5

Participatory GIS: opportunity or oxymoron?

Jo Abbot, Robert Chambers, Christine Dunn, Trevor Harris, Emmanuel de Merode, Gina Porter, Janet Townsend and Daniel Weiner

• Introduction

In January 1998, a group of 35 researchers and practitioners met at the University of Durham for a workshop to discuss participatory research and the potential for participatory Geographic Information Systems (GIS). The workshop drew on experiences with participatory GIS in South Africa and on participatory approaches to the management of the coastal zone ecosystem in Ghana. The objective of the workshop was to identify the benefits and problems of a participatory GIS approach.

In this article, we share some of the workshop findings and hope to stimulate debate about the potential, but also the pitfalls, of attempts to integrate GIS and participation. We start by briefly describing GIS and participatory GIS, including a case study of what has been achieved in South Africa through combining land survey maps with mental maps generated by local communities. We then describe the complementarity between GIS and PRA and discuss some of the emerging opportunities and challenges. We conclude by sharing the debates that were raised in the workshop and include a checklist for practitioners to consider before embarking upon participatory GIS.

• What is GIS?

A GIS is a computer-based technology increasingly used in planning, resource management, optimal siting studies, marketing, and numerous other activities which involve map-making. However, unlike mapping software which only draws maps, GIS enable complex spatial analysis.

GIS comprise several components. One component brings geographical data into the GIS, either from remote sensing sources, ordinary printed or digital maps, or field reports, and converts those data into computer-readable form. Secondly, a GIS incorporates a database which allows the data to be manipulated and managed. A third component of GIS comprises the ability to bring together selected themes or 'layers' of data and perform a number of spatial analytical operations. Finally, the results from analysing data in a GIS are disseminated in a number of ways, but most commonly in map form. The very rapid diffusion of the technology has arisen because of the need to handle information that is geographical, that is, it is or could be mapped.

• Participatory GIS

As GIS becomes widely used in spatial decision-making, there is concern that top-down development planning will be reinforced. This is because GIS hardware, software, and data are expensive, require a high level of technical expertise, and are usually seen as 'expert' systems. Participatory GIS is, therefore, an attempt to utilise GIS technology in the context of the needs and capabilities of communities that will be involved with, and affected by, development projects and programmes.

Participatory GIS draws on the diversity of experiences associated with 'participatory development' and involves communities in the production of GIS data and spatial decision-making. For example, local people could interpret output from a GIS or contribute to it, such as by integrating participatory mapping information to modify or update a GIS. Capturing local knowledge and combining it with more traditional spatial information is, therefore, a central objective (see Box 1 and Figure 1).

Through the use of participatory GIS, it is expected that community involvement in development projects will be enhanced. This requires structures and procedures within planning agencies, NG0s and the private sector that facilitate GIS production and use which are community-based and not elitist. To achieve such a goal, participatory GIS methodologies need to be established and field-tested. It is important that participatory GIS builds upon the successes of existing participatory development concepts and methods.

BOX 1

THE KIEPERSOL PROJECT

Kiepersol is a locality in the Mpumalanga Province of South Africa and is the location of an experimental participatory GIS project. The area exhibits significant social and ecological variation, has a long history of contested resources and forced removals, and the demand for land and agrarian reform is high. The initial phase of the project involved 'capturing' local knowledge through the production of mental maps and the integration of that knowledge with traditional spatial information within a GIS. The mental maps were produced from a series of participatory workshops involving residents of the former KaNgwane 'homeland' (see Figure 1). The integration of 'local' with 'expert' knowledge raised four broad sets of issues:

1. *The historical geography of forced removals:* Using data obtained from oral histories, aerial photography, and satellite imagery, we are recording the historical geography of forced removals and information on past farming systems. Together these data provide complementary images of changing local apartheid geographies and an understanding of contemporary natural resource struggles and land restitution demands.
2. *Defining agro-ecological potential:* Overlays of official land type data and local knowledge about soils indicate conflicting representations of land potential. These discordant understandings are a product of scale, the multiple meanings of agro-ecological potential, and differing farming systems. We were able to make maps of the area from these different perspectives which could help groups understand each other better.
3. *The politics of land, water, and biomass access:* The Kiepersol participatory GIS demonstrates that proximity should not be confused with access. For example, differential access to river water and changes in the boundary of the Kruger National Park were identified as significant issues which the traditional GIS obscured.
4. *Developing policies for socially appropriate land use:* The GIS incorporates community ideas about spatial transformation and supports a more democratic land use planning process.

Source: Weiner et al. 1995

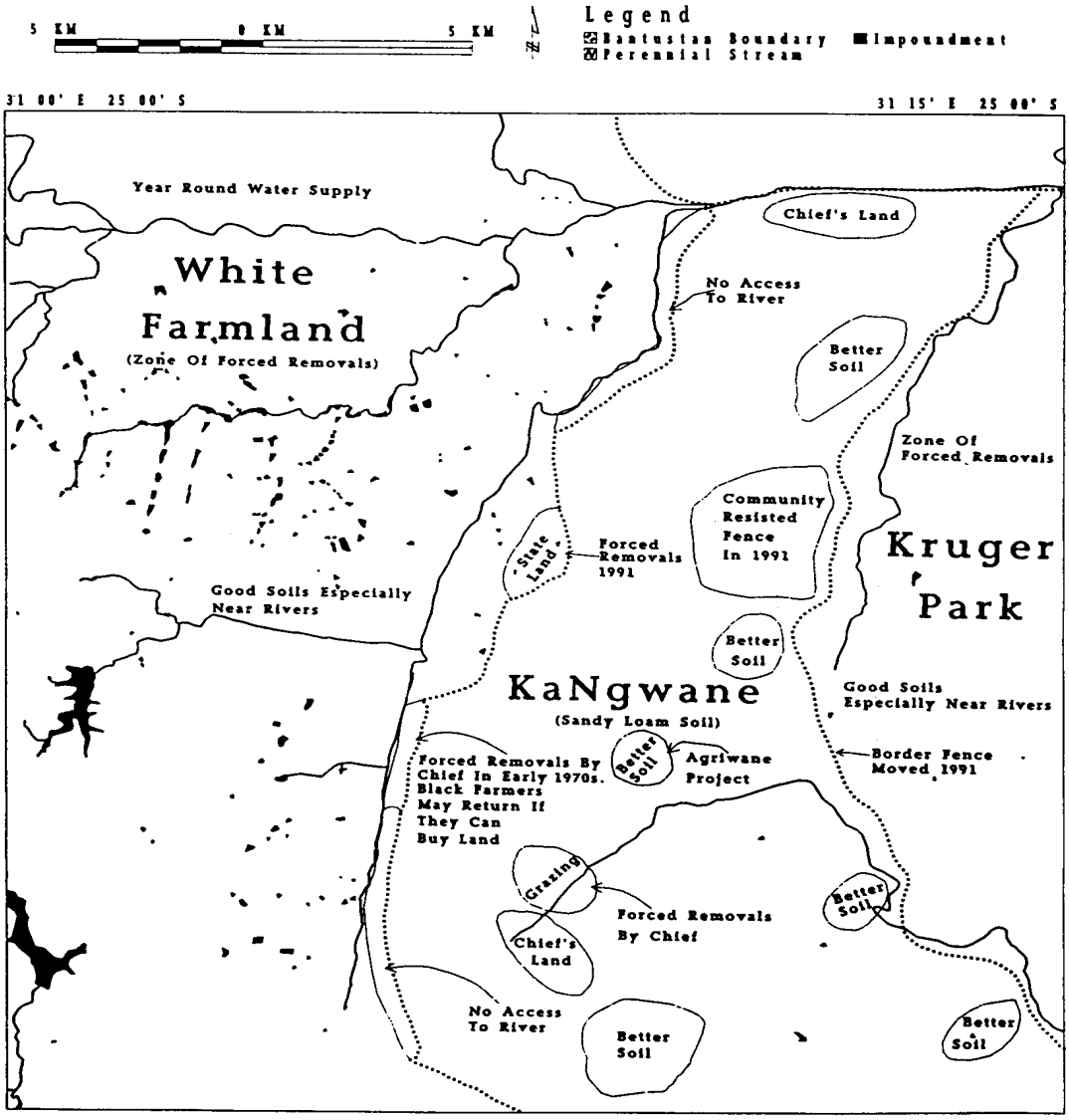

Figure 1. Integration of local knowlege with spatial information.

- **Commonality and complementarity**

The Durham workshop arose from a desire to explore the opportunities and constraints of a participatory GIS in more depth. The workshop drew on the University of Durham's work in Ghana, where there is considerable interest and capability in GIS, as Jacob Gyamfi-Aidoo illustrated at the workshop. At the same time, the Ghanaian government is committed to popular participation in planning and is currently undergoing a decentralisation exercise. Thus, the possibility of developing some kind of participatory GIS is attractive to government institutions. But the challenge is to build a participatory GIS which is user-friendly and inexpensive so that it is accessible to local people at district level.

The combining of participatory approaches with other methodologies is not new. As the use of participatory approaches has expanded, practitioners have realised both their potential, and some of their limitations. This has encouraged experimentation and the sharing of principles and methods between disciplines, as was explored in PLA Notes 28.

An area of commonality between a map generated through GIS and a PRA

diagram is that they both provide visual information in a way that is intuitive to the people who have created them. The challenge for integrating them is whether common ground can be found, such that each group can first understand and secondly develop in a meaningful way the data generated by the other group. If this can be achieved, then GIS has the potential to complement PRA in the following ways:

Scaling up

One of the challenges of participatory approaches is how to scale them up to show local concerns as well as broad regional or national perspectives. GIS provides the potential for local level PRA to be integrated at a regional or state level, which means that, under a system of decentralised administration, local priorities can be developed into regional plans. This could result in a more integrated approach to needs assessment and service delivery, as local-level priorities become shared knowledge, rather than the more exclusive product of dialogue between an intervention agency and a community. However, there are also risks to local knowledge becoming recorded and centralised (see below).

Legitimacy and advocacy

One force behind the growth of GIS has been its use as a policy tool, through the new access it gives to use and manipulate quantitative and qualitative data. So far this access has been limited to a number of high-level decision-makers. A question now is whether GIS can give similar access to local people, empowering them to influence policy decisions through owning and using the data.

An advantage of GIS information is that it can be presented to policy-makers in a form and at a scale which they find credible and usable. In contrast, they may have difficulty with the richness of local detail generated through PRA. The challenge is to combine the realities and detail expressed locally through PRA with the precision and scale of GIS. The question then is whether such a 'participatory GIS' would simply be extractive, or whether it could empower local voices to more effectively influence policy.

• Opportunities and challenges

GIS, like PRA, is only as good as the local politics. Whose interests are considered in local policy? Who owns the information and decides what is important? What are the goals of local politicians, experts and bureaucrats? Politics is important as it determines the extent to which people trust their local and national government. To get public services, schools, post, transport, health services, clean water, you need to be on the map. But the map also tells state authorities where you are, which may not be so attractive.

Jon Duncan, a civil engineer from Cape Town, provided a fine example at the workshop. Local people in Isthumba Village, near Durban, South Africa, helped him build a GIS of their area, marking the scattered houses, people and facilities. Before the GIS was finished, there was a police raid on Isthumba, and people wanted to know how the police knew how to find them. Presumably the answer was a local informer, because the police had not seen the GIS. But this highlights the problem: a PRA or a GIS turns local knowledge into public knowledge and out of local control. It can be used to locate resources and development needs, or merely to extract more taxes and to increase control from the outside. The people of Isthumba village used the GIS to get latrines and a postal service, but they are now on the map and will have to deal, in the future, with other consequences of this.

A GIS, being more powerful than a map and easier to update, is both better and

worse. A GIS can handle an immense volume of data. While PRA can be controlled by experts against the people (Mahiri 1998), or by a powerful clique in a village or town, a GIS is even more susceptible to control by experts and by the powerful, from district officers to transnational corporations (TNCs).

Information about people is expensive to gather, so there is a dangerous temptation to do without it. But PRA can help build and update these GIS. Councillors and citizens could use the GIS for development, integrating local and outside expertise, or the GIS could be a high-tech waste of money, or another tool of repression.

A GIS can legitimate local information (which is important) and enable local people to use a modem argument, or it can legitimate bad data (which is disastrous). TNCs which sell GIS software and hardware claim that a GIS can do the planning for vou, but this is nonsense: GIS can analyse, select and display information for people to think and talk about, but, like a map, they are only as good as those who use them. Users do not need to be technical experts, but they do need to know that a GIS is good at patterns, but not at processes or relationships. Often the 'physical' information from satellites is very reliable, but the information about people is wrong or out of date.

• Workshop discussions

Presentations at the workshop showed what is achievable, although discussions, both in small groups and in larger fora, remained critical. It was clear that the invited participants were keen not to become self-congratulatory in terms of the potential benefits of participatory GIS. However, the discussion remained constructive, and addressed three main issues:

- whether a top-down technology such as GIS has a place in participatory research;
- whether a technology developed largely by commercial companies in North America and western Europe can be used appropriately in the 'South';
- how local knowledge can be integrated with, and represented in, an information system which, by definition, has traditionally rejected such knowledge in favour of spatially defined 'expert' information.

The above questions represent awkward challenges, not least, for the mainstream GIS community, many of whom would regard the theme of the workshop as a minority interest. Similarly, there is much resistance amongst the non-GIS community towards any forms of GIS. There may be common ground, however; for example, in the call for 'softer' sources of information (e.g. mental maps) to be incorporated into a GIS framework.

Small group discussion at the workshop focused on the following key questions:

- is participatory GIS achievable and in what context?
- what are the principal constraints to the development of participatory GIS?
- what role does participatory GIS have in systems research?
- where next?

Each of these is discussed below.

Is participatory GIS achievable?

The workshop discussions centred around issues of the ownership of, and access to, information and the final outputs. Participation in a GIS can operate not only at the level of producing information but also in terms of the active use of that information. By exposing alternative representations in one system, participatory GIS should

generate dialogues and stimulate reflection and debate, e.g. in relation to conflicts over the use of resources. The most appropriate participatory GIS is perhaps one which is issue- and context-driven.

What are the constraints?

Many of the identified constraints are common to both participatory GIS and conventional GIS (e.g. cost, sustainability, privacy and confidentiality, skills and training, user-friendliness, data quality, and currency and legitimisation of 'bad' data). More specific issues related to: the difficulties of capturing power relations and politics in a spatial database; integrating information derived at small scales from conventional sources with that at much larger scales from exercises such as participatory mapping, and finding an appropriate 'balance' between such widely differing types of data and information; the dangers of raising expectations for local communities; and problems in controlling the use and development of a participatory GIS, including the potential need for a gatekeeper.

What role for participatory GIS?

The key roles for participatory GIS in systems research were identified as: a means of integrating previously isolated qualitative and quantitative information sources; a potential aid to conflict resolution; and a means of consolidating and sharing ideas. In this last context, GIS provide an opportunity for interdisciplinary work which, by raising awareness across different interest groups, can avoid dangerous misrepresentations, such as using the physical environment to infer lifestyles.

Where next?

Proposals for future developments included a call for the implementation and evaluation of practical case studies of participatory GIS; development of World Wide Web-based GIS; and considering the use of participatory GIS in urban settings in the 'South'. In addition it was a potentially valuable tool for participatory research practitioners: 'GIS in participatory research' rather than 'participatory GIS'. Finally, it was felt that more thought should be given to appropriate representations of geographical information which go beyond simple two-dimensional space as found in most mapping exercises. This does not negate the value of maps per se, however, since mapping can be used to highlight the dangers of accepting 'bad' data or as a route to raising awareness of the need for political action (Kumar et al, 1997).

- ## Checklist for participatory initiatives

Before embarking on a participatory GIS, GIS professionals may find value in a basic PRA tool: participatory resource mapping (PRM), where local people make their own maps. PRM can take the form of maps made on the ground and/or redrawn on paper, or of overlays on aerial photographs. PRM has probably been practised in over 100 countries but since it is dispersed and not linked to centralised information systems, its prevalence has largely been overlooked.

Unless those who ask and answer the questions about participatory GIS have personally experienced the power of PRM, they are likely to misjudge what best to do. (When the Director of one Remote Sensing Centre was shown slides of ground and paper PRM, he asked whether it had taken one or two years to teach people to do it. In all cases, people had made the maps without help in one go).

Key questions

Before opting for a GIS, some questions to ask are:

1. Have you experienced PRM? If you have not, can you gain that experience of well-facilitated PRM before you commit to any GIS-related programme? Or failing that (but very much a second-best), consult others who do have experience?

2. Is a GIS really necessary? Would GIS add anything that cannot better be achieved through PRM?

3 Are you proposing to start with PRM or GIS? If you start with GIS, will this trap you from the outset in ways of thinking, seeing, representing which are alien to, and disempower, local people? Conversely, if you start with PRM, will you be empowering local people to express and explore their realities?

4. Who would gain and who would lose from PRM and who from GIS? To assess this:

- List stakeholders. These may include (i) local people: children, women and men, landless and landed, the better off, the poorer, pastoralists, cultivators etc. and (ii) professionals: NGO staff, government staff, technical professionals, researchers, and international donors.
- List types of gains and losses. Gains may include income (salary etc.), capital, access to and control of resources, knowledge, power, professional prestige, personal fulfilment, etc.. Losses or costs may include the personal time of local people, power through sharing knowledge, and loss of access and control.
- Draw up a matrix of stakeholders and questions and score each box, first for PRM and then for GIS. Some questions could include: Whose reality is expressed? Who is empowered / disempowered? Who gains and who loses? (see Table 1).
- Review process and practice and identify ways in which realities, power, gains and losses can be made more equitable.
- Repeatedly ask: Who participates in whose mapping? Whose knowledge, categories, perceptions and reality are expressed? What is missed (e.g. micro environments like home gardens)? Who owns the map? Where is it kept? Who has access and how? Who does not have access and why? Who understands it? Who does not understand it? Who updates it? Who uses it? For what purposes? And ask again, and again: Who is empowered, and who disempowered? Who gains and who loses?

Table 1. Suggested matrix for comparing the value of PRM and GIS to different stakeholders

	Stakeholder 1		Stakeholder 2	
	PRM	GIS	PRM	GIS
Q1				
Q2				
Q3				

• Final thoughts

Rundstrom (1995) describes GIS as G potentially toxic'. There are examples where this potential has been realised: software companies are selling GIS as a solution to low-income governments and are serving further to disempower the powerless. How far then can a participatory GIS help to bring about desirable change? (Dunn et al. 1997).

Some of the real value of a participatory GIS, or perhaps more appropriately termed community-integrated GIS' (Harris and Weiner 1998), will come if it can help to inform process and relationships, rather than simply extracting patterns from large volumes of data, which conventional GIS are best at. A more radical GIS may also alter the position of potential funding bodies who, following experiences of failed projects

where conventional GIS has been used as a quick technological 'fix', may otherwise be reluctant to provide support.

But even a GIS which allows multiple realities, and which is locally controlled, finds it difficult to handle 'tacit' indigenous knowledge, that knowledge which we all have and use but which we find difficult to describe to others, since this cannot be 'geo-referenced'.

As one participant at the workshop noted, participatory GIS do not currently exist. But they are at a stage of exploration. Workshop participants felt that much more needs to be known about achievements and limitations, as well as the conditions under which participatory GIS can produce something of value which empowers a range of stakeholders. This calls for monitoring and evaluation, specifically participatory monitoring and evaluation (see PLA Notes 31, February 1998), of what participatory GIS has achieved and an assessment of what it can and cannot deliver in the future.

- Jo Abbot, Sustainable Agriculture and Rural Livelihoods Programme c/o IIED: jo.abbot@iied.org
- Robert Chambers, Institute of Development Studies, University of Sussex, Brighton BN1 9RE, UK
- Christine Dunn, Department of Geography, University Durham, South Road, Durham DH1 3LE, UK: c.e.dunn@durham.ac.uk
- Trevor Harris, West Virginia University, Department of Geology and Geography, 425 White Hall, Morgantown WV 26506-6300, USA: tharris2@wvu.edu
- Emmanuel de Merode, Department of Anthropology, University College London WC1E 6BT, UK: e.merode@ucl.ac.uk
- Gina Porter, Centre for Overseas Research and Development, University of Durham, South Road, Durham DH1 3LE, UK: r.e.porter@durham.ac.uk
- Janet Townsend, Department of Geography, University of Durham, South Road, Durham DH1 3LE, UK: janet.townsend@durham.ac.uk
- Daniel Weiner, Office of International Programs and Department of Geology and Geography, West Virginia University, 153 Stanbury Hall, PO Box 6214, Morgantown WV 26506-6214, USA: dweiner@wvu.edu

NOTES AND ACKNOWLDGEMENT

This article primarily describes the content and outcomes of the Durham workshop. It does not, therefore, necessarily reflect the individual or collective views of the authors. Further information on the Durham workshop can be obtained by contacting Christine Dunn (contact details as above).The workshop, and the research in Ghana, was funded by the UK Department for International Development (DFID) Natural Resources Systems Programme. However, DFID can accept no responsibility for any information provided or views expressed.

REFERENCES

Dunn C E, Atkins P J, Townsend J G, 1997, 'GIS foe development: a contradiction in terms?' Area 29, 151-159

Harris, T and D. Weiner (1998). Empowerment, Marginalization and Community Integrated GIS. Cartography and Geographic Information Systems 25, 67-76

Kumar N, Raju S, Atkins P J, Townsend J G, 1997, 'Where angels fear to tread? Mapping men and women in India' Environment and Planning A 29, 2207-2215

Mahiri I 1998. Comparing transect walks with experts and local people. PLA notes 31: 4-8. IIED: London.

PLA notes 28 Methodological Complimentarity. February 1997. IIED: London.

Rundstrom, R. A. 1995. GIS, indigenous peoples, and epistemological diversity. Cartography and Geographic Information Systems 22:45-57

Weiner, D., T. A. Warner, T. M. Harris and R.M. Levin 1995. Apartheid Representations in a Digital Landscape: GIS, Remote Sensing and Local Knowledge in Kiepersol, South Africa. Cartography and Geographic Information Systems 22: 1 30-44