, and knowledge of village land uses. Furthermore, the selection procedure aimed at achieving a balance of gender, ethnicity, and socioeconomic status among VLMC members. Achieving gender balance often involved tough negotiations with local authorities as they were often reluctant to provide enough women's names, arguing that women do not usually make decisions at village level, are too busy with domestic tasks and field activities, and are not knowledgeable enough on land issues. Despite long discussions, in most cases, the initial gender balance requirement ended up as a man: woman ratio of 2:1. A committee membership of 10–15 participants was found ideal to ensure real interactions could take place within the group and all individuals could voice their concerns (Neef & Neubert, 2011).

##### 4.3.2. Participatory landscape simulation

A role-playing game developed by Bourgoin and Castella (2011) and called "PLUP Fiction" was used to train VLMC members in negotiating land zoning on a stylized landscape. Within a relatively short time (one and a half days), a group of villagers learned about the implications of land zoning for their livelihoods. This group-building exercise was the cornerstone of an empowerment process, as it put VLMC members in the role of land use planners. During the zoning simulation, people drew areas of different land uses on a board made of 100 one-hectare cells. After delineating all the zones, players counted the number of cells of each land use type to get the corresponding number of hectares. The values on economic and environmental returns to the land use types were then multiplied by the number of cells associated with each land use to compute the economic and environmental values of the whole simulated landscape. Environmental value pertains to biodiversity and carbon indexes associated with the different land use

**Table 1**  
Characteristics of household types.

Type	Main income source	Criteria (main/secondary)
A	Shifting cultivation	- No major income from plantations - Receive less than 10–15 million kips/year from livestock (cattle + buffalos) - Involved in off-farm work activities: waged worker, handicrafts
B	Livestock	- No major income from plantations - Receive more than 10–15 million kips/year from livestock (cattle + buffalos) - Involved in off-farm work activities: waged worker, handicrafts
C	Plantations	- Involved in plantations: teak, rubber, agar wood, etc. - Involved in livestock raising
D	Off-farm	- Involved in off-farm activities: trader, shopkeeper - Involved in livestock raising - Involved in plantations

types. Incomes derived from livestock raising and NTFP collection in the simulated landscape were included in the calculations along with agricultural income. The “landscape values” resulting from successive land zoning simulations helped participants to explore different options without consequences in reality. They could negotiate land uses and adjust and readapt the plans until consensus was reached among the different stakeholder groups they represent (i.e., villagers, district authorities, conservationists). This exercise resembled a rehearsal for the actual land zoning negotiations taking place the next day.

#### 4.3.3. Village zoning

The land zoning process involved the VLMC delineating zones on a 3D model of their village instead of the simulation board of the “PLUP Fiction” role-play. First, the participants familiarized with the blank terrain landscape by writing the names of places they recognized (e.g., mountain summits, rivers). Then, data collected during the focus group discussions (e.g., location of NTFPs, wood, and wildlife) were displayed on the 3D model with stickers. When all features of the landscape had been encompassed, the participants used pins and threads to delineate land zones within their village boundary (Rambaldi, 2010). This interactive method triggered lively discussions about the location and type of land use (Fig. 2B). When the whole landscape had been dealt with, and the zones named and described in relation to physical features of the terrain, the zoning stopped. Pictures were taken from above to encompass the whole village landscape. Then, the landscape pictures were geo-referenced with the help of recognizable terrain features such as mountains, roads, and rivers, to capture the land use plan into GIS software (ArcGIS). When the image fit an appropriate scale, the different land use types were subsequently digitized as polygons. A script was run to calculate the exact area of each polygon.

#### 4.4. Iterative planning

##### 4.4.1. Time

The parameters used to provide environmental and economic feedback from the land use plan were the same as those elicited by the VLMC members during the “PLUP Fiction” zoning simulation. They were complemented by socio-economic data from detailed household surveys to estimate the proportion of each household type in the target village and their relative dependence on each land use type. Based on the GIS-computed area for each land use type, a cost–benefit assessment of the land use plan was generated from an Excel spreadsheet and presented to the VLMC. First, an overall environmental value for the landscape was provided as a combination of biodiversity and carbon indexes. Then, the total village income was computed based on returns to land from livestock, agriculture, and NTFPs.

The economic outputs of a given landscape arrangement could thus be compared with the livelihood needs of the different household types and discussed by the VLMC. Depending on the feedback received, committee members negotiated which kind of land use should be added, removed, or modified. They thus entered into a new round of planning, that is, delineation/capture/analysis. Time wise, the process was not costly. Photographs were taken after each round of LUP and analyzed in the GIS. Then, given the dynamic structure capabilities, the model instantly generated outputs after computing land use areas. On average, this activity took one day. As with the zoning simulation, the process stopped when a satisfactory compromise was reached.

##### 4.4.2. Scale

The government of Laos has stated that LUP activities should take place at the scale of the newly created sub-district units (i.e., village clusters). Once the village boundaries had been agreed upon at the village cluster level, LUP was conducted in each of the six villages in the Muongmuay village cluster. Fig. 1C represents the final land use map of the cluster as an aggregation of single village land use plans. At the end of the process, a planning meeting was organized at the village cluster level, gathering two key members of each VLMC, one man and one woman, who were selected by their peers to represent their village. The overall objective of the meeting, chaired by the head of the village cluster, was to visualize the results of the LUP conducted for each village and propose to negotiate any changes that planners wished to make on the 3D model at the higher level of integration (i.e., village cluster). For example, discussions took place on livestock areas that cut across village boundaries and that therefore lead to livestock circulating in neighboring villages. Some villages decided to build fences around their livestock areas while others reached agreements on inter-village livestock management (e.g., communal livestock zones). Corridors were also created for wildlife circulation by creating continuous tracts of conservation forest between contiguous villages. After the meeting, the various village and inter-village agreements were checked collectively, and a village cluster agreement was prepared for endorsement by the district governor.

#### 5. Discussion: how does the proposed approach fit with PLUP principles?

The approach presented in this paper combines a number of tools and methods that address the challenges of PLUP implementation in Laos (Fujita & Phanvilay, 2008; Lestrelin et al., 2011a, 2011b; MAF & NLMA, 2009). Both the whole framework and its individual components were designed through a participatory learning and action process, and gradually refined to overcome practical problems encountered during implementation. This learning process enabled the identification of lessons for out-scaling (i.e.,

replication in other places) and up-scaling, reported below in relation to the two principles of PLUP introduced in Section 2.

### 5.1. Participation: from meeting attendance to consultation and negotiation

As pointed out by *Lestrelin et al. (2011a)*, too often land use planners consider participation as a question of who is present in the room during the LUP process. Questions like “who should participate?” and “how should key issues be addressed through multi-scale co-management” (*Wagle, 2000*) receive too little attention. Similarly, the extent to which people understand the process and challenges of land use planning and the influence they could have by voicing their ideas, remain largely overlooked. In many cases, improving participation has been interpreted as balancing genders and ethnic groups in the assembly, or addressed by increasing the number of community members attending meetings. Consequently, the qualitative dimension of participation (i.e., people’s engagement, commitment, and empowerment) has been neglected by land use planners, who have focused more on the quantitative dimension of participation. A commonly reported reason for suboptimal implementation is that time constraints prevent local communities from gaining a good understanding of the complex issues involved in LUP, and consequently from actively engaging in negotiations with land use planners. As we learned from the innovative PLUP experience reported in this paper, other important obstacles to genuine involvement of local communities are: (i) the absence of visualization and learning tools that would increase local communities’ understanding of the land issues at stake and promote effective participation; (ii) land use planners’ limited facilitation skills for engaging local people in an open negotiation process; and (iii) limited efforts for assessing the *quality of participation* (i.e., the actual engagement of local people into the planning process) which, in turn, provides limited motivations for land use planners to perform better.

In the approach reported in this paper, landscape visualization and learning tools were developed to support LUP activities and help local people elaborate their own views based on a simple representation of the landscape. First, a terrain model of the target village cluster was built based on a DEM. The 3D representation of the landscape facilitated the interventions of the villagers who were not able to locate themselves on a simple 2D topographic map. The main advantage of P3DM is that it allows participants to project their own mental model of village land use on a scaled physical landscape (*Rambaldi & Callosa-Tarr, 2002*). After the preliminary discovery phase, during which participants built a common representation of their environment by naming the important benchmarks of their village landscape (i.e., streams and rivers, valleys, and mountains are labeled and named in the local language), they could exchange views and negotiate meaningfully based on the boundary object they co-constructed with the land use planners (*Brunckhorst, Coop, & Reeve, 2006; Castella, 2009; Maginnis et al., 2004; Sayer & Campbell, 2004*).

Second, an abstract landscape representation was used during the “PLUP Fiction” role-play to focus the participants’ attention on learning the rules of the game (i.e., socioeconomic implications of decisions made in relation to the location and area of different land use types), rather than allowing them to be distracted by land issues in their real landscape, which would have been made visible by more realistic boundary objects such as high-resolution satellite imagery. The landscape simulation board used to train participants in land zoning is therefore an abstract representation of the land cover/use of a hypothetical village. It triggered lively discussions about the general implications of spatial arrangements during land zoning made independently of the real situation of the village. This social learning experience also involved villagers

assessing different scenarios through which they could understand the implications of alternative futures (*Blackstock, Kelly, & Horsey, 2007*), and comprehend that LUP is not a frozen representation of their landscape but an adaptive instrument they can use to redesign their landscape whenever necessary. Learning-by-doing with boundary objects turned out to empower local participants, who could employ the lessons learned during the simulation and demonstrate local appropriation and adoption of the process to engage more actively in the planning process for their real village (*Becu et al., 2008; Berkes, 2009; Castella, 2009*).

Engaging a group of villagers, often illiterate or with only elementary school education, in balanced negotiations with land use planners is a real challenge. The “PLUP Fiction” tool provided a unique experience for villagers to learn the tips and tricks of LUP, and enhanced local capacity for problem-solving through scenario planning (*Berkes, 2009; Bourgoin & Castella, 2011*). It helped elucidate the seemingly complex planning approach by explaining how the environmental and socio-economic value of different landscape patterns can be assessed based on local knowledge of land use systems. This boundary activity motivates knowledge co-production by providing clear linkages between village socioeconomic information and the spatial arrangement of the land. As noted by *Castella, Trung, and Boissau (2005)*, individual farmers often have a limited understanding of the village land use as a whole, and thus a simulation involving playing different roles can increase awareness of how various local strategies in land management are related to households’ reliance on the land for subsistence and income generation. Field observations showed that in the absence of training of new land management committee members, past land use plans mainly resulted from the inputs of government implementers and/or a few local elites (*Lestrelin et al., 2011a*). Through the training in land use negotiations, villagers from a range of social positions were transformed from marginalized observers to main actors in the process.

### 5.2. Integrating landscape planning and management

Managing the trade-off between local relevance and scientific credibility is a key challenge in landscape design (*Cash et al., 2003; Nassauer & Opdam, 2008; Opdam, 2010; Pullin et al., 2004*). For instance, a more complex method was applied in a pilot study using GIS scripts and scenario modeling to compute all the values and deliver the outputs (*Pullar & Lamb, 2008*). Although this approach has more credibility for an academic audience, it would have required advanced GIS training for local government staff. The complexity of the scripts and algorithms would have prevented them from adapting the method to their own circumstances and/or reusing it in other villages. Other evidence-based approaches relying exclusively on high-definition satellite imagery are constrained by the time and skills required for planners to ensure that local actors can actually understand and use these high-tech devices. In a context of co-management, the negotiation support tools developed in this study were designed to bridge socio-economic data and spatial information in simple media that (i) retained the most important information for decision-making and (ii) packaged the relevant knowledge in a format that made it understandable by all stakeholders involved. To ensure a legitimate process, time and resources were dedicated to provide proper training to empower members of the VLMC. Otherwise, there is a risk that participants become passive spectators, leaving the district planners to pilot the planning process. These experiences are reported here to stress the importance of adapting materials and methods to local contexts and to the capacity of the people who will be further implementing the land use plan.

Throughout the field work, it was also important to highlight the adaptive nature of the process. While at the end of the initial

one-week learning process a land use plan is signed by the local authorities, members of the VLMC have learnt that this plan needs to be revisited in time. They know that this first step is the beginning of the PLUP process and not the end. Implementing the land use plan (including land management rules, sanctions for deviant behaviors, land titling, monitoring, etc.) is a highly adaptive process. When members of the VLMC decide that they want to make a completely new land use plan as the ecological and economic situation of their village has changed since the last plan, they may engage in a new planning and implementation loop with the support of district staff that have been trained in PLUP facilitation.

The initial action-research process was driven by external expertise (e.g., facilitation, interpretation of spatial data, documentation) and financial resources, which is similar to previous land use planning processes in Laos that were driven by external assistance. But, in the case reported in this paper, after initial validation in several villages, guidelines and toolboxes have been developed to support capacity building of district implementers toward a wider implementation of PLUP and to engage district staff in durable activities.

Another key aspect of PLUP success is the need to build trust between the stakeholders who will interact during the few days of the planning process, that is, the district planners (with the support of the action research team in our case) and the village community. At the debriefing session at the end of the collective process, villagers usually admitted that they were reluctant to provide real, precise information to the team collecting socio-economic data as they suspected that the information would be used for tax collection. The learning process increased the participants' confidence, as they realized that using correct information about land use and livelihood systems would improve the quality of the final product—the land use plan—and therefore would facilitate its implementation.

Once trust had been built between planners and community members, the manipulation of the boundary objects allowed villagers to refine and adapt their plans to make them more realistic. Being realistic is a necessary condition for a plan's actual implementation. In villages investigated by Lestrelin et al. (2011a), as a response to land shortage issues from early LUP/LA implementation, villagers were allocated whatever land they would request for agriculture, resulting in unrealistic plans similar to those obtained during the first round of PLUP. In these villages, the land use plan was never translated into action, mainly because people had not cared about producing a realistic plan at the outset. The iterative learning approach allowed farmers to gradually become amateur landscape planners but, most importantly, it increased trust in the district staff who came to facilitate the planning process, engaging them in a long-lasting partnership toward an improved landscape management (Reed, 2008).

## 6. Conclusions

This paper shows how visualization and learning boundary tools can help translate participatory principles into reality by empowering locals in designing future land use plans and by acting as catalysts of negotiation (Folke, Hahn, Olsson, & Norberg, 2005). Our action-research approach attempts to move beyond the “dos and don'ts” or “PLUP recipes” to propose an integrative communication platform combining local and scientific knowledge. It exemplifies “how [science] can improve the quality of the decision-making process, as well as that of its outcome” (Beunen & Opdam, 2011, p. 325). The concept of “design” in landscape science, introduced by Nassauer and Opdam (2008), has been used in the context of PLUP through the development of legitimate, credible, and salient “landscape boundary objects”. The proposed boundary objects

empowered the VLMCs by improving effective participation. Often relegated to the role of mere observers of a planning process piloted by district authorities, local villagers could voice their views and influence the land use decisions. Hence, by negotiating land use plans and development scenarios, participants seemed to have been able to reach an agreement on a spatially explicit landscape management plan with a high degree of ownership.

The legitimacy of PLUP outputs should be considered at both local and national scales. A successful bridging approach needs to be pertinent at the national level while being supported by local authorities. Therefore, boundary work should be anchored in a national governmental strategy to engage communities in decentralized governance of the farm/forest interface, and thus build long-lasting mechanisms of co-management.

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