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A Public Participation GIS for Community Forestry User Groups in Nepal: Putting People Before the Technology

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Abstract
A Public Participation GIS (PPGIS) was developed, applied and evaluated to determine its potential to assist village communities in the management of their communal forest resources in the mountains of Nepal. It was successful in involving the community in determining their information needs, collecting data, obtaining resource information and forest management decision making. During the evaluation of the PPGIS it was found that for developmental work the emphasis needs to be firmly on participatory rather than technical issues when developing the PPGIS. This rarely occurs in practice and can be a limiting factor on the effectiveness of GIS as a participatory tool. An argument is presented that in a developmental context PPGIS should be viewed primarily as a consultative, participatory methodology rather than a predominantly technological aid.

Introduction
Community Forestry is one form of 'social' forestry that has its roots in the change in development theory from industrial forestry, based on the Northern European macro-economic model (Van Gelder and Keefe, 1995), towards local level forestry geared towards the subsistence needs of local communities. It has been said that community forestry has more to do with people than trees (Gilmour and Fisher, 1989), and this has been reflected in an approach traditionally dominated by the social sciences. Participatory techniques have been the primary tool for obtaining community and resource information,

and participation, empowerment and facilitation of the Forest User Group (FUG, a village based forest management committee) the main objectives.

Increasingly there has been a need for obtaining more quantitative information for forest management purposes. There are a number of reasons for this, principally:

- to assess responsible (' sustainable') forest management
- to allow a sustainable yield of timber to be calculated
- for local specific needs
- to examine tenure rights and rights to resources
- for conflict resolution purposes
- for compensation claims
- for monitoring biodiversity
- to meet the requirements of other International agreements
- for identifying potential economically viable Non Timber Forest Products (NTFP' s)

These resource assessment information needs do not replace the need for social information, but extend the range of information that has to be collected, analysed, and collated. Much of this information has a quantitative spatial component, and GIS has been increasingly used for data management and analysis.

The normal developmental approach has been to keep qualitative and quantitative data collection and management separate. This may be due to the different disciplines they are associated with: social scientists have continued to conduct the participatory information gathering and analysis, whilst colleagues from the natural sciences and IT have managed the quantitative information.

A general observation can also be made regarding scale. Local level studies use participatory techniques and work closely with FUG' s, whilst District or National level studies use secondary data sources, commonly entered into a GIS with little or no ground truthing.

District or National level studies often map socio-economic indicators, commonly called ' indicators of development' , although the people targeted for the development process are entirely unaware of these indicators. Indicators are used for policy planning to identify both development priorities and geographic regions of activity. Therefore the ' developmental' role of GIS is often one of disempowerment of local people, involving a very low level of participation. It encourages the separation of the planning process from the people affected. There is little or no discussion with FUG' s and other villagers regarding what information would be useful to them, and what information a GIS could provide. The GIS information is not *meant* for them. It is for the policy makers, planners and researchers.

The most charitable way of looking at this lack of participation associated with the traditional use of GIS in development work is to view GIS as enabling decision makers to correctly evaluate the required development input. But this is *putting the technology before the people*. Whilst it appears that GIS is being used for classic decision support purposes, the

decision making process itself is fundamentally flawed. There is little or no consultative process with communities. Their needs have not been identified, and the information gathered does not reflect their requirements. The old top-down development paradigm is being actively encouraged (Hobley, 1996).

Background

Although it is technically and organisationally possible to integrate much participatory information into a GIS, this has seldom been attempted in development work, with a limited number of applications. The lack of use of GIS for local level needs when compared to National or regional use has been commented on (Haase, 1992; Simonett, 1992; Carter, 1996). This may be due to social scientist's mistrust of GIS technologists, who often have a simplistic understanding of the complexity of community forest resource management, coupled with their scepticism of a technology that is both centralising and based on logical, deductive and empirical principles (Hutchinson and Toledano, 1993). Much other work that could be expected to have an element of participatory research relies on secondary data sources. This is true of most socio-economic research associated with natural resource management (Fowler and Barnes, 1992; Daplyn *et. al.*, 1994; ICIMOD, 1996). An observation made nearly a decade ago for developmental work in sub-Saharan Africa still holds true today; most GIS applications are driven by a desire to demonstrate the technological capability rather than a desire for real life problem solving (Falloux, 1989).

There are a limited number of examples of GIS being used as a public participatory tool for community forest management. The Kayan Mentarang Nature Reserve Project in East Kalimantan combined oral histories, sketch maps, GPS and GIS for customary land-use mapping (Stockdale and Ambrose, 1996; Sirait *et al.*, 1994). It was noted that a constraint was the ability of social scientists and map-makers to accurately capture and portray the complex relationships of traditional resource management systems. Work in north west Zambia by Jordan and DeWitt (SNV, 1996) incorporated RRA techniques to determine where villagers collected constructional timber, a participatory inventory to determine resource quality, and a GIS database for analysing this information and determining whether sustained yield management was being practised. Whilst this proved to be an effective management tool for examining village level forest resource utilisation patterns by local communities it is felt that the participatory element of this work could have been increased, as decision making was largely the task of 'outsiders'.

The Study

PPGIS in the field of community forest management is still in its infancy, and many issues still need identifying and evaluating. It was with this background that a study was initiated in Nepal, with the aims of assessing the applicability and relevance of a PPGIS in this context. The initial objectives were to:

- identify stakeholder information needs. This uses the classic Rapid Rural Appraisal (RRA) techniques of focus groups, semi-structured interviews, group walks and participatory mapping.
- obtain the necessary information using general participatory techniques, geomatics techniques (participatory photo mapping, GPS), and participatory inventory techniques.

- analyse information and present it in a format and language that is appropriate for FUG's.
- Feed it back to FUG's and determine the usefulness of the information to them.
- examine the potential and problems of the PPGIS as an empowerment tool for FUG's.

However, as the study progressed it became apparent that a more process orientated approach was necessary. The focus shifted towards examining a systematic approach for participatory forest management combining the collection of quantitative, objective information and qualitative, subjective information, in a way that was beneficial for the FUG.

The Study Area

The study was conducted in the Yarsha Khola watershed, Dolakha District of Nepal. It is an area of the high mountains of Nepal, and the watershed varies in altitude from *ca.* 1000 - 3000m. This a predominantly rural economy, with some extra income earned from working in the tourist industry in Kathmandu, a day away by bus. There are a variety of ethnic groups, including Brahmins and Chettri in the lower altitudes and Sherpas at higher levels. Community forestry is an important component of an integrated farming system, with the majority of animals being stall fed, fodder and bedding coming from forest products. Dung is used to fertilise terraced fields for intensive crop production. There is great interest in community forestry at a village level, and the FUG has an important role to play. A FUG is a representative body from a village, which includes all forest users of a community forest. It has a committee which liaises closely with the local forest ranger and the District Forest Officer (DFO), both from the Nepalese Department of Forests. The FUG has to demonstrate a capacity to conduct forestry operations in order for the DFO to authorise forest management practices. A limiting factor for the FUG is the availability of management information about the forest, and spatial information on the extent of the resource. Hence the potential of PPGIS for empowering the FUG.

Methods

The methodology employed is outlined in Figure 1. It is interdisciplinary in its approach, combining the use of social science participatory techniques with geomatics technology and participatory assessment procedures. The methodology is on the interface between social approaches to community forestry and more traditional quantitative techniques to resource assessment. This is regarded as essential owing to the increasingly demanding and diverse information needs for community forestry in Nepal outlined in the introduction. It should be noted that a greater emphasis is placed on the means of collecting and disseminating information than the technical design of the GIS database, as it believed that a PPGIS is fundamentally dependent on obtaining community needs, perceptions and ideas. Indeed, it will be seen from Figure 1 that the role of GIS in its traditional capacity for data input, storage, retrieval, transformation and display (Burrough, 1986; Grimshaw, 1994) is limited, and the other aspects of an information system, namely planning, user need identification, data collection and information feedback are of equal importance.

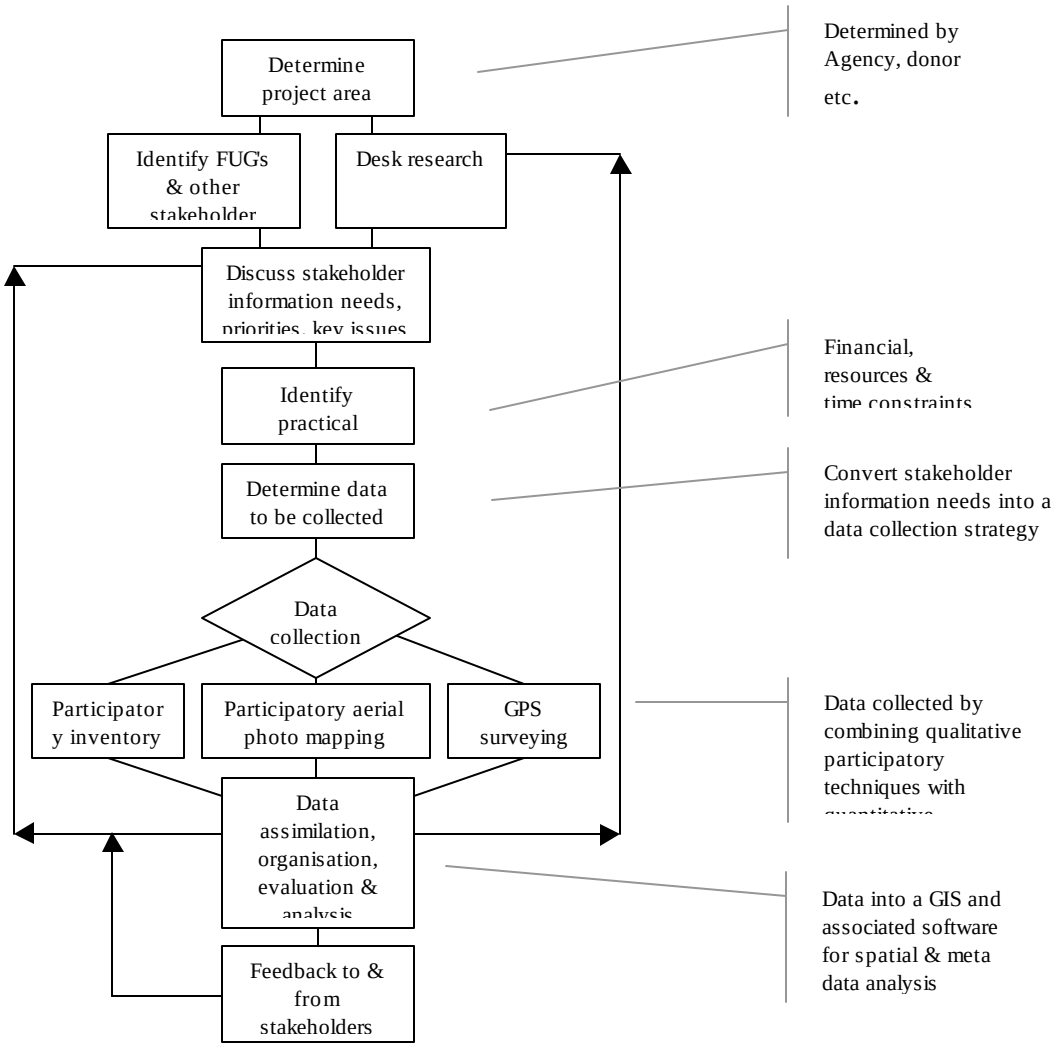

Figure 1. A systematic methodology for a community forestry PPGIS

It should also be noted that as well as examining the information needs of the FUG this work also looks at the information needs of other stakeholder groups, including the District Forest Office, National policy makers, and international monitoring organisations. The PPGIS is designed to provide information to all these diverse stakeholders, at an appropriate level. This is an additional attribute of GIS; it allows the information to be effectively stored, analysed and prepared for dissemination in a means appropriate for each stakeholder group.

The above methodological framework was trialed with five FUG's from October 1997 to May 1998. Owing to the participatory nature of the work the exact methodology varied between FUG's, although the approach outlined above was followed. The initial participatory session with the FUG examined their specific requirements. These ranged from maps of the community forest for boundary dispute issues to inventory information to assist them in planning sustained yield harvesting for commercial purposes. Additionally, FUG's sometimes requested information on the sustained yield of fodder (grass, leaves and shrubs for stall-fed livestock), when they could start removing fuelwood, and the general condition of their forest. This information was requested to enable the FUG to utilise their forests more intensively. Contrary to popular opinion, community forests in Nepal are usually managed in

a very conservative manner. The information requirements were usually a combination of basic spatial information and management information; how best to manage their resource. This is where a combination of quantitative and qualitative information is essential. It is impossible to offer useful management advice without understanding the FUG's requirements and usage patterns. Once the information needs of the FUG were established the data collection process was developed. This was based around a participatory forest resource assessment, designed as a multi-resource inventory to meet the information requirements of all stakeholders (Lund, 1998). The resource assessment procedure contained one or more of the following elements: a participatory photo mapping session, a participatory inventory (always conducted) and a GPS survey of internal and external boundaries. The specific procedure adopted with each FUG depended on information needs, availability of aerial photographs and terrain considerations. Of these methods, perhaps the least known is participatory photo-mapping. This is similar in philosophy to participatory sketch-mapping (Messerschmidt, 1995), but uses a large scale aerial photograph as a participatory tool (Fox, 1986; Jordan and Shrestha, 1998; Mather, 1998). This has the participatory advantages of sketch-mapping, but greatly increases the spatial accuracy of information obtained. It should also be noted that the participatory inventory was designed so that the FUG could undertake all activities, and the inventory was also a training exercise, enabling the FUG members to conduct inventory work themselves with minimal assistance.

Once the information was gathered it was organised using a GIS and other basic software. Descriptive information obtained from the participatory research, such as indigenous management, FUG requirements and problems was recorded. Inventory information was entered into a database, and the spatial information was entered into a GIS (IDRISI). This can be regarded as the information management component of the participatory information system.

Discussion

The PPGIS is now functional as a basic pilot version. For a given FUG it has a georeferenced boundary of the community forest, with the area of the forest (something that is in itself often unavailable for community forests), internal community designated boundaries, and associated basic information, such as key species. Files can be called up for each internal compartment that have information on the sustained yield, recommended management practices, community uses and importance of spatial sectors of the resource for the community. Additionally the raw inventory data is available for researchers and policy makers who wish to examine biodiversity issues, slope angles or other issues. At present the PPGIS is clumsy, involving non-integrated software packages, and interfaces need developing. For the FUG's who have no access to IT, the appropriate images and management information can be used to form the basis of a visual report which the FUG committee can use for its forest management. Initial work indicates that FUG's appreciate the maps as a tool they perceive can help them in their negotiations with the Forestry Department. Inventory information is converted into basic management information to allow the FUG to participate in discussions with the forest ranger and DFO, regarding forest management, which the FUG's also felt was useful. The feedback is of critical importance: a PPGIS is there for its users, the participants. Some stakeholder groups have been very

satisfied with its role, but the evaluation process is not yet complete. It should be noted that although the initial evaluation was based on the ability to produce and organise data for FUG use, this is only one benefit. The participatory work involved in community consultation, obtaining resource information, and the feedback meetings gave the FUG a sense of ownership and involvement with the process. This acted as an agent of empowerment, raising community expectations of what the FUG and individuals could achieve. These 'social' processes are felt to be of great importance, and should not be ignored by concentrating solely on the technical performance of the PPGIS. Evaluation issues for PPGIS are discussed in more detail below.

The initial objectives of this study have been satisfactorily met, and initial evaluation of the PPGIS indicates that it is an appropriate and beneficial tool for providing stakeholders with information regarding community forest management issues in Nepal. While this does support the validity of PPGIS in this context, a number of further additional issues have been raised that need both discussing and further evaluation.

PPGIS as a process

Whilst a PPGIS can produce information that is useful for the FUG, it can be viewed as extractive in nature, rather than achieving the Participatory Rural Appraisal (PRA) goal of utilising local peoples analytical capabilities as well as their knowledge base (Chambers, 1994). This may seem academic, but it is important to note that any technology which requires data to be taken away for analysis rather than encouraging people to undertake their own investigations and analysis limits participation to some extent. This ties in with the consideration of whether GIS is appropriate technology for participatory development work, where access to GIS is severely limited. Does the use of GIS encourage an alienation between participants and their information? Does it remove them from much of the decision making process? If GIS is viewed as software and hardware, this could be a valid interpretation. But it is felt that a PPGIS should be a *process*; it starts with the public participation procedure and intrinsically involves feedback to, and from, the FUG. Decision making should not be made centrally, the PPGIS should be a decision support tool for the FUG, providing information they can use for their management decisions. Although the software and decision analysis processes are outside of the sphere of access of the FUG's, with associated problems (Harris *et al.*, 1995), it can be argued that the decision making process can be brought back to the FUG. This is a central issue in making a PPGIS genuinely people orientated.

Representing village level reality

There can be a loss of detail when entering descriptive information obtained by participatory methods into a GIS. Qualitative information is not easily entered into a GIS, and the rich social, economic and environmental fabric of resource management at a village level is impossible to replicate. A people orientated PPGIS must have a capability for storing some of this descriptive information. This may not just be as textual and diagrammatic information, multimedia offers a variety of interesting ways to represent this more realistically. But it is important to realise that all the information will still not be obtained. What is necessary is to involve local people and incorporate their knowledge and decision making into the PPGIS.

The task is not to capture and replicate all the village information, but to organise and present pertinent information that was not previously available, using the technological capability of GIS, to assist the FUG in their decision making.

The need for participation

It is felt that a fundamental requirement for the use of PPGIS is having the emphasis on participation. This has been mentioned in the introduction, but this work illustrated the importance of this. GIS is a useful tool for enabling the participation and empowerment of FUG's, through providing them with increased information for decision making, but only if it is geared to their needs. The technical performance of the GIS, spatial accuracy and quality of output are all secondary to the need for a participatory approach. This can easily be forgotten, particularly as this is a reversal of the traditional GIS priorities.

All the discussion points converge with the need to view a PPGIS as a systems based process. The focus is on participation. Although the system will vary greatly from situation to situation, it should be based around identifying user information needs, and providing this information to support decision making. Figure 1 indicates a workable system, but it should be noted that as this worked progressed, the emphasis switched from the technological considerations towards participatory issues. This is where the emphasis must be for development work.

Evaluating a PPGIS

The discussion above partly focuses on the evaluation of the PPGIS, and many of the issues discussed implicitly suggest a need for evaluation. The evaluation conducted during this research mainly involved feedback from stakeholder groups and technical issues relating to data quality. Whilst this represents an example of current best practice (Kwaku Kyem, in press), it is felt that further work needs to be conducted in this area. PPGIS evaluation in general is not conducted with enough rigour. Without detailed systematic evaluation PPGIS could easily fall into the trap of combining sloppy GIS practices with sloppy social science.

The thorough evaluation of a PPGIS is complex. The PPGIS has to be examined both as a systems based process, and in terms of the information utilised and generated by it. Whilst the emphasis should be on participation and the process, data issues also need considering. Areas that require consideration during the evaluation are presented in Table 1 below.

Table 1: Evaluation areas for a PPGIS

PPGIS Data Issues:	**Means of Evaluation:**
Spatial accuracy	Spatial statistics
Relevance of data	Stakeholder feedback meetings
Quality issues	Data assessment
Error budgets & sources	Statistical analysis, data assessment
PPGIS Process Issues:	
Level of participation (at each stage of process)	RRA, PRA & social science techniques
Stakeholder satisfaction	Stakeholder feedback meetings Examine usage of data provided by PPGIS
Ability to produce & organise data for stakeholder use	Examine usage of data provided by PPGIS
Assessment of long-term empowerment	RRA, PRA & social science techniques Examine outcomes of meetings/discussions using provided data
Assess how stakeholder expectations have been raised	Stakeholder feedback meetings Examine outcomes of meetings/discussions using provided data
Value of GIS to the process	Cost benefit analysis of the added value contributed by using GIS
Overall value of PPGIS	Social cost-benefit analysis

Conclusions

In general it appears that PPGIS is an appropriate and advantageous tool for community forestry in Nepal, and should have much wider applications in participatory development work. It has a number of distinct advantages over more traditional approaches to this type of complex management issue:

- if it is viewed as a participatory process it can empower the FUG by involving them in the decision-making process, and raise their expectations of information availability for them
- it can be used to effectively combine quantitative and qualitative approaches to community forestry, and rural development in general
- maps, resource management information and other spatial data can be given to an FUG to aid with their decision making and negotiations without the need for them to have access to a GIS
- information can be easily collated, analysed and returned to stakeholders

- the appropriate level of information can be returned to stakeholders

However, the technology does have the potential to assist extractive collection of information, and GIS can disempower disadvantaged groups, and further distance them from the decision making process. It was found that the emphasis had to be firmly on participation rather than technical issues, and a system based approach that actively encouraged participation was found to be the key requirement for a useful PPGIS.

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