

# Community Participation and Geographic Information Systems<sup>1</sup>

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## INTRODUCTION

Geographic information systems (GIS) and geographic information technologies (GIT) are increasingly employed in research and development projects that incorporate community participation. For example, there are now applications involving indigenous natural resource mapping in arctic and tropical regions within the Americas (Marozas, 1993; Cultural Survival Quarterly, 1995; Bond, this volume). There is also a rapidly growing network of planning professionals interested in how GIS can merge with community participation in the context of neighborhood revitalization and urban planning (Aitkin and Michel, 1995; Craig and Elwood, 1998; Leitner *et al.*, this volume; Sawicki and Peterman, this volume; Talen, 1999, 2000). Environmental groups are experimenting with community GIS applications to promote environmental equity and address environmental racism (Sieber, 2000; Kellog, 1999). Furthermore, NGOs, aid organizations, and governmental agencies are linking communities with geographic information systems as they seek to promote more popular and sustainable development projects (Dunn, *et al.*, 1997; Elwood and Leitner, 1998; Gonzalez, 1995; Harris *et al.*, 1995; Hutchinson and Toledano, 1993; Jordan and Shrestha, 1998; Kwaku-Kyem, 1999; Mitchell, 1997; Obermeyer and Pinto, 1994; Rambaldi, G. and J. Callosa 2000; Weiner, *et al.*, 1995; Weiner and Harris, 1999).

Importantly, these applications have in common the linking of community participation and geographic information systems in a diversity of social and environmental contexts (Abbot, *et al.*, 1998; Harris and Weiner, 1998). They also demonstrate a variety of methodological approaches. In October 1998, an NCGIA (National Center for Geographic Information and Analysis sponsored Varenus initiative (Craig *et al.*, 1999) brought together academics and practitioners experimenting with public participation GIS (PPGIS) (see Goodchild, *et al.*, 1999 for an overview of the Varenus project). Case studies were presented that were drawn from many world regions and included applications in urban and community development, environmental management, and development planning.

This volume on *Community Participation and Geographic Information Systems* draws upon Varenus project case studies and conceptual contributions. The book situates PPGIS within the broader GIS and Society debate, and addresses six core concerns:

- differential access to geographic information and technology
- integration and representation of multiple realities of landscape within a GIS
- identification of the potential beneficiaries of participatory GIS projects

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<sup>1</sup> This position paper was rapidly compiled at the request of the Spoleto Workshop organizers. To produce the paper, we merged the introductory and concluding chapters of our forthcoming book: Craig, Harris and Weiner (eds. 2002). *Community Participation and Geographic Information Systems*. London: Taylor and Francis. For this reason, there are redundancies and awkward transitions.

- development of placed-based methodologies and methods for more inclusive community participation in spatial decision making
- situating of PPGIS production and implementation in its local political context
- identification of community GIS contributions to geography and GIScience

A key assumption of the Varenius initiative was that community-based GIS projects simultaneously promote the empowerment and marginalization of socially differentiated communities. As a result, the nature of the participatory process itself is critical for understanding who benefits from access to GIS and why. PPGIS explicitly situates GIS within participatory research and planning and, as a result, local knowledge is incorporated into GIS production and use. There are formidable social and technical challenges involved in the successful design and implementation of public participation geographic information systems. The enthusiasm for undertaking PPGIS is thereby complicated by the difficulties encountered in its implementation (Barndt, 1998).

*Community Participation and Geographic Information Systems* is intended for a broad audience of students, academics, planners, policy makers, and GIS practitioners. When reading the book, we caution that substantive GIS and Society concerns should not be ignored because of the growing fascination for developing more inclusive geographic information systems. Johnston (1999:45) argues that GIS 'usages have been subject to substantial critiques . . . and the role of GIS in creating new images of the world is increasingly appreciated . . . but the technology's positive potential has been submerged under the weight of this (usually valid) assessment of likely negative impacts.' This book and its 48 contributors suggest an alternative interpretation whereby the critique of GIS has helped to launch a flood of alternative community-based GIS applications. Indeed, we are concerned that the rapid growth of PPGIS might have the opposite effect of submerging a critical theory of geographic information systems and technology. PPGIS is not a panacea, and must not undermine the robust debate on the political economy of GIS, its epistemology, and the philosophy and practice of GIScience. Pickles (1999) and Sheppard *et al.* (1999) provide valuable overviews of these issues.

## **GIS AND COMMUNITIES**

*Community* can be defined by physical proximity to others and the sharing of common experiences and perspectives. The word has become synonymous with neighborhood, village, or town, although communities can also exist in other forms—for example, through professional, social, or spiritual relationships. Communities can thus be virtual (Kitchin, 1998; Graham, 1998). *Public participation* in this book refers to grassroots community engagement. Jane Jacobs (1961) has eloquently documented how neighborhoods attain vitality through the collective efforts of individuals who care about their common place. Castells (1983) has provided evidence that community-based action has occurred in a wide variety of cultures and is universal.

For several reasons, communities formalize themselves and create official organizations with which the state can negotiate. Participants in such organizations see opportunities to achieve individual goals through collective action (Olson 1965). Politicians are responsive to community organizations when they represent sufficient numbers of committed voters (Grant

and Omdahl, 1993). Planners in particular pay attention to public participation and community organizations (Jones, 1990) because community input is critical for defining local issues. Planners accept that community developed solutions are feasible because they tend to be reasonable, realistic, and sustainable. Public participation is important in community planning, but has been practiced in ways that range from evasion to full empowerment. This range may be seen as a ladder of increasing participation. On the lowest rung, citizens are (sometimes) provided with requested information. At the top rung, the public has a full voice in the final decision, usually through a community organization.

Geographic information systems can assist community organizations regardless of the rung they are placed on, and assist them to climb the ladder further. Better information will help develop appropriate responses, and the technology will support the creation of map products and analysis. GIS can also help a community organization climb the participation ladder, and the state may be willing to share more power with a credible partner. Similar community organizations see one organization's status grow, and are more likely to enter into collaborative efforts with them. However, even the most homogeneous community contains individuals whose goals differ from those of the group, and who may be marginalized by this process.

## **THE CONCEPTUAL ORIGINS OF PPGIS**

Although PPGIS projects are being implemented within the context of an academic debate over GIS and Society, there is also a spontaneous fusion of participatory forms of development planning with new information technologies. As a result, PPGIS has a rich and diverse conceptual history that draws upon several intellectual traditions including political economy and critical theory, participatory planning and community development, democracy and social justice, anthropology and ethnography, political ecology, and philosophies of science.

Although the GIS and Society debates emerged in the 1990s, Tomlinson had earlier recognized the importance of non-technical institutional and managerial issues in the success or failure of a GIS effort (Chorley Report, 1987), and Chrisman had provided valuable insight into the social, political, and ethical implications of GIS use (Chrisman, 1987). In the early 1990s, however, several researchers entered into a social-theoretical critique of the perceived positivism and hegemonic power relations embedded within geographic information systems (Curry, 1995; Goss, 1995; Lake, 1993; Pickles, 1991, 1995; Smith, 1992; Taylor, 1990, 1991; Taylor and Overton, 1991, 1992). Much of this concern focused on the claimed objectivity and value-neutral nature of GIS. Taylor (1990) argued that with the increasing popularity of GIS within the field of geography, 'facts' had risen to the top of the geographical agenda, accompanied by a concomitant retreat from knowledge to data. As a result, GIS was viewed as a return to empiricism and positivism (Taylor, 1990: 212). Pickles (1991) and Edney (1991) also questioned the potential anti-democratic nature of GIS brought about by differential access to data and technology, as well as the surveillance capabilities of GIS that reinforced both particular knowledge-power configurations and the technologies of normalization, knowledge engineering, and control of populations (see also Rundstrom, 1995 and Yapa, 1991). Openshaw's (1991) response captured the surprise, frustration, and anger of the GIS community to the scale and intensity of such critiques. Goodchild (1995) and

Sheppard (1995), on the other hand, acknowledged the validity of some of these critiques and offered a valuable prospective for GIS and Society research.

Building on this literature and conference discussions of these themes, a workshop sponsored by the NCGIA on 'Geographic Information and Society' was organized in 1993 at Friday Harbor by Poiker, Sheppard, Chrisman, and others. Some 23 prepared papers were discussed, and several were subsequently published in a special issue of *Cartography and Geographic Information Systems* (Sheppard and Poiker, 1995). The workshop exchanges were surprisingly positive, and laid the foundation for an ongoing dialog and research agenda that identified issues of access, ethics and values, representation, democratic practice, privacy, and confidentiality as particularly significant (Sheppard, 1995). Contemporaneously, the influential book *Ground Truth: The Social Implications of Geographic Information Systems* (Pickles, 1995) sought to capture the essence of the critique of GIS, and to build on what Pickles perceived as the 'creative tensions' between the social theory and GIS communities.

Building on the enthusiasm of the Friday Harbor meeting, the NCGIA sponsored Initiative #19: 'GIS and Society—The Social Implications of How People, Space, and Environment are Represented in GIS.' The first specialists meeting of this initiative was held in March 1996 in Minnesota (Harris and Weiner, 1996). Three broad conceptual issues were identified: the epistemologies of GIS; GIS spatial data institutions and access to information; and developing alternative GIS. Participants at the meeting questioned whether a 'bottom-up' GIS could be successfully developed, and discussed what forms this system might take. A number of other probing questions were raised, including how community participation could be incorporated into a GIS, and to what extent such participation would serve only to legitimize conventional top-down decision making. It was at this meeting that a further question was posed regarding what an alternative GIS—what became known as GIS2—might look like. It was from these reflections that the concept of public participation GIS arose. This theme was developed and the term defined at a subsequent meeting held in Orono, Maine (Shroeder, 1996). The discussion about 'alternative' types of GIS production, use, access, and representation is based on an understanding of the social impacts of existing applications of geographic information systems. Thus, it is unwise to detach the PPGIS discussion from its broader conceptual base in GIS and Society issues.

At a 1997 University Consortium of GIS summer retreat in Bar Harbor, Maine, it was proposed that PPGIS be incorporated into a new Varenus initiative. A core planning group was established, and a proposal was submitted to the NCGIA. From the beginning, it was presumed that the initiative would focus on field experiences and alternative GIS implementations reflecting the existence of PPGIS in many socio-geographic contexts. The workshop reviewed a variety of PPGIS initiatives, considered critical social and technical issues associated with their implementation, and discussed the successes and failures of existing PPGIS projects.

The formal presentations and the discussions that ensued generated a number of perspectives about community uses of GIS and GIT. The chapters that follow are a result of this workshop, and are valuable not only for shedding light on the conceptual core of PPGIS, but also for providing case studies of how PPGIS are presently constructed and implemented. The

chapters also point to the importance of the social, historical, and political contexts in which PPGIS initiatives are pursued.

## **PPGIS IN PRACTISE**

*Community Participation and Geographic Information Systems* identifies PPGIS as a broad tent with multiple meanings and a global reach. The introductory chapters in Part I confirm that there are many emerging forms of community interaction with geographic information systems that are linked to the social and geographic context of PPGIS production and implementation. Sawicki and Peterman report on the already extensive PPGIS suppliers in the United States. Although their survey generated low response rates, and the broad definitions of PPGIS created difficulties when compiling the database, they identified 67 organizations in 40 cities that claimed to have some form of PPGIS. Four types of institutional location for PPGIS delivery in the United States are identified: nonprofit organizations (31), universities (18), government agencies (16), and private companies (2).

Leitner *et al.* draw on experiences in Minneapolis and St. Paul to identify six models of PPGIS delivery for community and grassroots organizations:

- community-based (in house) GIS
- university-community partnerships
- publicly accessible GIS facilities at universities and libraries
- map rooms
- Internet map servers
- neighborhood GIS centers

Based on a review of these six models, they conclude that 'community organizations do not just choose one model, but draw on different ways of gaining access to GIS, changing their strategies over time and perhaps developing novel ways of accessing and utilizing GIS.'

Part II of this volume contains 18 case studies that highlight the diversity of contexts in which PPGIS has been applied. The Inner City examples offer a fascinating view of the complexities of PPGIS production and implementation in established urban neighborhoods. Parker and Pascual, for example, report on a project that is empowering to participants because the PPGIS helps them express their views and aspirations in ways that were previously unavailable, even though the particular gentrification struggle detailed in the case study was not successful. Casey and Pederson are working with the City of Philadelphia in a project that incorporates local community knowledge of historically marginalized neighborhoods. The project illustrates how neighborhood mapping by local residents can contribute to the development of an Internet-based 'public records GIS' containing place-based knowledge. In so doing, the project also contributes to building local capacity for neighborhood improvement. Elwood is working with the Powderhorn Park Neighborhood Association in Minneapolis in a project focused on GIS and community housing improvement. While noting considerable progress in incorporating neighborhood input to address critical housing issues, she also observes that the power relationships within the community organization were altered. Specifically, a neighborhood discourse about the local landscape was replaced, in part, by an official housing discourse associated with technical planning methods. As a result, the residents 'most affected by this shift in language and expertise were those who

traditionally have been marginalized from neighborhood organizations—people of color, renters, senior citizens, and non-native English speakers. Sawicki and Burke, in their chapter on the 'Atlanta Project' PPGIS effort, are more optimistic about the empowering capabilities of GIS technology: 'We illustrate that there is no fundamental incompatibility between the use of technology and community empowerment. In the code enforcement case, citizen mobilization was the determining factor in the successful change in the city's approach to enforcement.'

These inner-city PPGIS case studies begin to identify the differing, and sometimes contradictory, nature of PPGIS applications because they empower and marginalize simultaneously and are locally dependant. The chapters also indicate the growing use of the Internet to connect community members with geographic information systems, and point to the Internet as central component of PPGIS delivery. For example, Kingston provides an example from the United Kingdom of a 'virtual Slaithwaite' planning experiment. He suggests that a PPGIS is more robust because of the interactivity and connectivity provided by the Internet. He raises concerns, however, about the implications for planners when seeking to incorporate 'fuzzy information' that is not easily mapped or verified. Ventura *et al.* give a case study of a land information system that performs a number of functions in support of land-use planning. The system also integrates conventional planning methods with innovative web-based planning tools, including the solicitation of community perspectives through chat rooms and the equivalent of an electronic town hall meeting. Using the Internet in this way broadens community participation in land-use planning, and is augmented by a citizenry that is, in this case, highly computer literate. As a result, the planners simultaneously train community members and gain valuable local input into the planning process. Bosworth and his colleagues tell a similar story from Portland based on public engagement in growth management and transportation planning. A PPGIS has been operationalized for 'real-time' urban planning using the Internet. In this way, they suggest planners can reach a much wider audience. 'A public workshop is considered a success if 60 people attend, while a web site on the topic can reach 6000 people a week.' In rural Australia, Walker and Pullar involve communities in a watershed GIS in which the catchment is dominated by industrial sugar production. They establish a participatory planning methodology using GIS in the context of community resource information centers.

The next set of case studies revolves around environmental management and activism. Sieber discusses five GIS applications in the California environmental movement, and finds that the availability of technological expertise within the groups is not much of a constraint. Access to digital data is, however, a problem because it tends to 'favor groups engaged in proactive and non-confrontational agendas.' Activist groups encounter much greater difficulty in gaining access to digital spatial information. McNab's case study of participatory GIS in a Newfoundland fishing community is an innovative demonstration of the integration of local and 'expert' knowledge. Tulloch and Walton are working with a New Jersey umbrella NGO that oversees PPGIS projects and find that 'identifying the extent of participation may become increasingly difficult as citizens learn to support and rely upon these groups for the employment of sophisticated technologies on their behalf.' In a different arena, Meridith and colleagues are building local capacity for PPGIS applications for biodiversity conservation, and argue that community GIS applications can contribute to ecosystem sustainability.

The final group of case studies is concerned with development planning in underdeveloped regions. Kyem's study of forest management in Ghana is an excellent example of established participatory development methods being merged with geographic information systems. The case study highlights important political aspects of PPGIS projects: 'We soon realized that some rich and powerful people in the community objected to the open and participatory uses of GIS.' This suggests that PPGIS methods need to be politically integrated into the local development infrastructure for them to be empowering. Jordan's work in Nepal and Harris and Weiner's field work in South Africa supports this conclusion. Jordan also reminds us that a critical aspect of PPGIS projects is the actual form of participation and not the hardware/software configuration; PPGIS is as much about participation as it is about GIS. These three case studies are also a reminder that PPGIS projects can be exploitative as advocates and researchers 'capture local knowledge.'

Stonich employs PPGIS in a global NGO coalition project to fight the hegemony of industrial forms of shrimp production. The coalition uses the Internet to politically 'scale up' from local ethnographic cases of struggle to link regional and global resistance movements. She finds that NGOs are enthusiastic about using advanced information technology, but that the challenges they face are magnified with a global coalition that includes communities with significant differences in power, language, culture, and wealth. Despite such obstacles, the Internet-enabled global resistance coalition supports a common opposition to industrial shrimp production. The final two case studies also focus on ways to represent alternative knowledge systems and resist the hegemony of a Western, scientific, Cartesian understanding of space and territory. Laituri's work is with a Maori community in New Zealand, while Bond is working with the Cherokee Nation in Oklahoma. Both studies map culturally relevant information that is important for local resource management decisions, and challenge the epistemological limits of conventional GIS.

These case studies demonstrate how the socio-geographic context of PPGIS production and implementation impacts community access and use of geographic information systems and technologies. Furthermore, the context of PPGIS is intricately linked to the nature of the participation process itself. In core industrial regions, community GIS applications are rapidly incorporating Internet capacity for connectivity, and multimedia forms of representation with virtual—and sometimes shifting—communities. In underdeveloped regions, PPGIS is comprised mainly of participatory development research and planning methods with a GIS/GIT interface. In such cases, the type of participation remains field-based within established communities. In all regions, however, there is evidence of the simultaneous empowerment and marginalization of people and communities. PPGIS does impose a technological layer to complex political struggles that are locally based, and this can alter existing community power relations. Issues of data cost and access also remain a concern, and can actually be compounded due to the high costs and time involved in collecting, maintaining, and updating local knowledge databases. Another interesting PPGIS characteristic is its contribution to computerized 'countermapping' and spatial story telling.

Significantly, most current PPGIS projects do not utilize GIS functionality for advanced spatial analysis. In PPGIS applications with an Internet GIS backbone, the Internet and its multimedia capabilities form the core of the application, with the GIS providing the digital maps. In this respect, the evolving generation of Internet mapping systems will likely play a

significant role in future PPGIS projects. The final section of the book gazes into these possible PPGIS futures. Dangermond of ESRI offers a very optimistic view of Internet mapping systems and how they will service communities while also educating the lay public about geography: 'By combining a range of spatially referenced data, information media, and analytic tools, GIS technology enables citizens to prioritize issues, understand them, consider alternatives, and reach viable conclusions.' This, he suggests, will act to reinforce and promote democracy. Dangermond also reiterates that, 'One key element that has affected the growth of public involvement in GIS is the Internet.' Shiffer focuses on the potential of Internet PPGIS for virtual communication and public access, but recognizes the problems that might arise due to the necessity of communicating with non-technical people, the technical problems of implementation, and differential understanding of information presented through virtual images and representations. Al-Kodmany develops this latter point and demonstrates how environmental design and visual representations of community perceptions and desires can be empowering in a Chicago community. His study concludes that: 'The GIS helped highlight the importance of cultural values in history in the future design of the neighborhood'. Krygier provides a similar story of a PPVisualization demonstration project in a Buffalo neighborhood. Interestingly, his 'research suggests that the most vital issues for PPGIS and PPVis are not technical issues . . . but funding and [the] complexities within communities. . . . Unfortunately in most cases it will be those communities that are more stable, wealthy, and less vulnerable that can support the development of PPGIS and PPVis sites on the WWW.'

The issue of who has access to PPGIS and who benefits from such systems is a recurring theme in the book. Although PPGIS is intended to broaden access to GIS and GIT, Barndt rightly questions the criteria to be used for the evaluation of such implementations. PPGIS projects are, at their core, political because they attempt to broaden access to digital spatial information and empower historically disempowered people and communities. PPGIS projects are also political because they involve community participation, which is again essentially a political process. This suggests that understanding the politics and associated power relationships of PPGIS are critical for unpacking their impacts, wherever and however implemented. Community GIS is a reflection of the politics of the builders and users of such systems, although these politics extend beyond the local impacts on participating and non-participating communities.

In an insightful concluding chapter, Aitken responds to the common assumption that community activism is spatially fixed and asks: 'Is it possible that PPGIS enables a breakthrough of local practices and community concerns from what John Agnew (1993: 252) calls the "hidden geographies" of scale?' The Cartesian logic of GIS assumes a human agency bound by scale coordinates, but people operate at many scales simultaneously. As a result, Aitken questions the assumption that scale arises simply out of some simplistic notion of cartographic hierarchy and representation of space that enables political struggle to shape political discourse. He provocatively contends that: 'PPGIS can be part of creating strong multiple publics that augment democracy. They do so by enabling people to become involved at a level that does not obfuscate their daily lives through maps and language drawn from instrumental, strategic logic. Rather, to be effective, the maps and language of PPGIS must communicate spatial stories that clarify and ultimately politicize the issues about which people feel concern.'

*Community Participation and Geographic Information Systems* is an eclectic collection of conceptual essays and case studies that demonstrate the social, political, epistemological, and methodological possibilities and boundaries of PPGIS. We have genuine concerns that academics engaged with PPGIS will tire and fall back to their familiar role as researcher. In such cases, PPGIS has the potential to become another form of community exploitation. But the evidence from this volume suggests a more optimistic scenario as a growing coalition of professional planners, community activists, NGOs, government agencies, private sector groups, and academics find innovative and progressive ways that enable ordinary people and historically marginalized communities to benefit from the technologies of the digital age.

## **PPGIS IN CONTEXT**

'Working in Africa, I've found cockroaches vie with power surges as computer killers. It is really a serious issue. Putting mesh over the holes certainly helps, but then you risk overheating the machine—all the more as the weather is hot anyway. Current computer casing seems designed for use in cool climates with low insect densities. It's about time some smart manufacturers jumped into this market gap.' (Rob Denny of One World International; Digitaldivide e-mail list, January 26, 2001)

The spontaneous coming together of community participation with geographic information systems and technologies is taking place in a diversity of social, political, and geographic

contexts. Computer-killing cockroaches in Africa are a stark reminder that PPGIS are indeed context dependent, and this important reality is demonstrated by the case studies in this book.

Within the broad umbrella of what has become known as public participation GIS, applications range from Internet-dependent spatial multimedia systems to conventional field-based participatory development methods with a modest GIS/GIT component. These diverse PPGIS case studies have in common the application of GIS to address concerns articulated by community participants and the blending of local knowledge with 'expert' information. As a result, data products and the scale of analysis must be appropriate for the needs of the participating community, and community data access must be assumed. Establishing and maintaining community trust is also essential for successful PPGIS production and implementation. These are critical ingredients for any participatory research and development project, and they indicate the centrality of the *nature of participation* in understanding PPGIS.

There has been a tendency in the past to focus on the technical challenges of community geographic information systems. The case studies in this book suggest, however, that the political complexities inherent in community participation may be larger obstacles for system implementation, and that technical challenges may be overestimated. PPGIS is purposefully value-laden and redefines the meaning of 'accuracy.' Its objective is to include 'peoples' maps and narratives to more fully understand complex socio-economic, cultural and political landscapes. This is why positivist truth statements are used with discretion. The ability of a PPGIS project to influence spatial decision making is, therefore, of central importance in evaluating the potential impact of community GIS initiatives. The digital countermapping of PPGIS tells the spatial stories of marginalized people and communities. Whether this can be translated into real power and political influence remains to be seen. However, the potential for PPGIS to augment place-specific political struggles is intriguing. Stuart Aitken (chapter 27) asks whether 'PPGIS can be part of creating strong multiple publics that augment democracy by enabling people to become involved at a level that does not obfuscate their daily lives through maps and language drawn from instrumental, strategic logic.' This possibility of 'jumping scale' with PPGIS is an important example of how new information technologies can impact the terrain of political struggle. All technologies are contradictory, however, and GIS is no exception, for PPGIS simultaneously empowers and marginalizes people and communities.

PPGIS is also a platform for integrating qualitative and quantitative information. This is significant for social scientists because of the historic dualism between researchers who employ qualitative methods and those who employ quantitative methods, and because of the unfortunate difficulties in merging the two. In this way, PPGIS highlights *place*, and in ways that conventional GIS systems normally do not. Such unanticipated benefits of PPGIS are important for geographers and other social scientists who (once again) have discovered the importance of place for scientific enquiry and development projects.

## **LESSONS LEARNED**

Geographic information systems are being integrated in communities to serve many purposes, and with various degrees of effectiveness. The contributions in this book provide a broad view of the current state of PPGIS practice in the United States and around the world. As outlined

by Leitner *et al.*, community groups are accessing geographic information systems and data in a wide variety of ways. Some communities use PPGIS to administer and manage territory under their control (e.g., Elwood; Walker *et al.*; Kyem; Jordan; Bond) and to make informed input into local planning processes (Sieber; Parker and Pascual; Ventura *et al.*; Kingston; Bosworth, Donovan, and Couey). There are also cases where PPGIS has helped communities to develop their own spatial strategies and policies (e.g. Sawicki and Burke; Tulloch; McNab; Laituri; Harris and Weiner). Bosworth, Donovan, and Couey show the multiple ways a government can make data available to communities, while Kingston, Ventura *et al.* and others demonstrate how PPGIS is rapidly merging with the Internet. Dangermond describes Community 2020 and the Geography Network as examples of growing access to data and analytical services available online.

Sawicki and Peterman document the diversity of institutional arrangements for PPGIS production and implementation. Most PPGIS are not produced and sustained within participant communities. An interesting exception to this is Powderhorn Park (Minneapolis), an inner-city neighborhood organization that created its own in-house capability to support local day-to-day housing efforts (Elwood). There are many potential paths for developing in-house GIS capability. In Australia, Walker *et al.* collaborated with a group of organizations to create a center that serves their spatial information needs, needs that could not be met by individual organizations in the area. In New Jersey, non-governmental organizations developed GIS with help from the state environmental agency (Tulloch), and the Intertribal GIS Council provides a support base for its Native Americans constituents. But not every organization should, or can, have in-house GIS capability (Sieber). Stonich's coalition, working to resist industrial shrimp farming, does not possess the resources to acquire or maintain an in-house PPGIS.

Many community information needs can be met by conventional maps and reports delivered by a government service center on compact disc or over the Internet. Casey and Pederson call this 'public records GIS,' and many cities and counties now provide this type of public data inventory. Such an approach does not, however, fulfill the needs of what they call 'community-based GIS.' A community-based GIS provides relevant local data and is capable of performing spatial analysis for participating communities. For example, the Data and Policy Analysis Group of the Atlanta Project provides sophisticated maps to assist local committees in understanding the nature of prioritized community issues, and to help them develop policy recommendations (Sawicki and Burke).

One of the greatest difficulties with implementing community-based GIS is incorporating complex and socially differentiated information. Harris and Weiner overcome this difficulty with the production of socially differentiated mental maps with particular themes, and then incorporate that information into a spatial multimedia database. Al-Kodmany employs an innovative graphic design method to extend GIS to incorporate block-specific community views. But community organizations do not necessarily represent the views of a majority of community members. Kyem's case study in Ghana identifies the common contradictions inherent in practices of community participation. For example, women are excluded, some people are intimidated by the technology, clans have a difficult time working together, and the existing power structure is often disinterested in empowering citizens. Laituri talks about the unwillingness of indigenous people to contribute data they consider sensitive for fear of being

exploited. Elwood discusses how aligning a community group with the culture of municipal government has transformed the internal politics within the participating community. Bosworth, Donovan, and Couey use a communication pyramid to show that most people choose not to get involved in community activity, but clearly some aspects of organizations and technology tend to systematically exclude some individuals.

A final point about PPGIS practice is concerned with viewing PPGIS as a process. Walker *et al.* demonstrate that communities working together to create a GIS center helped resolve many conflicts among the participating groups. Process was also a central theme of Jordan's case study in Nepal and the study by Meridith *et al.* in Canada and Mexico. The latter identified 'second order cybernetics' whereby people working together become more aware of their situation, and thus make personal adaptations to accommodate community needs and desires.

## **PPGIS FUTURES**

The contributing chapters in this book provide many perspectives on how community participation is being linked with geographic information systems and technology. For the first time it is possible to observe specific instances of what PPGIS is and how it might evolve in the future. PPGIS is presently both academic research and community development planning. Despite the underlying theme of community participation and GIS, the chapters demonstrate that many different variants of PPGIS exist. In drawing upon these chapters, we wish to identify seven core themes that both summarize current trends and point toward the future.

### ***PPGIS and socio-geographic context***

PPGIS in urban and industrialized regions are increasingly Internet-based. Elsewhere PPGIS combines conventional participatory field methods with a GIS/GIT component. In the future it is likely that the Internet, with associated spatial multimedia, will become the dominant PPGIS platform. Nevertheless, context and place will inevitably remain important and will influence specific PPGIS production and implementation. As such, there is no universal PPGIS model, and place-based methodologies that navigate local politics and production relations should predominate.

### ***Defining communities and the nature of participation***

Community participation is the cornerstone of PPGIS. This volume demonstrates that participation is practiced in a diversity of ways. There is a tendency to homogenize communities, and this is problematic. In the future, community GIS projects must explicitly recognize the complex social differentiation within participant communities. Internet-based PPGIS will further complicate the definition of a community and practices of participation. Virtual communities present significant opportunities and challenges as participation is broadened, but becomes placeless. Community participation from the home computer will ultimately transform PPGIS in ways that we do not yet understand.

### ***Appropriate technologies and data***

PPGIS produces information that is desired by communities, and employs accessible technologies that are not limited to GIS. It is thus possible to question the role of GIS in

PPGIS futures. At present, PPGIS uses very limited GIS functionality, and mostly involves digital cartography that links local (qualitative) and expert (quantitative) knowledge. It is questionable to what extent the Internet-based spatial multimedia configurations of the future will rely on the advanced spatial analytical capabilities of GIS. Evolving community spatial decision support systems will likely draw upon a variety of technologies and software interfaces. The role of GIS in this mix is thus ambiguous, and might even bring the term PPGIS into question.

### ***How empowerment and disempowerment occur***

PPGIS can empower communities when digital countermaps communicate spatial stories that are integrated into local decision making. Success stories to date include crime prevention, housing condemnation and renovation, smart growth and land-use planning, natural resource management, and the preservation of indigenous territories. Disempowerment has been observed through the reconfiguration of established community groups and the threatening of existing elites in response to the introduction of new technologies. Changes in the planning discourse associated with PPGIS have altered existing community power relationships. Disempowerment can take place when government agencies limit data access to community groups that are deemed to be too radical. Unequal access to the Internet also empowers and disempowers simultaneously. To date we have seen only glimpses of this empowerment/disempowerment process. As a result, the specific mechanisms by which PPGIS empowers and disempowers people and communities remain fundamental areas for research.

### ***PPGIS as research methodology***

PPGIS research contributes to geographic information science and interdisciplinary studies of place. One perhaps unintended consequence of PPGIS for the discipline of geography is a more contextual GIS-based analysis of place. Future PPGIS academic research can thus contribute significantly to geography and to the social sciences in general. As with any participatory research, however, it is imperative that community participants fully understand why they are participating before a project is initiated. The chapters include a number of rich PPGIS case studies that do not directly support community-based spatial decision making.

### ***Democratizing spatial decision making***

Perhaps the greatest challenge for PPGIS is to contribute to more inclusive spatial decision making. Although the chapters do provide some anecdotal insight as to how this might take place, there has been little systematic long-term evaluation of the contribution of PPGIS to local and regional spatial decision making. This is understandable given that PPGIS is in its infancy and is only now penetrating the administrative and bureaucratic structures of planning agencies, development organizations, universities, NGOs, and the private sector. The monitoring and evaluation of PPGIS projects over a longer time span will provide insight into the effectiveness of such implementations. Most, if not all, PPGIS projects intend to support community involvement in some type of spatial planning process. The effective transition from PPGIS product to implementation in the context of the local and regional landscape of economics and politics must be a central focus of future PPGIS work.

## REFERENCES

- Abbot, J., R. Chambers, C. Dunn, T. Harris, E. de Merode, G. Porter, J. Townsend, and D. Weiner, (1998). 'Participatory GIS: Opportunity or Oxymoron.' *PLA Notes*, 33: 27–34.
- Agnew, J. (1993) 'Representing Space: Space, Scale and Culture in Social Science.' In *Place/Culture/Rrepresentation*. Editors James Duncan and David Ley, 251–71. London and New York: Routledge.
- Aitkin, S., and S. Michel, (1995). 'Who Contrives the 'Real' in GIS? Geographic Information, Planning, and Critical Theory.' *Cartography and Geographic Information Systems*, 22(1): 17–29.
- Barndt, M. (1998). 'Public Participation GIS – Barriers to Implementation.' *Cartography and Geographic Information Systems*, 25(2): 105–112.
- Castells, M. (1983). *The City and the Grassroots: A Cross-Cultural Theory of Urban Social Movements*. Berkeley: University of California Press.
- Chorley Committee, (1997). *Handling Geographic Information*. HMSO, London.
- Chrisman, N. R. (1987). 'Design of Geographic Information Systems Based on Social and Cultural Goals.' *Photogrammetric Engineering & Remote Sensing*, 53(10): 1367–1370.
- Craig, W., Harris, T., and D. Weiner, (1999). 'Empowerment, Marginalization and Public Participation GIS.' Specialist Meeting Report compiled for Varenus: NCGIA's Project to Advance Geographic Information Science. NCGIA, University of California at Santa Barbara, February.
- Craig, W., and S. Elwood, (1998). 'How and Why Community Groups use Maps and Geographic Information.' *Cartography and Geographic Information Systems*, 25(2): 95–104.
- Cultural Survival Quarterly*, (1995). Special Issue on Geomatics, vol. 18, no. 4.
- Curry, M.R. (1995). 'Rethinking Rights and Responsibilities in Geographic Information Systems: Beyond the Power of Image.' *Cartography and Geographic Information Systems*, 22 (1): 58–69.
- Dunn, C., P. Atkins, and J. Townsend, (1997). 'GIS for Development: a Contradiction in Terms?' *Area*, 29(2): 151–159.
- Edney, M.H. (1991). 'Strategies for Maintaining the Democratic Nature of Geographic Information Systems.' *Papers and Proceedings of the Applied Geography Conferences* 14: 100–108.

Elwood, S., and H. Leitner, (1998). 'GIS and Community-Based Planning: Exploring the Diversity of Neighborhood Perspectives and Needs.' *Cartography and Geographic Information Systems*, 25(2): 77–88.

Gonzalez, R. (1995). 'KBS, GIS and Documenting Indigenous Knowledge.' *Indigenous Knowledge and Development Monitor*, 3(1):

Goodchild, M.F. (1995). 'GIS and Geographic Research.' In Pickles, J., ed. *Ground Truth: The Social Implications of Geographic Information Systems*. New York: Guilford.

Goodchild, M., Egenhofer, M., Kemp, K., Mark, D., and E. Sheppard (1999). 'Introduction to the Varenus Project.' *International Journal of Geographical Information Science*, 13(8): 731–745.

Goss, J. (1995). 'We know who you are and we know where you live: the instrumental rationality of Geodemographic Information Systems.' *Economic Geography*, 71: 171–198.

Graham, S., (1998). 'The End of Geography or the Explosion of Place? Conceptualizing Time and Information Technology.' *Progress in Human Geography*, 22: 165–185

Grant, D.R., and L.B. Omdahl. (1993). *State and Local Government in America*. Madison WI: Brown and Benchmark.

Harris, T.M., D. Weiner, T. Warner, and R. Levin, (1995). Pursuing Social Goals Through Participatory GIS: Redressing South Africa's Historical Political Ecology. In Pickles, J., ed. *Ground Truth: The social implications of geographic information systems*. New York: Guilford, 196–222.

Harris, T., and D. Weiner, (1996). 'GIS and Society: The Social Implications of How People, Space and Environment are Represented in GIS.' Scientific Report for NCGIA Initiative # 19 Specialist Meeting, University of California at Santa Barbara, November.

Harris, T., and D. Weiner, (1998). 'Empowerment, Marginalization and Community-Integrated GIS.' *Cartography and Geographic Information Systems*, 25(2): 67–76.

Hutchinson, C.F., and J. Toledano, (1993). 'Guidelines for demonstrating geographical information systems based on participatory development.' *International Journal of Geographical Information Systems*, 7(5): 453–461.

Jacobs, J. (1961). *The Death and Life of Great American Cities*. New York: Vintage Books.

Johnston, R. (1999). 'Geography and GIS.' In P. Longley, M. Goodchild, D. Maguire and D. Rhind (eds.). *Geographical Information Systems: Principles, Techniques, Management, and Applications*. New York: John Wiley.

Jones, B. (1990). *Neighborhood Planning: A Guide for Citizens and Planners*, Chicago and Washington, D.C.: Planners Press, American Planning Association.

Jordan, G., and B. Shrestha (1998). 'Integrating Geomatics and Participatory Techniques for Community Forest Management: Case Studies from Yarsha Khola Watershed, Dolakha District, Nepal.' International Centre for Integrated Development, Kathmandu, Nepal.

Kellog, W. (1999). 'From the Field: Observations on Using GIS to Develop a Neighborhood Environmental Information System for Community-Based Organizations.' *URISA Journal*, 11(1): 15–32.

Kitchin, R. (1998). 'Towards Geographies of Cyberspace.' *Progress in Human Geography*, 22(3): 385–406.

Kwaku-Kyem, P. (1999). 'Examining the Discourse about the Transfer of GIS Technology to Traditionally Non-Western Societies.' *Social Science Computer Review*, 17(1): 69–73.

Lake, R.W. (1993). 'Planning and Applied Geography: Positivism, Ethics, and Geographic Information Systems.' *Progress in Human Geography*, 17(3): 404–413.

Marozas, B.A. 1993. 'A culturally relevant solution for the implementation of Geographic Information Systems in Indian Country.' *Proceedings of the Thirteenth Annual ESRI User Conference*, 1: 365–381.

Mitchell, A. (1997). *Zeroing In: Geographic Information Systems at Work in the Community*. Redlands, CA: ESRI.

Obermeyer, N., and J. Pinto, (1994). *Managing Geographic Information Systems*. New York: Guilford.

Olson, M. (1965). *The Logic of Collective Action; Public Goods and The Theory of Groups*, Cambridge, MA: Harvard University Press.

Openshaw, S. (1991). 'A view on the GIS crisis in geography, or, using GIS to put Humpty-Dumpty back together again.' *Environment and Planning A* 23: 621–628.

Pickles, J. (1991) 'Geography, GIS, and the Surveillant Society.' *Papers and Proceedings of Applied Geography Conferences* 14: 80–91.

Pickles, J. (1999). 'Arguments, Debates, and Dialogues: The GIS–Social Theory Debate and Concerns for Alternatives.' In P. Longley, M. Goodchild, D. Maguire and D. Rhind (eds.). *Geographical Information Systems: Principles, Techniques, Management, and Applications*. New York: John Wiley.

Rambaldi, G., and J. Callosa (2000). *Manual on Participatory 3-Dimensional Modeling for Natural Resource Management (Volume 7)*. NIPAP, PAWB-DENR: Philippines Department of Environment and Natural Resources

- Rundstrum, R. (1995). 'GIS, indigenous peoples, and epistemological diversity.' *Cartography and Geographic Information Systems*, 22(1): 45–57.
- Schroeder, P. (1996). Report on Public Participation GIS Workshop, in Harris, T. and D. Weiner eds. GIS and Society: The Social Implications of How People, Space and Environment are Represented in GIS. *NCGIA Technical Report 96–97, Scientific Report for Initiative 19 Specialist Meeting*. South Haven, MN, March 2–5, 1996.
- Sheppard, E. (1995). 'GIS and Society: Towards a Research Agenda.' *Cartography and Geographic Information Systems*, 22(1): 5–16.
- Sheppard, E., and T. Poiker, (1995). GIS and Society special issue. *Cartography and Geographic Information Systems*, 22(1), January.
- Sheppard, E., Couclelis, H., Graham, S., Harrington, J., and H. Onsrud (1999). 'Geographies of the Information Society.' *International Journal of Geographical Information Science*, 13(8): 797–823.
- Sieber, R. (2000). 'Conforming (to) the Opposition: the Social Construction of Geographical Information Systems in Social Movements.' *International Journal of Geographical Information Science*, 14(8): 775–793.
- Smith, N. (1992). 'History and Philosophy of Geography: Real Wars, Theory Wars.' *Progress in Human Geography*, 16(2): 257–271.
- Taylor, P.J. (1990). 'GKS'. *Political Geography Quarterly*, 3: 211–212.
- Taylor, P.J. (1991). 'A Distorted World of Knowledge.' *Journal of Geography in Higher Education*, 15: 85–90.
- Taylor, P.J., and M. Overton. (1991). 'Further thoughts on geography and GIS.' *Environment and Planning, A* 23: 1087–1094.
- Taylor, P.J., and M. Overton (1992). 'Further Thoughts on Geography and GIS: A Reply.' *Environment and Planning, A* 24: 463–466.
- Talen, E. (1999). 'Constructing Neighborhoods from the Bottom Up: the Case for Resident Generated GIS.' *Environment and Planning B*, (26): 533–554.
- Talen, E. (2000). 'Bottom-Up GIS. A New Tool for Individual and Group Expression in Participatory Planning.' *APA Journal*, 66(3): 279–294.
- Weidemann, I., and Femers, S. (1993). 'Public participation in waste management decision making: analysis and management of conflicts.' *Journal of Hazardous Materials*, Vol. 33, pp. 355–368.

Weiner, D., T. 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.

Weiner, D., and T. Harris, (1999.) 'Community-Integrated GIS for Land Reform in South Africa.' WVU Regional Research Institute Research Paper # 9907, Morgantown W.V. (<http://www.rri.wvu.edu/wpapers/1999wp.htm>).

Yapa, L.S. (1991). Is GIS appropriate technology? *International Journal of Geographical Information Systems* 5: 41–58.