16 | Geographic information systems for participation

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Computer modelling is of growing importance in understanding and finding potential solutions to environmental problems ranging from global climate change to local issues of community resource use. Modelling future environments presents a particular problem: namely, how to create socially robust predictions that can also claim to be reliable knowledge about complex futures. One view is that community-inspired solutions are based upon naive etiologies while expert-led solutions are based upon more sophisticated understandings; others view citizen involvement alongside expert assessments as important but differing processes which, if brought together in the right way, can provide a more informed picture. A more open contractual arrangement of this kind between experts and citizens lies at the heart of a methodology called geographic information systems for participation (GIS-P). The early inclusion of knowledge based upon citizen expertise and the 'opening up' of the process (see Chapter 15) can add legitimacy to the reception and uptake of advice based on models and also give rise to better predictions through the widening of assumptions and data inputs upon which the modelling of different scenarios is based.

GIS-P was first used in South Africa to capture and analyse local understandings of natural resource use (Cinderby 1999). The method was then transferred to the UK where GIS-P was developed in an Economic and Social Research Council (ESRC)-funded study to produce spatial representations of local knowledge about air pollution (Yearley et al. 2003). GIS-P indicates how citizen participation in modelling future environments can contribute to the responsible governance of the environment as well as the creation of a better-informed and involved citizenry.

Previous use of GIS-P in developing countries

Use of geographic information systems (GIS) for environmental research has largely been viewed as a critical success by practitioners and their scientific peers. Spatial representation of information undoubtedly enhances precision and communication. Relevant social and cultural information has largely been excluded from environmental investigations, however, and GIS technology has justifiably been perceived as being used to reinforce top-down analyses of development issues. Thus, conventional

GIS has been guilty of not fully addressing and incorporating other bodies of knowledge, questions and experiences, and the social issues relating to these. To address the first of these criticisms, new approaches were developed integrating mental maps showing various interest groups' perceptions of their environment. Mental mapping is a process by which an individual organizes and recalls information about the attributes of their environment. The new dimension is the incorporation of this bottom-up analysis of lay citizens' understandings within the GIS database. Iterative production of citizen maps typically involves members of the local community drawing features of note in a workshop. Features selected for inclusion are dependent on the community group, with any guidance from the outside facilitator being limited to procedural issues. Once the features are produced, their meaning can be interrogated during interviews and the maps subsequently enhanced to represent any greater understanding so generated. The use of spatially referenced base data has allowed these citizen maps to be integrated into a GIS. By overlaying the maps of different interest groups, differing perceptions of the importance of resources and potential areas of conflict can be identified. Combining different perceptions allows for the investigation of the multiple realities of what is thought to be a single issue. Further, resource maps of communities may be redrawn over time to monitor changing resource perception, quality and usage.

It is also possible to incorporate conventional agency-produced information. Comparison may show broad agreement between the official assessments and that of the (often higher-resolution) knowledge of the local communities. In the Namaqualand GIS (Cinderby 1999), information on water quality produced by a hydrological surveyor was combined with information from the local community. Combining different data-sets enhanced the understanding of both the local community and the surveyor. For example, the citizen maps indicated far more water points than had been identified by the outside agency, and to what use the water was being put – information that was largely unknown to the surveyor. Data on water quality were useful to the local communities, as by highlighting where contamination was lowest the use of wells for human consumption could be reassessed and the case for better water supplies could be made more powerfully. Further, as part of the Namaqualand GIS, Landsat satellite imagery was classified to show the levels of green biomass and the types of land cover present. When these data-sets were compared to the community assessments of grazing quality, similar patterns were broadly differentiated. The village assessments, however, contained additional differentiation: areas identified as average grazing land by farmers had physical conditions that should have classified them as good grazing according to the satellite assessment, but additional factors such as wild animal attack or distance from settlement had reduced the attractiveness of the land. This type of qualitative information is usually unavailable in conventional 'expert' spatial data-sets.

The combination of existing environmental information with that obtained from the users of the resource allows greater insight into possibilities and constraints for local development. Combining these multiple viewpoints on to a common map visually increases clarity of communication and allows the potential for local groups to engage on a more level footing with outside agencies.

Current use of GIS-P in the UK

As in South Africa, GIS-P sessions in the UK are conducted by means of citizen groups convened around spatially significant science-based issues that have consequences for participants. The methodology consists of integrating a group discussion to access citizen expertise in environmental issues with a mapping exercise. This allows participants to engage collectively with and criticize different environmental models, drawing on their own local knowledge.

While social issues of democratization and increased trust, and increasing stakeholder involvement in science, are considered laudable themes, they do not necessarily build upon another important potential for increased public involvement in science: namely, enhanced data collection and improved local accuracy – that is, more reliable science. Much work in the fields of environmental policy analysis, health studies and the social studies of science supports the view that people other than official experts have insights into matters of environmental and health impacts (Forrester 1999; Irwin and Wynne 1996; Watterson 1994). Local people have knowledge about mechanisms that are unknown to official experts. This has been further demonstrated in the case of urban air pollution models, where local informants have expertise complementary to that of official modellers (Yearley 2000).

GIS-P has been used successfully in the recognition of problems and in public deliberation of potential solutions, resulting in several notable successes. The air quality management area (AQMA) of one city was chosen using a GIS-P process (Cinderby and Forrester, forthcoming). This AQMA was actually chosen over that identified by the technical modelling process (Yearley et al. 2003). GIS-P has also been used in the analysis of policies resulting from AQMA designation in two other UK cities, and the methodology is being tested further as an engagement and communication methodology in an Engineering and Physical Sciences Research