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Participatory GIS and local knowledge enhancement for community carbon forestry planning: an example from Cameroon

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Introduction

This article explores how participatory GIS (PGIS) can add value to indigenous knowledge for use in carbon planning within the Clean Development Mechanism (CDM) of the Kyoto Protocol. Accessing payments and benefits for environmental services such as carbon mitigation requires enormous amounts of technical information – which local communities in developing countries often lack. Local spatial knowledge and indigenous knowledge can be vital sources of information – but there is still a divide between local and scientific knowledge.

In this article we try to explore the extent to which PGIS can enhance the use of local and indigenous knowledge in the CDM certification processes. We report on part of an ongoing study, working with a long-time partner, the Bimbia Bonadikombo community, located in Cameroon's Southwest Province. The study is researching possibilities for including carbon forestry as an objective in a community forest management plan. The results would be used to develop strategies relevant for CDM requirements and community forest management in general.

CDM information demands

The Kyoto Protocols set out specific targets for industrialised countries to reduce their greenhouse gas emissions to 5% below 1990 levels by 2012 (UNFCCC, 1997).[1] There are three flexible mechanisms to help industrialised countries meet their targets, one of which is the CDM which includes the development of greenhouse gas mitigation projects in the forestry sector in developing countries. CDM also aims to contribute to sustainable development in the project host countries.

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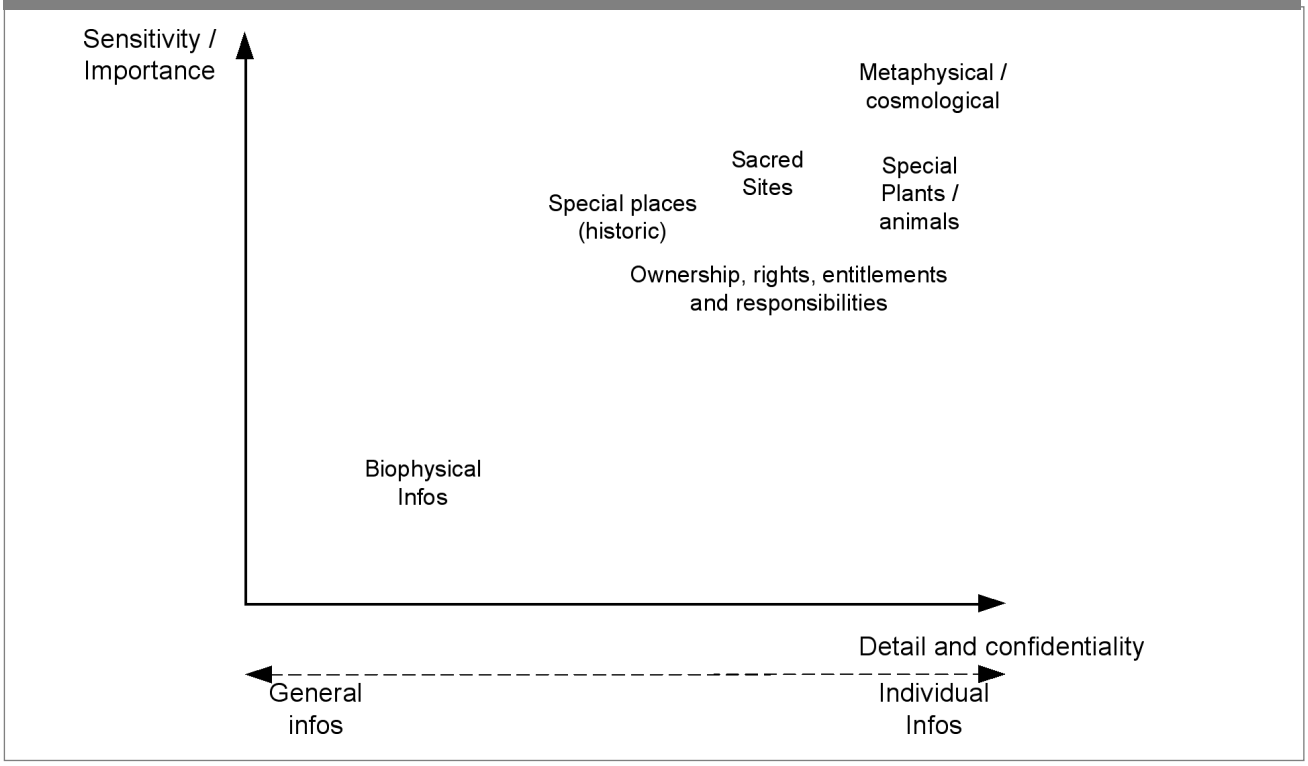
To meet these objectives, there are a number of requirements that project developers (which may include commu-

[1] United Nations Framework Convention on Climate Change. See: www.unfccc.int

Figure 1: Framework for organising indigenous knowledge



nities) must fulfil in a forestry project development document. These include:

- a general description of the project;
- information about land and resource rights;
- methodologies for measuring biomass and carbon baselines;
- methodologies for monitoring and verification;
- calculations of how much greenhouse gas will be removed;
- environmental impacts; and
- stakeholder comments (Lee, 2004).

Much of the relevant information in the project document needs to be represented spatially including:

- the boundaries of the project area;
- the status of land and resource ownership and entitlements;
- evidence that the project area has not been deforested over the last fifty years (a CDM Certification requirement);
- the inventory plots and comparison or control sites;
- baseline evidence (current uses, physical state of forest, forest change history); and
- environmental impacts of the project.

These could be provided through remote sensing, GIS and other geographic evidence. But most rural communities in developing countries lack this sort of information. Combined with a lack of foundation geographic data, poor Internet access, and a lack of technological resources and know-how, including power supply problems, these factors hamper the use of geographic information technologies. Participatory use of indigenous spatial knowledge in PGIS could meet these gaps.

Local and indigenous knowledge

Local knowledge has some significant characteristics:

- it is a (spatial) information system that develops from the close relationship between local people and their land and natural resources;
- members of the community are expert repositories for different categories of data, according to their experience and social status, e.g. what land is used for what purposes and when;
- originally, the local community 'owns' the knowledge,
- it is a 'scientific' system in that it consists of classification structures and employs particular methodologies (e.g. oral histories); and,

Box 1: CDM requirements and local knowledge

CDM information requirements	Related local/indigenous knowledge
Project Boundary	Local land use policy/rules
State of forest in Dec 1989/or 50 years ago	Oral history of forest evolution, changes
Inventory and comparison or control plots	Local botanical and biophysical knowledge
Baseline evidence	Traditional land/forest quality indicators
Environmental impacts	Traditional land/forest quality indicators
Situation of land/resource ownership	Traditional land/resource tenure

- it is holistic because it is used for decision-making in overlapping areas, such as agriculture, food, healthcare, natural resource management, etc.

Some relevant weaknesses of indigenous and local knowledge include:

- communities find it hard to predict what will happen when conditions are new or changed;
- there are deficiencies in ways that information is stored and communicated; and,
- there is little quantification of information for analysis.

Box 1 gives an example of how CDM information requirements can be matched to local knowledge.

In our case study, we used a framework for organising indigenous knowledge (see Figure 1) based on Harmsworth (1998) in which we considered land and resource ownership rights an important area to focus on. This was reinforced by an analysis of a carbon plantation project in Uganda (FERN 2000), which reportedly failed due to deficiencies in understanding and working with local land and resource tenure.

An example from practice: integrating PGIS and LSK in community carbon planning

To investigate how PGIS could employ local spatial knowledge in CDM project planning, we worked with a long-time partner, Bimbia Bonadikombo community, located in Cameroon's Southwest Province, on an interactive process (see Table 1). Our main focus was land and forest resource ownership and rights, and access to use of forestland.

Bimbia Bonadikombo community is partly peri-urban in character and located on the fringes of the Limbe (Victoria) urban settlement. Limbe and the surrounding areas have a population of about 123,900 inhabitants. Bimbia Bonadikombo is a highly heterogeneous complex of many villages and plantation workers camps. The community has been managing a 3700 ha Community Forest since mid-2002. An elected community forest management council manages the forest on behalf of the community. This council reports to the Ministry of Forests and Wildlife (MINFOF)[1] based on the terms of the management agreement signed with government.

Table 1: Summary of PGIS process in Bimbia Bonadikombo

Phases/ Elements	I. Understanding local knowledge	II. GPS point survey and mapping
Participatory tools involved	Sketch mapping Transect walks Semi-structured interviews Focus group discussions	GPS survey GIS (done by an external researcher)
Actors	NGO; Ministry of Forests staff; chiefs; 14 farmers, hunters; charcoal burners; women (6); community forestry staff	Four farmers/hunters; Ministry of Forest staff; community forest operations committee members
GIT tools	Topographic sheets; GIS maps of Bimbia Bonadikombo forest	GPS; GIS mapping
Outputs	Community forest use sketch map; use rights perception maps; descriptions of use rights	GPS points of farm locations; GIS maps of use rights perceptions
Degree of participation	Interactive Facilitation	Consultation Facilitation

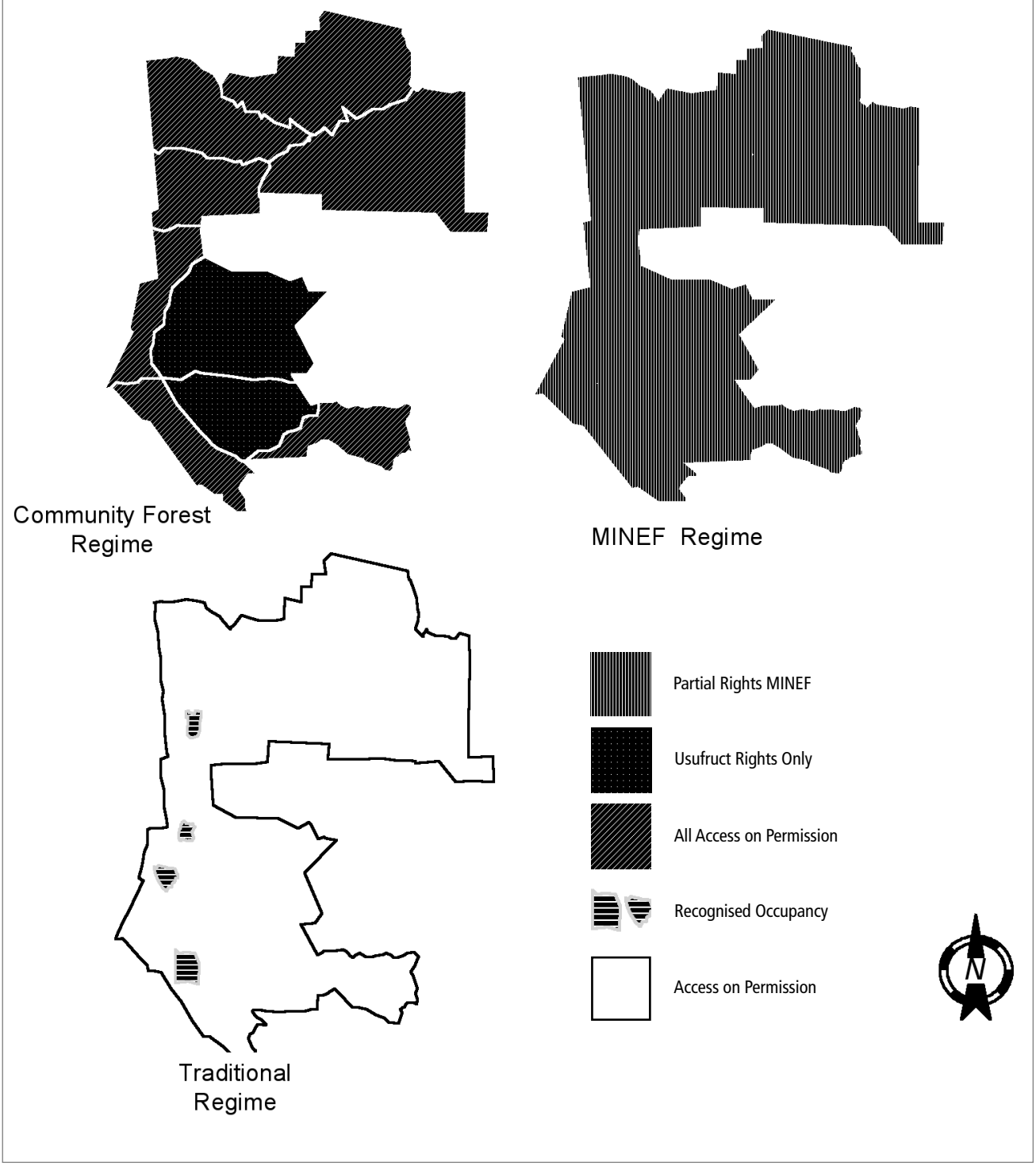
In Cameroon, following the 1974 land ordinances all forest areas without statutory titles are 'communal' and therefore subject to local traditional resource rights regimes. These forest areas fall under the recognised sovereignty of community chiefs who have certain political and legal, as well as attested ritual powers over it.

We asked the Bimbia Bonadikombo community to participate because of their previous experience in using PGIS methods. They were interested and willing to participate.

The first step was to find out detailed information on LSK through a combination of oral history, historical timelines and

[1] Until 2004, since this study, MINFOF was known as MINEF (Ministry of Environment and Forests.

Figure 2: Prevailing resource use regimes in Bimbia Bonadikombo



sketch mapping in focused group discussions. This took approximately three months. Examples of focus groups discussions included traditional land tenure access rights and farmer access rights and responsibilities. The elderly also discussed the historical evolution of forest tenure and user rights. Table 1 summarises the process in terms of the phases and the tools, actors, outputs and the degree of participation elicited. The GPS training took two days and the GPS field surveys were spread over three weeks. All GIS maps (e.g. Figure 2) in the process were produced outside the community and brought back for validation because GIS facilities were not available in the community.

The process was facilitated by one of the authors, a research assistant and the community forest manager. We coordinated the planning, advised on the tools to be used, provided GPS devices and working material, and helped to ensure full participant involvement in the sessions. We worked with the forest management council to choose the participants. Each village and user group representative in the forest management council worked with their village or group to identify participants for each activity.

Results and discussion

What were the main results?

Figure 2 shows land/forest use and control rights as viewed by the three key groups of forest stakeholders. The maps resulted from the PGIS process described in Table 1. It presents various interpretations of tenure rights as seen by local MINFOF staff, the community forest management council and the traditional authorities (chiefs).

The community forest management regime shows two types of area. One is for conservation purposes, which is only open for usufruct rights (basic collection and gathering for subsistence purposes). The remaining areas are for access for logging, farming (not more than 1 ha per person) and agroforestry activities that can be carried out with permission from the community forest management council.

MINFOF staff argue that the management council and local ministry staff should issue all forest use permits jointly. But the community forest management council believes that the Manual of Procedures and Norms for the management of community forests gives them full control and management authority over the forest.

The traditional regime shows that a few farms and other forms of occupancy within the community forests are illegal. The chiefs argue that access rights to the use of forest land for either agriculture or collection must be subject to traditional procedure, usually:

- firstly, by virtue of first occupation for very old family lineages;
- secondly, by community members by birth, marriage or co-optation following local access practice through family lineage, elders or traditional councils; and
- thirdly, strangers or non-natives can pay tribute to the rulers to be granted usufruct.

"This approach could help in terms of creating more reliable data outputs, and encouraging capacity building and learning processes"

We can see on this basis that chiefs recognise some patches of forest areas as legally occupied. When we compare these results to the community forest regime map, we see that various uses are permitted in almost half the forest area, but this implies that hundreds of farmers currently using the forest are considered illegal as they do not have permission from the community chiefs to use the land.

These results explain current conflicts experienced in community forest management as well as poor farmer adherence to agreed rules. As a result, a negotiation process for joint issuance of permits between the forest management council and community chiefs is now ongoing. A farmer education programme and a conflict management mechanism are also planned in view of the first five-year review of the community forest management plan in mid-2007.

Has this approach added value to the data?

We compared three characteristics of the community data on land use, before and after the study, to investigate whether the form, content, and quality of the data were more likely to be acceptable for CDM project requirements.

Form

The main contribution of PGIS to local knowledge in this study was the transformation of local knowledge into digital map formats. Information on land use history and tenure rights was previously in unconsolidated written and oral forms. This means that the results can now be documented, and also shared more widely using digital media.

Content

Communities were able to include local place and stream names, footpaths, village boundaries and other features not previously included in official maps. For example, the evalu-

ation raised community concerns on the omission of local information such as caves and mangroves they thought had ecotourism potential. PGIS introduces the advantage of easy updates for omitted items.

Figure 2 shows diverse tenure rights perspectives that had never been seen before. This approach shows overlaps and conflicts between these stakeholders in a new way. The information will be used to commence a conflict management process as communities can identify with the results.

Quality

Though products from the study showed better or improved representation of community knowledge than any existing maps, PGIS could not completely resolve the representation of fuzzy land rights issues such as inheritance and power over resource use rights. Figure 2 does not show us how much power each stakeholder wields or how power is shared. We also found that there is confidential and sensitive information such as hereditary rights that cannot easily be captured in spatial format. So mapping alone is not sufficient for representing all the dimensions of land rights. One way of solving this would be to use linked text files to map objects such as land parcels explaining these resource rights and storing them in protected layers accessible only to designated persons or with permission, as suggested in Harmsworth (1998).

Has this approach been an example of good practice?

We examined the relevance, equity, participation, learning and facilitation aspects of the process, to evaluate whether the project was an example of good PGIS practice.

Relevance

The resulting forest use rights information was found to be extremely relevant to CDM criteria, and for being able to predict the impacts on the community of implementing a CDM project. For example, the implications of duality of national vs. local forest tenure systems are serious, and the conflicts between them need to be understood. 'Communal tenure' can imply free-for-all in the minds of users who claim rights because it is national land. This has implications for leakage in carbon projects.[2] The restraining management measures that result from carbon projects like the CDM being adopted could lead to users relocating to other areas they deem 'communal'. This would mean that carbon sequestered, or emissions avoided, by the project would be 'leaked' or lost elsewhere and would be untraceable.

[2] 'Leakage' is a CDM requirement that any decrease or increase in carbon benefits outside the project accounting boundary as a result of carbon project activities must be accounted for.

Equity

Another implication could be on equity. Most farmers have failed to pay a registration fee of about 2000 FCFA (US$4) to the Bimbia Bonadikombo Forest Management Council. This is because they think traditional authorities consider them 'illegal occupants' of their land and so could impose prohibitive occupancy charges once they have registered. In the case where these many farmers who are considered illegal do not receive any share of the carbon benefits there would be serious consequences for their livelihoods. This could instigate forest users to rebel against the project, leading to project failure. It is necessary to develop a benefit sharing mechanism in which all would participate in order to have everyone feel secure and motivated.

Participation

Although the original project aimed to implement an effective, participatory process, the main problems found in ensuring proper participation were:

- the insufficient number of women included in the process; and
- it was difficult to bring together older persons in peri-urban Bimbia Bonadikombo.

Despite their predominant role in forest product harvesting, women were reluctant to participate in the study partly because they were very busy at that time of year. Assembling older persons in Bimbia was difficult due to their dispersion and their varied occupations. This made some group discussions irrelevant since elderly participants are critical for discussing history of land use and tenure rights. To overcome this, more individual interviews of women and older people were done in a bid to complete and triangulate the necessary information. For similar projects, it would be important to take this factor into consideration at the start of the process.

Learning

An important process benefit for communities is their acknowledgement of knowledge sharing on the history of land use and tenure rights. Many group members, especially the young, mentioned that the process had enabled them to learn from the old, meanwhile the old who could not go to the forest anymore were amazed and alarmed at the forest changes especially the extent of deforestation. The PGIS process reinforces and enhances local knowledge analysis and transfer.

Conclusion

Our experience suggests that using PGIS with communities can add value to local knowledge in support of the Clean Development Mechanism. This approach could help in terms of creating more reliable data outputs, and encouraging capacity building and learning processes, especially in analysing critical CDM criteria such as leakage, risk of project failure, and sustainable development impacts.

The study showed that the current land and forest use rights system in Bimbia Bonadikombo could hamper community participation in carbon management and forest management participation in general. Most users of the forest are considered illegal and hence would not be considered direct benefactors from Carbon credits. This may be a demotivating factor for forest users.

However, we did learn that:

- Participatory mapping (notably in two dimensions) would have to be used alongside other more discursive tools and techniques in order to adequately represent power and inheritance dimensions of land/forest tenure rights;
- Facilitation needs to be more persistent in aspects relating to the involvement of women and the elderly in such processes to enable contribution to learning, empowerment and equity; and,
- That if PGIS facilitation focuses on the who, what, why, where and when issues of participation – rather than having precise maps of land and resource rights – it is more likely to better enhance local knowledge to be used for CDM purposes and for resource management in general.

More importantly, our experience showed that there is great potential in the use of PGIS for the purposes of enhancing local knowledge use. The approach is worth replicating and we hope to learn more as the body of knowledge grows with many more experiences.

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theme section

THEORY AND REFLECTIONS FROM PRACTICE