# *Empowerment, Marginalization and Public Participation GIS*

## Report of Varenius Workshop

**October 15-17, 1998**

**Santa Barbara, California**

**Compiled by**

**Will Craig, Trevor Harris, and Daniel Weiner**

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# I. History, structure and organization of the meeting

This workshop and its focus on PPGIS have several origins. The concept of Public Participatory GIS came from Initiative 19 *GIS and Society: the social implications of how people, space, and environment are represented in GIS* held in Minnesota in March 1996 (NCGIA Technical report 96-7). This theme was developed and the term defined at a subsequent meeting held in Orono, Maine. It was at the Orono meeting that the term Public Participation GIS was coined and the concept developed further. A web discussion group was also established. The discourse on GIS and Society of course has a longer antecedence extending back to the NCGIA sponsored meeting at Friday Harbor held in November 1993. The Friday Harbor meeting was organized by Nick Chrisman, John Pickles, Tom Poiker, Eric Sheppard and others and built upon earlier debates at the annual meeting of the Association of American Geographers. Following the Friday Harbor meeting '*Ground Truth: the social implications of Geographic Information Systems'* edited by John Pickles was published. Soon after came a special issue of *Cartography and GIS (CAGIS*) edited by Eric Sheppard and Tom Poiker, which contained a series of papers presented at the Friday Harbor meeting. In addition, NCGIA Initiatives 16 and 17 contributed to the focus on the societal impacts arising from GIS use. This literature, and the momentum generated at the Friday Harbor meeting, provided the conceptual base for the Minnesota workshop.

The Minnesota workshop identified three broad conceptual issues that focused on:
1) Epistemologies of GIS
2) GIS Spatial Data Institutions and Access to Information
3) Developing Alternative GIS

It is from the last conceptual base that the PPGIS issues discussed in this meeting arose. However, it is unwise to dislocate the PPGIS discussion from its broader conceptual base in GIS and Society issues. The discussion of 'alternative' forms of GIS production, use, access, and representation came from an understanding of the social impacts of existing uses of GIS. Certainly, participants at the I-19 meeting questioned whether a 'bottom-up' GIS could be successfully developed and what it might comprise. A number of other probing questions were raised including how community participation could be more fully incorporated into a GIS and to what extent would such participation be seen to only legitimize conventional top-down decision-making.

At the 1997 UCGIS summer retreat in Bar Harbor, Maine, it was proposed that the idea of PPGIS should be incorporated into the new Varenius initiative. As result, a core planning group and co-leaders was established and a proposal to NCGIA was submitted. From the beginning it was envisioned that the PPGIS initiative would be concerned with field experiences with alternative GIS implementations. There is presently a rapid proliferation of PPGIS in many social contexts. These include urban planning, community development, environmental equity, social forestry, indigenous resource mapping, and third world development. As a result there is a need to take stock of how these GIS are being produced, the successes and failures of PPGIS related projects, and the critical social and technical issues associated with their implementation. All participants recognized that this initiative was important for understanding 'geographies of the information society'. The rapid diffusion of GIS marginalizes and empowers people and

communities simultaneously and one of the workshop's critical objectives was to understand the social context in which PPGIS are developed and implemented and the social impacts of its use.

Organizationally, the meeting was a combination of both conference and workshop formats. An introductory session preceded the presentation of some 30 papers from the participants. Extensive discussion ensued following each presentation and common themes and issues were identified. During the second day the meeting entered a workshop phase. A summary was presented of the significant questions prompted from the papers and discussion of these provided the focus for four groups to workshop around significant issues of PPGIS. Rapporteurs reported back to the main body in preparation for the final plenary session that focused on establishing a PPGIS research agenda.

## II. Call for papers

Call for Participation
Note: Call closed July 17, 1998
Santa Barbara, California October 14th-17th, 1998

This Specialist Meeting is expected to bring together individuals who have a deep experience with PPGIS. It will be a forum for sharing experiences about alternative GIS designs and applications, which better reflect community interests and involve and empower its members. The meeting will also be concerned with ways in which Public Participation GIS (PPGIS) can have unintended consequences by marginalizing people and communities. This initiative will, therefore, explore the contradictory nature of PPGIS design and implementation through presentations of case studies in a diversity of social contexts. A PPGIS research agenda will be developed and plans established for a possible subsequent conference. This follow-up conference would involve community groups, policy makers, planners, government agencies, NGOs, GIS vendors, private sector representatives, and academics that are involved in PPGIS.

Key themes of the Varenius October specialist meeting will include:

- identifying community information needs and how PPGIS might contribute to those needs
- the multiple ways in which PPGIS are being designed and implemented
- the impacts on communities arising from differential access to GIS hardware, software, data, and expertise
- the nature of GIS knowledge distortion and the ways in which socially differentiated communities and their local knowledge might be represented within a PPGIS
- changes in local politics and power relationships arising from the use of PPGIS in decision making
- unintended outcomes of PPGIS implementation, including red-lining, local surveillance, and breaches of confidentiality and privacy
- the potential of PPGIS to empower people and communities

This specialist meeting is sponsored by the Varenius project, with funding from the National Science Foundation. Varenius is a project of the National Center for Geographic Information and Analysis (NCGIA), and seeks to advance geographic information science through research to extend our understanding in three strategic areas: Cognitive Models of Geographic Space; Computational Implementations of Geographic Concepts; and Geographies of the Information Society. Varenius is a three-year project, and is described in greater detail in materials available at the NCGIA Web site http://www.ncgia.ucsb.edu.

Invited participants should have professional interests relevant to PPGIS design, research, and implementation, have rich histories to relate, and be able to reflect on the strengths and weaknesses of that work. We are seeking a diversity of case studies involving, for example, urban neighborhoods, indigenous people, Third World development projects, and environmental movements. Proposals to participate in the specialist meeting should consist of two parts: (1) a 750-1000 word abstract which explains the objectives, participants, methods, and progress of

your PPGIS project and (2) a one-page biography or curriculum vitae with up to five selected publications most relevant to the topic. Small project teams are welcome to submit a proposal. Participants will be expected to prepare a research paper for distribution one month prior to the meeting and may be invited to contribute to an edited book on PPGIS.

Completed proposals should be sent to Will Craig at the University of Minnesota by July 17th 1998, in both hard copy and email formats (ASCII or WORD). Notices of acceptance and travel awards will be issued on August 14th 1998. All submissions will be reviewed by the Initiative co-leaders in consultation with the core-planning group. Participation will be limited to 25-30 people, and will be by invitation only. The project will reimburse reasonable travel and accommodation costs for participants. Please include a quote of lowest available airfare in your application. Funded foreign participants must use U.S. air carriers and meet immigration/visa requirements.

Please direct requests for information to the project co-leaders:

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## IV. Summary of critical issues raised in paper sessions

The formal presentations and the discussions that ensued generated a number of perspectives on the issue of PPGIS. A number of themes became apparent but in many respects the presentations and discussions generated as many questions as they did answers. These questions or issues were collated during the session and then presented as a basis for subsequent breakout group discussions. These questions also begin the process of forming a research agenda.

- What are the distinguishing characteristics of PPGIS?
  - Can we define PPGIS?
  - PPGIS as a participatory process
  - Incorporates local knowledge
  - Has a broad diversity of socially differentiated knowledge.
  - Can we generate several models of what PPGIS might be like?
  - What are the distinctions, if any, between PPGIS, PGIS, GIS, CIGIS?

- What constitutes a community?
  - How is a community defined and who defines it?

- What do we mean by empowerment?
  - Who are we empowering and for what purpose
  - In PPGIS are we seeking community input in order to compete against agency based GIS?
  - What of the importance of community self-discovery?
  - How do we redress structural knowledge distortion?
  - PPGIS use for advocacy
  - Are we empowering through participation?

- To what extent will the World Wide Web control access to PPGIS?

- To what extent is PPGIS embedded in politics and power relations in the context of:
  - The origin of the PPGIS project
  - Where the system will reside
  - The use of a PPGIS

- What are the software implications for PPGIS?
  - GIS v1.0, GIS v1.2, GIS v.2.0
  - Quantitative and qualitative data capability
  - GIS and multi-media
  - The role of vendors and government agencies in software/data development

- Where should the PPGIS be located and who should operate or ‘control’ it?
  - Technology and expertise dependency
  - Building local capacity
  - System sustainability

- What information should be in a PPGIS and how should that information be represented?
  - How best can we capture or extract information about a community?
  - What of the multiple realities of space?
  - What of visualization and representation?
  - What of fuzzy space?

- What are the untended consequences of establishing a PPGIS?
  - Creating a new local elite?
  - Continuing an information underclass?
  - Confidentiality and privacy issues?
  - Individual and community rights to know?

- How should or can we evaluate the performance of a PPGIS?
  - By means of the process?
  - By the outcomes?

- Does everyone need a PPGIS?
  - What are the more suitable contexts for PPGIS use?
  - How do we establish what a community needs?

- What are the implications for 'outsiders' assisting or facilitating in the establishment of a community PPGIS?
  - Participant – observer
  - Filters of community knowledge
  - Trust vs. dependence
  - Cultural sensitivity

- How will PPGIS contribute to decision-making?

- What are the constraints acting against PPGIS?
  - Cost recovery
  - Resources
  - Legal
  - Technical

- How do we decide when PPGIS is an appropriate technology and when is it inappropriate?

# V. Breakout Group Summary Reports

After the papers were presented and discussed, four breakout groups were formed. Each group was asked to provide their summary of the major issues that emerged and to identify key PPGIS research questions. Summary outlines of the four group reports are presented below:

**Group 1**

- Core issues for PPGIS
  - Start with nature of participation
  - Goal is to reduce community marginality with GIS
    - complications with introduction of new technology
    - enhancing local participation is critical
    - generating local data is essential
  - Realize that PPGIS may not change balance of power
  - Concerns for safeguards
    - assessment tools
    - examples of best practices
    - issues of ethics and privacy
    - guidelines; be watchful of abuses

- Empowerment [of community] has long tradition -- older than GIS; so PPGIS needs to work with others

- Other mandates for PPGIS
  - Make needs known to software development community
  - Lobby for more flexible software
  - Educate users and potential users, i.e. the public
  - Strengthen systems design to improve access, while still protecting privacy

- What legacy to address?
  - Share "lessons learned", as well as "best practices"
  - Note outcomes of disempowerment as well as empowerment
  - Identify appropriate settings for professional and community interactions

- Need metrics to assess success and failures of PPGIS, both process and product, especially since PPGIS output is input to policy and is a step removed from results

**Group 2**

- What is a PPGIS?
  - Deals with community (spatial and aspatial issues)
  - Addresses a specific scale
  - Involves public participation ($2^{nd}$ cybernetic sense)
  - Is pluralistic, inclusive and non-discriminatory

- Includes qualitative and quantitative data
- For and by the community and "indigenous" people – the stakeholders

♦ What is desired in PPGIS?

Iterative process begins here ←

- Driven by [social] values; treats factual data as well
- Represents both facts and values
- Performs some analysis
- Leads to decision-making
- … implementation …
- … [social] change
- Evaluation of efficacy

E T H I C S

- Pervasive learning, with feedback loops, throughout process
- Strong ethical/moral tones

- NB: Group participation changes GIS, which in turn changes group iterative processes

♦ What are critical GIScience questions in PPGIS?

- How to make a better/new GIS tool (cf social telescope)
- Additional information types required by new GIS tool
- Impact of new GIS tool on social paradigms
- New research domains [unspecified]
- Measurement of change in community

♦ What are important research topics for PPGIS and PPGIScience?

- Nature of data and information needed
- Methods of data and information acquisition
- Impacts of communication structures
- Models of access
- Visualization and representation
  Appropriateness
- Metrics of success
- Pedagogical issues

} Controlled by Empowerment Access Scales

♦ What are important research topics specific to PPGISystems?

- Handling of qualitative and quantitative data
- Metadata for communities
- Software tool design
- WWW possibilities and impacts
- Performance
- Technology transfer

**Group 3**

- PPGIS poses quandaries, for example:
  - Multiple dimensions
  - Providers/Users of data are one and same, leading to many models of provision
  - Many styles and levels of inclusiveness in participation are possible

- Evaluation and Performance measures
  - Outreach
  - Awareness
  - Access to data and information
  - Costs of data and information
  - Levels of collaboration
  - Changes in lifeways, social equity, preservation of values

- Data Representation
  - Must be computerized – legitimization issue
  - Who collects, filters, and provides data?
  - Usefulness of public data at local level [large-scale]
  - Scale, and resolution of all types of data and information
  - Qualitative/Quantitative dichotomy
  - Field verification of data
  - Local knowledge: non-standard, fuzzy, spiritual data
  - Transformation of cultural concepts across boundaries of language and technology

- Political orientation of PPGIS
  - In design
  - In use / outcomes
  - In evaluation

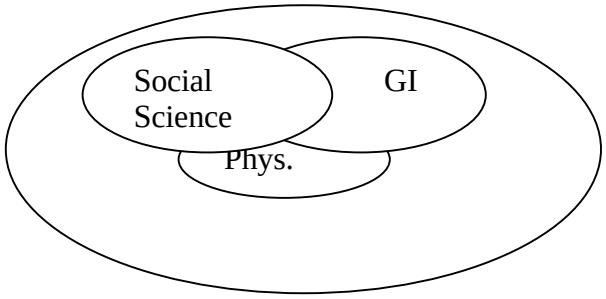
  } Situational context embedded at all levels

- Interface design issues
  - GUI itself
  - Artistry
  - Multimedia
  - Cognitive mapping
  - Cartographic concepts
  - Technology and people mediate the data

- Other agendas and questions
  - How to empower people in public change?
  - What is the role of academics, vs practitioners?
  - When does GIS matter after all?

**Group 4**

- What is PPGIS?
  - Multi-dimensional
  - Fuzzy – agreement that it could not be precisely defined
  - Generated within, or outside, the subject community
  - Generated bottom-up or top-down
  - At intersection of social science [broadly defined] and GI Science; but inclusive of the physical sciences as well




  - Involves "ladders" – levels – of social empowerment and change: access → feedback → consultation → joint planning → delegated authority → self-determinism

- What is "special" about PPGIS?
  - Social concerns and events are located in space
  - Incorporates both qualitative and quantitative data
  - "Weird" data - touching, visceral, emotional issues
  - Local knowledge transformed back into data
  - More interest in social than technical arenas
  - Highly interdisciplinary

- What is needed in PPGIS?
  - Avoiding "sloppy" social- and GI- science
  - Evaluation of both process and outcomes
  - Ensuring success – results – as much as possible
  - Integration of evaluation techniques from many disciplines

- Interfacing the "whole process"
  - Representation of "weird" things
  - Design of new tools and facilities
  - Education
  - Providing a nexus between community members and experts

- Models of institutional structures
  - Who does PPGIS, how, and for whom?
  - Taxonomy of institutional organizational types, methods

- How is PPGIS structured in different contexts?
- How does participation affect process?

♦ Data acquisition and collection
- Access! to government, private, sacred, personal, and academic data
- Methods of local knowledge-to-data transformation
- Ramifications of [re]sharing different types of data in the community

After the small groups presented their summaries in a plenary session, there was a discussion about the critical elements of a PPGIS research agenda and implementation strategy. A summary of this discussion follows.

# VI. Toward a PPGIS Research Agenda

This research agenda grows out of an interest in understanding and improving PPGIS activities in this country and around the world. This agenda is based on the following basic assumptions:

- PPGIS can empower the community and its members.
- Equal access to data and information is a key component of PPGIS.
- Scale of data should match the needs of the community.
- PPGIS use (and research about this use) should be appropriate to the needs of the community.
- Establishing and maintaining community trust is key for people working with PPGIS.
- PPGIS is purposefully value laden.
- Consequences of PPGIS, both intended and unintended, should be monitored.
- More than most other technology implementations, PPGIS involves ethical issues.

**Monitoring and Evaluation**

Too little is known about the nature of PPGIS. We need a better understanding of the scope of existing activity. More than that, we need to document successful and unsuccessful activities and the reasons for their level of success. We believe that such studies will lead to a better understanding of PPGIS and stimulate the growth of PPGIS activities that bring more benefits to the community, with fewer negative side effects.

A significant number of PPGIS activities are already underway and both the number and types of such activities are growing. Sawicki has begun to build an inventory of PPGIS suppliers. Our experience in this workshop is that much can be learned from each activity, so it is important to continue to monitor these developments. Such an inventory will allow PPGIS providers to connect with each other, and allow researchers to monitor the size and nature of this ever-changing field.

A guidebook of best practices is needed to assist people attempting to develop PPGIS operations. Too many PPGIS leaders have begun their activities from scratch, with little knowledge of what has gone before. This workshop involved many of the leaders in PPGIS, yet much was learned from what others were doing.

Of course, before such a guidebook is developed, we need to evaluate existing practices so we know what works well and what does not. We know of no formal evaluation of any PPGIS activity, only anecdotal evidence of success or failure. Evaluations will assist in identifying best practices. A series of evaluations in different geographic locations and different substantive areas will uncover commonalties useful to all PPGIS efforts as well as issues that are unique to place and topic.

Before any evaluation can be done, we need to develop evaluation criteria that are germane to PPGIS efforts. Barndt has made a good start on the criteria by describing a range of product, process and sustainability criteria. The evaluations should be both summative and formative. Summative evaluations focus on the end results and will have great value for other organizations.

Formative evaluation focuses on intermediate goals, such as the number of people involved, and is useful for the host organization in making adjustments to improve their processes. Because we feel process is as important as product, these formative evaluations will also be useful for others.

**Interface and the Process**

Through this title we focus on how people connect with technology. One focus is how the community becomes connected with a PPGIS. A second focus is the nature of the technology itself, and the final is on the user interface – both for directing software and for assimilating the results.

When and how is it appropriate for community groups to access GIS to meet their needs? Sieber has begun to study the relationship between a group's characteristics and the appropriateness of GIS for them. Leitner *et al*. have begun development of a framework describing how the community might acquire PPGIS capabilities. Further work in these areas will help answer questions about appropriate ways for community groups to access GIS.

While we have used the label PPGIS, where GIS implies existing geographic information systems, we are not convinced that existing GIS technology meets the needs of community groups. An evaluation of GIS functionality against community needs would document the strengths and weaknesses of today's software; it should also identify missing functionality. We suspect that the Internet meets additional aspects of the community's needs and that, in fact, it might be the GIS2 we are looking for. Multimedia and other software may also fulfill needs. Research is needed on the appropriateness of these alternatives to meet community needs.

A second aspect of interface includes the user interface and the visual products that result. While desktop GIS packages have made user interface much easier than earlier GIS, they still have a scientific and generic feel that is not friendly to community users. We see a need to study community use of the technology and develop an interface that better represents their view of the world and is therefore more inviting and useful.

Likewise we know little about the appropriateness of standard cartographic products for community needs. Some maps, like parcel maps with building outlines, are at human scale and seem to work for community groups working on local issues. Other issues are not represented well by standard cartographic techniques and new techniques are needed. For example, contour maps of income distribution may not work well for layperson. We need research on visualization techniques that are appropriate to the needs of community

**Organizational Issues and Societal Context**

What are appropriate ways of organizing PPGIS activities? This question needs to be answered within a societal context. Through the first agenda item, monitoring and evaluation, we should have a good idea of nature of exiting PPGIS activities and knowledge about their success or lack of success. Under this agenda item, we ask for research that will point to ways of improving the chances of success.

One measure of success is whether the effort empowers or marginalizes people in the community. We suspect that certain ways of organizing communities are better than others at being inclusive and helping people feel they can control their own destinies. Much work has been done by social psychologists that is relevant to this discussion, but very little work exists which examines the impact of information technology on these organizations. What organizational aspects might ensure that the community is well represented and few people are marginalized? It is possible for one group within a neighborhood to take control and use PPGIS to promote their interests over the interests of other groups. What are effective ways of protecting the interests of the minority?

Useful research could be done which looks at the ways in which GIScience interfaces with the social and physical sciences through PPGIS.[1] Much is known in these other fields that is relevant to PPGIS (for example, about community empowerment) but neither side is well aware of the other and, more importantly, very little is known about the about how well the theories of those other sciences operate in the PPGIS arena. Meridith, for example, writes about second order Cybernetics where information gained by the community changes the way people behave and thereby the outcome is different from what is predicted by a purely scientific model. How does the PPGIS process empower communities and how does this empowerment induce change?

Community organizations will measure their success by the policies they have affected and the resources they have gained. From political science we know something about how interest groups work in the government arena, but we know very little about how PPGIS might impact that work. We know less about how community groups relate to the private and non-profit sectors, and know nothing about the impact of PPGIS on those relationships. Understanding those relationships and the impact of PPGIS can lead to a better understanding of the current social paradigm. It could also lead to recommendations to empower community organizations to bring about social change.

A very important issue is how to develop sustainable PPGIS centers. Leitner *et al*. have developed models of types of centers with various levels of sustainability, but all have potential problems of funding and sustained interest. More research is needed in this area.

Having established a PPGIS, the community will be faced with a variety of decisions concerning its rights in that system. To what extent is it willing to let outsiders have access to its data and resources. Where do privacy rights give way to community interests? What charges should be made for access? What legal rights does the organization have to its PPGIS? Research on these issues could lead to recommendations for best practices

**Data Issues**

A wide variety of data issues face the PPGIS community and research is needed to identify ways to maximize opportunities and overcome obstacles.

[1] It is critical to retain high levels of quality in both GIScience and the other component sciences. No compromise in standards should be allowed just because the work is interdisciplinary.

Acquiring data from others is important because is reduces costs and eliminates disputes about data quality. There are various problems with such acquisition including outright refusal, high cost, lack of documentation, and system incompatibility. Onsrud points out that new federal laws seem to be reducing access to data. Research on these issues could lead to improved sharing of data.

Some of this data held by others is unknown to the community or individuals in it. Worse, that information could be incorrect and inappropriately used against the community. We have ways of knowing about and correcting incorrect credit histories, but these rights do not apply in other areas. This area could benefit from research about the nature and extent of the problem, plus ways of alleviating problems.

Getting community information into a GIS is problematic. Often the information a community wants to add to its database is incompatible with existing GIS technology. Most often it is qualitative information or the information has fuzzy boundaries. Sometimes it is sacred information. New models need to be developed which would allow such data to be represented in a GIS. Sometimes the needed information is distributed across the community and innovative ways of collecting this information could allow it to be used in the GIS. Ways are also needed to validate community information. Research is needed in these areas which will lead to new ways of incorporating and empowering such information.

Finally, we need to know more about the ramifications of making PPGIS data available within the community or to others outside the community. There are clearly times when this sharing will help the community attain its goals, but individuals may suffer as a result. The circumstances of positive and negative effects need to be identified to provide guidelines to communities operating PPGIS.

Scale is a characteristic of data well known to the GIScience community, but we know little about how it affects community understanding of maps and other visual representations. It seems clear that people have little trouble with human scale data; e.g., the trees and houses they see in their everyday environment. We are less clear about how well lay people comprehend block summary data or national distributions.

# VII. Abstracts of papers

The abstracts are in alphabetical order by lead author. Full versions of these papers can be accessed online at: http:// www.ncgia.ucsb.edu/varenius/ppgis/papers/index.html

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## GIS and the Artist: Shaping the Image of a Neighborhood in Participatory Environmental Design

This paper explains how a collaboration of traditional and GIS tools facilitated an environment that fostered public input in participatory design. The project involved a large in-fill residential and commercial development in Pilson neighborhood, Chicago. A GIS image database assisted in visualizing public's ideas concerning the built environment. The artist, with traditional felt tips and markers, translated and incorporated the audience ideas into papers. The GIS image database tremendously extended the memory of each of the public, planner, and artist. It assisted in visualizing the past and present situation of the neighborhood. It also assisted in engaging the audience in developing alternative solutions that were incrementally visualized by the artist at the direction of the audience.

Key historic images of the neighborhood were "hot-linked" to their geographic locations on the map. These images provided an overview of how the area looked like. Another recent map was also "hot-linked" to current images of the neighborhood. Images were classified in terms of their architectural styles and use. Maps showed the clusters and patterns of architectural styles and landuse pattern in the examined neighborhood. Upon typing the name of an architectural style, images along their geographic locations appeared on the screen. Similarly, images of different functions were readily accessible and related to their geographic locations. Consequently, links between existing images of the neighborhoods to their geographic locations and uses were established. Discussing locations of functions and images empowered understanding of the neighborhood.

For visualizing audience's ideas about the future development, a GIS image database contained examples of numerous developments near the neighborhood and of key developments throughout the city. Images that represented design examples and prototypes were used as anchor points for discussing development alternatives. As audience suggested solutions, the planner attempted to bring on the screen images closest to the audience's ideas. Design examples were used to prop the audience's ideas. For the artist, these images helped to inform memory about how elements look like. For the planner, images helped to assess the contextual fit.

Once participants arrived at agreement on an idea, the artist sketched it on paper. Sketches were immediately projected on a large screen. Computer images' screen and the artist's screen were

set side-by-side. This positioning allowed the audience to constantly observe how the artist modified images and incorporate them in the design. Everyone was potentially able to voice an opinion or concern. Such setting reinforced the visual environment and minimized reliance on jargons. Consequently, it reduced isolation. As the audience agreed on additional ideas, the artist further developed the sketch.

These processes were repeated incrementally to advance the artists' sketch. The artist included human figures in all stages of the drawing to keep the sketch on scale; i.e. human scale was used as the basic unit of measurement. When the artist completed the skeleton of the sketch, finely-grain issues were discussed. Participants suggested color, textures, and architectural details. Then the artist included these ideas and finished the sketch. The gradual built up of the artist's sketch reflected the public collective desire on how the neighborhood should change and how it should look like. Several sketches were developed following the same process.

The artist's facility to translate ideas graphically under pressure proved to be irreplaceable by machine. A computer could not play the artist's role who had to quickly translate collective ideas into graphic. Drawing under the direction of many people is a complex task. Responding to people ideas that constantly change proved to be challenging. The skills required to carry on these tasks were unattainable by the computer. Non of the present software possess the artist's facility of drawing at the direction of the audience at any point in the conversation. The power of talented artists using freehand sketches on the spot seemed to be unique. This suggested that traditional graphic skills are still most useful, relevant, and effective to represent collective ideas. Including the artist in public participation was invaluable.

On the other hand, the extended memory, provided by the GIS image database, was unattainable by human capacity; be it the artist, planner, or the public. Human's memory suffers serious shortcoming. People have different mental images about the same built environment and its components such as buildings, street, and plazas. Relying on human memory has frustrated people who have been involved in participatory design. Also, the artist was in a better position to incorporate ideas of the presented design examples on a screen rather than to rely solely on memory. Images helped the artist to gain confidence in sketching environmental elements. Furthermore, the audience and planners were better able to congressionally visualize the development of the design. In nutshell, the combination of artists' facility of drawing and the enormous image memory of the computer resulted in a collaborative environment that bridged some communication gaps.

Some disadvantage of this method must be mentioned. A classical disadvantage of prolonging the process was evident. As tools opened up possibilities and ideas, the process doubled the time. Another disadvantage was that time and effort required for building the image database were enormous. The price of visualizing neighborhood images, past, present, and design examples using the GIS exceeded the budget. One could simply ask; what would it be different if a slide projector were used instead of the GIS image database? Is the service of the GIS in projects of this nature ever needed? Is it worth the trouble? How much this tool improved public participation?

These questions are legitimate. Providing satisfactory answers require rigorous research. However, few advantages for using the GIS image database in the public process of shaping neighborhoods' images are apparent. First, visualizing images in their geographic context give participants and planners better perspectives and understanding of the context. Showing the location of images in the neighborhood or in the city helps to visualize spatial relationships that are unattainable by using a slide projector. By plotting on the map the locations of a particular architectural style, for example, we are able to show the density of such style, cluster, and pattern. Another advantage of the GIS image database is selectivity and interactivity. Unlike slides that are set in a predetermined path, the GIS image database provides real time pick and display capability. If one asked to see how a particular area looks like at any point in the conversation, it is readily doable.

In conclusion, for participatory design, this project suggested that a collaboration of traditional and GIS tools could be effective. Planners should carefully select the tools they use in public participation. Employed medium must be readily accessible to the public. Visualization seems to be a key for maximizing accessibility. A single medium of traditional or fully computerized may not be adequate for effective participatory design. Instead, a collaboration of traditional and computerized media may dramatically enrich public participation.

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# Assessing Public Participation GIS Experiences – Observations and Issues

Milwaukee provides an ideal laboratory to test and to evaluate the implementation of GIS tools as working components within community based organizations. The Data Center program of the Nonprofit Center of Milwaukee (formerly, Milwaukee Associates in Urban Development) has been a data clearinghouse and GIS service center since 1992. Through direct fees and through a grant to serve Community Development Block Grant agencies, the center has been serving more than 60 organizations each year.

The Nonprofit Center of Milwaukee has been able to provide comprehensive services responsive to the needs of community organizations by organizing the program as a part of package of services to nonprofit organizations who are members of the association. Community development objectives are critical to the Data Center design. Training programs, focus groups, extensive consultation, community internships and coproduction opportunities are a part of efforts to build organizational capacity.

I have grown increasingly interested in the question of how to evaluate community GIS services within the community development paradigm. I gave a presentation on this point at MIT in April and will speak to the issue at URISA in July. Often efforts by universities to help communities fail to have longer term effects because there is limited attention to these issues. As collaboration between universities and the Nonprofit Center of Milwaukee increases, I am also more aware of the cultural differences between these two environments.

With the commodification of GIS tools, to what extent will use become common place among laypersons? This question is being tested at many levels in Milwaukee. Experiences range from full empowerment of community organizations to use GIS as a routine tool, to more traditional provision of services at the request of individual organizations by staff with professional GIS skills, to preparation of reports that organize and analyze data for distribution to the community.

The most ambitious project began last winter. Six grassroots neighborhood organizations pooled their resources to pay a programmer to develop an MIS program for organizer based groups. This project has been dubbed – INIS – the "Integrated Neighborhood Information System". The MIS program is designed as a "CIS- Community Information System" with substantial links between client and member addresses and a property – parcel/ unit frame using City of Milwaukee data. The Nonprofit Center program has been assisting with design, training and support. ESRI has contributed Arcview software. The INIS program creates queries which can be mapped on a parcel file map base. Much of the support work involves organizing map layers and property information to fit well within the system. It is already clear that implementation will depend upon the individual response of staff within these small organizations. How can this degree of change become "institutionalized" within these organizations?

The Nonprofit Center is increasingly involved in community indicators efforts beginning in Milwaukee. This is best manifest by a partnership with the Milwaukee Health Department. The Nonprofit Center has been geocoding vital statistics and other databases to support the development of a "data warehouse" within the Health Department. The Health Department is interested in producing neighborhood health profiles – on prenatal care, infants, immunization, lead, children as victims of violence, etc. The challenge will be to structure access to this detailed information to help community groups to recognize the "local" character of these concerns. With programs addressing child violence and lead exposure, there will be a need to share detailed information with neighborhood based programs. Indicators efforts that end with undifferentiated annual trends do not provide the tools for program planning and implementation. A more complete and flexible access system is being developed – including protocols to address confidentiality concerns.

The Nonprofit Center has been providing free GIS services to Community Development Block Grant organizations for nearly three years. The growing capacity of some organizations to use this data well can be contrasted to other organizations where the use was entirely episodic – often stopping entirely when a key person left. Building the capacity for organizations to become effective consumers of maps and data may be more important than to expect a full technology transfer to these organizations as envisioned in the INIS model above.

Broadening the use of data and GIS tools requires attention to the technology, access to organized data, work with organizational environments, transfer of skills to professionals in other fields and a qualitative change in the political environment of community systems.

Community coalitions concerned for an advanced role for local stakeholders in public policy are perhaps the best allies in efforts to change the political climate. In Milwaukee there are several scenarios where organizations working collaboratively are seeking more comprehensive, information-driven approaches. Groups are working to implement neighborhood strategic planning, to find new solutions to community violence, to explore new approaches to housing redevelopment, and to mobilize neighborhood level assets to work with youth.

I propose to conduct a process level evaluation of the experiences in Milwaukee. There are three broad questions to evaluate:

What is the value of the results? Is information appropriate, accurate, "actionable" and a fit to local activities and priorities? Does it offer insight? Does it combine qualitative and quantitative information? Are outcomes different?

Is the process managed well? Can the work be replicated in a cost- and time-efficient manner that can be sustained by those who need the information?

Does the process support a community building agenda? Is the capacity of local organizations enhanced? Is access to information ensured? Does system wide collaboration around the organization and assessment of information increase?

My participation in the NCGIA Initiative 19 was an opportunity to participate in the conceptual development of the PPGIS paradigm. I have been involved in presentations, articles and actual testing of the opportunities and limits of the idealized model. This is an appropriate time to look more closely at experiences with implementation.

The challenges to implementation of the effective use of local data resources within a data warehouse and GIS environment will be magnified at the neighborhood level. This will be complicated by the additional constraints upon small neighborhood based urban organizations. The proposed followup meeting for this initiative is the critical one. I am particularly interested in participation from networks such as the Urban Institute National Neighborhood Indicators project, the HUD Community 2020 initiative, the "Information for Change" conferences in Minneapolis-St. Paul and the Association for Community Networking. Each of these organizations is just beginning to experience the difficulty with broadening the use of these tools.

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# Public Participation Applications of Metro GIS System

## Summary

Metro has developed a nationally recognized GIS and related socioeconomic information system known as the Regional Land Information System (RLIS). Over the course of an intensive public outreach and long-range planning process known as the 2040 Framework, Metro has put the power of the RLIS system into the hands of citizens. These applications have clearly illustrated the possible ramifications of land-use policy decisions in a map-based format that provides a vast amount of information in an accessible manner. This abstract will focus on three specific public participation tools that Metro has created using GIS.

## Background

Metro is the directly elected regional government that serves more than 1.3 million residents in Clackamas, Multnomah and Washington counties and the 24 cities in the Portland, Oregon metropolitan area. According to a voter-approved 1992 home-rule charter, Metro's top priority is managing the urban growth that the region is experiencing. The Growth Management Services Department is responsible for working with citizens and local governments to seta clear course for the region's future. Since 1991, Growth Management staff has implemented an intensive public involvement and rigorous planning effort for the next 50 years, called the 2040 Framework. The 2040 Framework is a series of policies and guidelines that will help the region's communities deal with the challenges of growth and enhance livability.

Regional Land Information System (RLIS) was created by Metro's Data Resource Center (DRC) which maintains a wealth of information about the Portland metropolitan region's land, population and economy. The center is part of Metro's Growth Management Services Department. RLIS and related socioeconomic information are at the heart of the DRC. RLIS has been in development since 1989. RLIS consists of Arc\Info coverages and grids with related databases.

The real strength of RLIS lies in its analytical capabilities. Each layer can be used by itself or in combination with other layers. This ability allows the user to produce new and unique layers and data bases from many combinations. Metro data and map coverages are seamless across the region, eliminating problems that arise from data gaps and overlaps at city and county boundaries.

## Applications

"URSA-matic" – Metro is required by Oregon land use laws to designate areas adjacent to the metropolitan urban growth boundary as urban reserves. Urban reserves are areas that are determined as the most appropriate places for urban expansion when the region falls short of a 20

year supply of developable land inside the existing UGB. Metro spent 16 months examining possible areas for urban reserve designation, called Urban Reserve Study Areas (URSAs) before selecting 18,600 acres as urban reserves in March 1997. As part of the analysis of URSAs, Metro created a tool, dubbed "URSA-matic", that merged GIS mapping information of the areas with a spreadsheet that allowed comparative analysis of the URSAs based on state-required factors for selection of urban reserves. These factors included: orderly and economic provision for public facilities and services; maximum efficiency of land uses within and on the fringe of the existing urban area; environmental, energy, economic and social consequences; retention of agricultural land; and compatibility of the proposed urban uses with nearby agricultural activities.

"URSA-matic" allowed planners, elected officials and citizens to compare the suitability of the URSAs by weighting the different factors in different ways. "URSA-matic" could be loaded onto a laptop computer and projected through a LCD projector so that groups of officials and citizens could test various scenarios "on the fly" in the course of meetings or hearings. The specificity of the application allowed citizens to learn whether individual taxlots were "in" or "out" of the URSAs and whether they were likely to be included or not in the final selection of urban reserves. Through "URSA-matic", citizens could understand and be part of the decision making process, breaking out of the traditional "black box" technical environment that involved planners, lawyers and elected officials.

Stream and Floodplain Protection Workshops – Metro recently completed a public outreach effort tied to new regional land-use policies on protection of areas along rivers, streams, floodplains and wetlands to protect water quality and reduce future risk of flood damage (in accordance with Oregon state land use goals). Metro created new data layers for RLIS representing protected areas where the new policies would be applied throughout the region. The public outreach effort included workshops conducted around the Portland metropolitan area to inform citizens about the proposed policies and how the policies would affect communities and specific properties in these protection zones. Metro staff loaded the desk-top version of RLIS, called RLIS-Lite, on to three laptop computers and set up "one-on-one" stations at the workshops. Citizens could sit down with a planner to look at specific sites and examine the proposed overlay zones. They were also given a hard copy map to take home with them. Additionally, both planners and citizens could fill out forms to request changes, with suitable documentation, to the maps if there were errors or omissions in the Metro data. Again, the decision making process was open to any interested citizen, not just technical and elected officials.

MetroMap – MetroMap is a simplified version of the RLIS Lite data base provided to the public on Metro’s website. The application displays layers of geographic information and be viewed and printed individually or in combination by anyone who has internet access and a web browser. Boundary information can be generated in a list form and includes the following major categories:

> Political Findings (such as county, municipality, urban growth boundary, reserve areas and voting precincts boundaries),
>
> Community Findings (such as neighborhood and school district boundaries),

Environmental Findings (such as 100 Year Flood Plain, wetlands, steep slopes and watershep basin boundaries), and

Infrastructure Findings (detailing garbage hauler information).

MetroMap helps Metro to communicate to constituents a better understanding of "their geography" including landform, urban form, jurisdictional boundaries and critical services such as solid waste disposal. The website address for MetroMap is: http://www.metro-region.org/metromap

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# Mapping Philadelphia's Urban Neighborhood

Like other large American cities that were built on a manufacturing economy, in the last 50 years Philadelphia has lost hundreds of thousands of jobs and people. A growing percentage of its population is living in poverty in neighborhoods that are filled with vacant buildings and trash strewn lots. Poverty and the attributes of poverty such as lack of education, unemployment, crime, and drugs are a barrier, making the people who live in these neighborhoods marginalized communities. For the last five years, the City of Philadelphia has been working to bring GIS technology to activists and planners in these neighborhoods, hoping to initiate with them a Public Participation GIS. While successful in generating enthusiasm for the applicability of GIS for this purpose, use of the technology in the neighborhoods is still minimal.

A 1995 paper by these authors documented a project sponsored by Philadelphia's Office of Housing and Community Development (OHCD) to give PCs, GIS software (ESRI's ArcView), data, and training to six neighborhood organizations called Community Development Corporations (CDCs). The vision was that, by now, scores of neighborhood planners and interested citizens would be sitting at PC's in the CDC offices using GIS to both query the information regarding the particulars of their environments and to perform "what if" scenarios to assist with strategic planning. This has not come to pass. If bringing that vision to reality were the only measure of the project's success, it failed. But it did not fail; it changed. The 1995 paper particularly focused on the limits of existing mapping techniques and symbology for mapping urban neighborhood environments.

This problem still exists. There are no standards and no "symbology vocabulary" for mapping features of urban neighborhoods in the way that exists in cartographic tradition for road maps or maps of natural features such as hills or grasslands. With or without GIS technology this limits the effectiveness of the maps. However, this was not the reason why the CDCs are not successfully using GIS. The more profound problem was that the skill level needed to manage and analyze the spatial and attribute data using the GIS software just did not exist in the CDCs and these groups could not afford to allocate any more of their meager resources for mapping.

New technologies, which allow GIS to be deployed over the Internet, had an impact on both of these problems. This technology allows the data to be managed centrally and an interface, which is much easier to use than PC based GIS software, to be created. The user, who has tools to pan and zoom to various extents on the map, can create maps by turning on and off preset map layers. Since the themes, symbology and classifications will all be pre-set and unalterable, they will de facto become standards. Since the data is managed centrally and the interface is user-friendly the need for GIS skills in the CDCs is eliminated.

However, the new technology introduces other problems and brought our attention to the fact that there were really two different types of systems which we distinguish as Public Records GIS and Neighborhood Planning GIS. Public Records GIS is the distribution of data that is recorded by the City or another government body in the course of administering its functions such as recording a property's change in ownership, or data that it collects for a purpose such as the Census or crime statistics. A Public Records GIS has a preset interface which would allow a user to view the data in various aspects and perform certain preset analyses but the user does not have wholesale access to the data and GIS software tools.

A Neighborhood Planning GIS needs to incorporate all the data of a Public Records GIS and it needs two additional aspects: community-based data and the facilities for manipulating and analyzing the data. The things of value in a neighborhood such as architecture or home grown community gardens, as well as the things of negative value such as garbage-strewn playgrounds and crack houses, are not line items in a city database. In order for neighborhood planners to effectively portray neighborhood features they need local data. They also need the ability to manipulate the data as part of the planning process. They need to be able edit the data to show the impacts of changes in the neighborhood. And they need access to the whole gamut of GIS tools for analysis and display.

While both of these systems have usefulness to marginalized communities, there are problems with each in terms of meeting the needs of Philadelphia's CDCs. This paper documents the progress of the City's continued efforts to give its neighborhoods access to its GIS resources and the impact on that effort of new technologies. Our theme is that although the City may now be in a much better position to distribute its GIS data through less expensive easier to use interfaces, the difficulties of effectively mapping urban neighborhoods still exist.

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# A GIS for Nuclear Emergency Response: The View from Oswego County, New York

In the aftermath of the Three Mile Island (TMI) accident (March 28, 1979), the Nuclear Regulatory Commission (NRC) adopted new emergency planning procedures. As a result, current population evacuation plans are based on the concept of Emergency Planning Zone (EPZ), an area that covers a 10-mile radius around a nuclear plant. One issue raised by the new procedures concerns the response to the accident of the people living in the EPZ. It has been shown (see, for example, Lindell and Eartle, 1983) that the public's perception of nuclear risk differs considerably from the experts' perception in the sense that most people tend to view nuclear accidents as more likely to occur and more drastic in their consequences than do nuclear experts. This disparity in perception suggests that people living close to a nuclear plant tend to overreact to an accident, and leave the area when not directed to do so. This was the case in the TMI accident, when almost 150,000 people chose to leave the area even though no formal evacuation order had been issued (Slovic, 1995, p. 466).

To explore how people would react to a nuclear accident, I surveyed residents in the EPZ of the Nine Mile Point nuclear complex, located in Oswego County, New York. Between September and December 1997, I mailed out two surveys to a sample of people living in the EPZ. The surveys asked residents how they would react to accidents of different magnitudes. To account for variations in residents' responses to different accident scenarios, I also included questions related to the socio-demographic and risk perception characteristics of the respondents.

The most important findings indicated that in general people were not familiar with the county's emergency plan, were not aware of the health consequences of an accident, and tended to disobey emergency planners' directives. All three findings point at one major problem in the management of nuclear risk in Oswego county, namely, the communication to the public of the hazards of nuclear energy production. Once a year, the county sends all residents of the EPZ a booklet describing the procedures that will be taken in the event of an accident at Nine Mile Point. Clearly, this effort is not working as planned and hoped. One problem is that the booklet is a unidirectional communique, from the "experts" to the "people," with little or no input from those living in the EPZ. The attitude among the planners is that there are too many "misconceptions" about nuclear energy production, and that the public needs to be educated. They have little sympathy for the public's fear of an accident, which they regard as highly improbable if not impossible.

The GIS can help overcome the lack of communication between experts and the public, and improve the understanding between emergency planners and people in Oswego County. In this sense, I believe my research plan fits well into the scope of the Initiative on PPGIS. In particular, the GIS implementation I am working on relates to at least two of the topics for the conference, namely:

*Risk Analysis* 3-4(1983): 245-253.

Slovic P., “Risk Perception and Public Response to Nuclear Emergencies”, in D. Golding, J.X. Kasperson, R.E. Kasperson, eds., *Preparing for Nuclear Power Plants Accidents*, (Boulder: Westview Press, 1995): 449-475.

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# Community-Integrated GIS for Land Reform in Mpumalanga Province, South Africa

## 'Community-Integrated' GIS

Community-Integrated GIS (CIGIS) seeks to broaden the use of digital spatial data handling technologies with the objective of increasing the number and diversity of people who are capable of participating in spatial decision-making. This necessitates that the *production* of GIS is made inclusive. As a result, Community-Integrated GIS:

- is likely to be agency-driven, but it is not top-down nor privileged toward conventional expert knowledge
- assumes that local knowledge is valuable and expert
- broadens the access base to digital spatial information technology and data
- incorporates socially differentiated multiple realities of landscape
- integrates GIS and multi-media
- explores the potential for democratic spatial decision making through greater community participation
- assumes that spatial decision-making is conflict-ridden and embedded in local politics

CIGIS recognizes GIS as an 'expert' system but tests the capacity of the technology in the context of people and communities normally peripheral to spatial decision-making processes and politics. In this respect, a CIGIS would contain not just the cartographic and attribute information traditionally associated with GIS but would be expanded to become a forum around which issues, information, alternative perspectives and decisions revolve. The difference here would be the explicit integration of a community's knowledge and involvement into the system rather than a system that is essentially 'external' to a community. A community-integrated system should be 'issue-driven' in that local knowledge, concerns, desires, and wishes are actually incorporated and embedded as layers or objects in the GIS: a GIS equivalent of a New England town meeting. In this form the GIS provides an arena in which the politics and conflicts of spatial decision-making are played out openly though such open forum GIS have the potential to raise all kinds of concerns regarding individual rights and confidentiality.

Community-Integrated GIS should be capable of incorporating information and knowledge in alternative forms that are not dependent on the map as the sole mode of representation. Much has been written about the privileged position of the cartographic map and the dominance of spatial primitives in the representation of geographic information. The technical capability now exists to combine GIS to other forms of representation as well as to other media. Linking narratives, oral histories, photographs, moving images, and animation, to GIS provides enormous capability to increase not only the richness and diversity of the information available but more

closely parallels the ways in which communities know or conceive their space. The linkage between GIS and multi-media systems is an obvious connection in this context and holds considerable potential for extending the knowledge base of GIS.

There are obvious questions regarding not only the construction of a Community-Integrated GIS but also its sustainability. We do not assume that all communities would want, nor indeed warrant, a GIS. Such systems would not be applied universally but selectively, contingent upon a mix of social, historical, and political factors. The Internet and the availability of interoperable GIS and media systems, along with initiatives such as the NSDI spatial data clearinghouse, will increasingly rely on the Internet as a means of accessing and enabling distributed GIS and will provide empowering conditions for community access discussed above. However, we assume there will continue to be resource and humanware issues to overcome. What we are proposing therefore, is not a complete replacement of existing agency responsibility for local GIS but a redefining of what such systems might 'look' like and how they might be extended into communities for greater public participation and ownership.

**A Case Study from Mpumalanga, South Africa**

The Mpumalanga project is a collaborative effort with the South African Department of Land Affairs (DLA) and contributes toward participatory land reform. The project seeks to maximize the participation of a diversity of communities in GIS production by drawing on relevant experiences, perspectives and skills. Participants include: land reform beneficiaries; non-beneficiaries of land reform from the former homelands; white farmers; black farm workers; chiefs and their patrons.

As part of this study several critical research issues are being pursued as they impact land reform:

1. *The historical geography of forced removals*: The key issue here is to broadly identify sub-regional histories of forced removals and to better understand overlapping land claims.

2. *Differential perspectives on land potential*: Land users have differing perspectives on the criteria and location of 'high', 'medium', and 'low' potential land. This is dependent on the local community's own perception of what land potential means and how land should be used.

3. *Socially appropriate and inappropriate land use*: We are concerned here with understanding land use from the perspective of peoples' needs and to go beyond the very narrow focus on need from a 'market-led' perspective. This includes identifying and questioning the use of state land, underutilized land, the inappropriate location of forestry or other land uses on high potential land, as well as perspectives on land for game tourism.

4. *Politics of access to natural resources*: This issue explores access to land, water and biomass as social and political processes.

5. *Identification of areas where land reform should take place*: The purpose here is to better use local knowledge in the identification of potential land reform projects. At present, willing sellers (at often-inflated prices) are dictating where land reform can take place.

6. *Participatory land use planning*: Land reform beneficiaries and potential beneficiaries produce their own land use plans.

The research methodology combines traditional GIS with qualitative and participatory methods.

## I. Production of Traditional GIS Coverages

These include: hydrology and dams; transportation; contour and elevation; land cover; nucleated settlement; land types and land quality; political and recreation boundaries; cadastral; state and public lands; forestry plantations and species type.

## II. Participatory Mental Mapping

Participatory mental mapping involves the use of tracing paper overlaid on topographic map sheets and GIS map products. Each social group is interviewed, and their views about the key questions are recorded. The local people themselves undertook the selection of group members after the mapping procedures were explained. Groups of men and women were interviewed separately. The mental mapping exercises were taped and are being transcribed. Video recordings and photographs were also taken. This information is being integrated into a GIS multi-media system which provides an innovative tool for decision-making around land reform.

## III. Participatory Land Use Planning

After completion of the mental mapping, participatory land use planning exercises were undertaken. The groups were asked to draw a map of how they would like to see their land used if they had access to land in a land reform program. This exercise primarily involved three types of residents of the former homelands:

(a) participants who have already benefited from the land reform program.
(b) participants who have submitted their claims and are yet to benefit.
(c) non-beneficiaries.

## Conclusion

Community-Integrated GIS assumes that specific GIS applications proceed with active community consultation. It compares and contrasts ‘expert’ and ‘local’ understandings of local and sub-regional landscapes. Furthermore, it is assumed that one important objective of community-integrated GIS is to facilitate socially appropriate land use. The concept of CIGIS assumes the contradictory nature of the technology and the political economy of data, hardware and expertise access. It is an attempt to more realistically conceptualize how GIS might support the struggles and aspirations of participating communities.

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# Methodology Matters: Designing a Research Program for Investigating PPGIS in Neighborhood Planning

Knowledge is built on a body of evidence. This body of evidence results from analyzing, comparing, and synthesizing sets of empirical findings. This paper discusses a concept-driven attempt at empirical research in group use of GIS, specifically geographic visualization in neighborhood planning. Systematic, practical and applicable research regarding the use and role of GIS as adopted and adapted by different and diverse group participants in various stages of a live planning process could benefit future collaborative neighborhood planning efforts, as well as enhance our understanding of Public Participation GIS (PPGIS) processes and products.

Public participation and empowerment are central to urban planning. If the use of GIS is an effective means for facilitating, increasing or enhancing meaningful participation and individual and community empowerment (as is oft asserted), then this is something planners (among others) ought to know, understand and actively encourage. This pilot study of GIS use in a Seattle neighborhood's planning process is a step in that direction. Objectives included: first, the development and testing of an appropriate research program to explore the linkage(s) between GIS/visualization, participation, empowerment, and collaborative decision making; and second, the development of a classification scheme of visualization aids organized by their purpose and use in planning processes. This paper discusses the first objective.

Visualization is at the heart of this research. Drawing on the work of DiBiasi and MacEachren, visualization of geographic information is interpreted as a process ranging from personal to public, and one of exploration, analysis or communication. These interpretations are important because a majority of urban planning information is spatially related or inherently geographic; interpretations also influence the design and function of GIS (as a tool or process of exploration, analysis and presentation), and shape our understanding of how and why people use GIS or other spatial decision aids.

Effectively visualizing information is especially important within a collaborative planning context. First, there are multiple participants, which as individual citizens or as organizations' representatives, can be categorized as concerned citizens, experts and technicians, or decision and policy makers. Depending on previous life experience, multiplex identity, and expertise (with the decision making/planning process, the decision/problem at hand, or interaction with information technology), each participant may perceive and employ visualization differently. Second, participants refer to places in temporal terms (i.e., past, present, and future). Visualization should support temporally oriented discourse. Understanding the range and diversity of visualization is a key to understanding participation and empowerment in neighborhood planning.

Interpreting PPGIS as a variation of Spatial Decision Support Systems for Groups (SDSS-G), this study benefited from previous research in Group DSS and SDSS. Enhanced Adaptive Structuration Theory (EAST), an emergent framework based on a structuration model, governed the research. EAST assumes that the uses and effects of technology emerge based on complex social interactions among its users, and that groups are organized around practices that are task-related and social in character. Decision processes previously treated in the literature as intelligence, design, and choice are (re-) interpreted as the process aspects of: 1) convening a collaboration, 2) collaboration as a group process, and 3) collaborative process outcomes. Convening constructs are appropriated during the collaborative decision making process; this in turn influences group processes, leads to emergent sources of structure, and ultimately leads to decision outcomes and new social structures. Seven theoretical premises relate the framework's constructs; these premises can be interpreted as research questions or further refined as hypotheses. The constructs themselves and their constitutive characteristics can be seen as meta-variables and variables. In addition to the initial premises, research questions, decision context and domain, a research program is also defined by the level and unit of analysis, meeting venue, choice of research designs, and specific data collection techniques. Each is briefly discussed, along with validity and triangulation.

The planned research program for the pilot study is presented, followed by a discussion of implementation problems. Of those, the lack of researcher distance and objectivity was the most damaging. In this pilot, active participation replaced observation. Inspired by the notion of praxis, this researcher consciously traded the objective demands of scientific study for the opportunity to assist, which included serving as de facto GIS work session facilitator, project coordinator, and all-around technical support for planning participants. While such participatory activity may appease the community activist within, it does little to further this research project in the eyes of the academic community. As a consequence, this pilot project was judged both a failure and success.

To be sure, there is a story to be told, and there is plenty of evidence to tell it. It is a story of neighborhood residents individually and collectively participating in the process of geographic visualization to explore, discover, analyze, understand, and communicate; it is a story of neighbors coming together to share ideas and concerns, reach consensus, and forge working partnerships. It is a story of individuals working collaboratively and establishing connections that might develop into lasting relationships. It is a story about social and physical community building, and empowerment. Alas, the story is not "valid." It is only anecdotal.

Between the loss of validity and the expression of activism, there must be a valid yet meaningful middle road. Finding that research path is one of the major challenges for future research. This student researcher is convinced that to meaningfully further PPGIS research in a neighborhood planning context, the traditional positivist influence and the orthodox scientific method of research should be replaced with a critical social perspective and a research program informed by participatory action research (PAR). This approach would permit one to help participants help themselves learn more about neighborhood planning and collaborative decision making, use GIS and other visualization tools, and seek answers to pressing research inquiries that they themselves generate. Indeed, PAR would ensure that real issues – such as public participation and empowerment - are made explicit, and that explicit steps would be taken to encourage and

enhance them. This need not result in sloppy social science or shoddy geographic science; a well-planned and faithfully implemented PAR-derived research program could satisfy the demands of both the academic and neighborhood communities.

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# Geographic Information Technologies and Community Planning: Spatial Empowerment and Public Participation

Public participation has long been recognized as an important component of the community planning process. A legislative requirement for many public-planning activities, pursuit of meaningful public participation is a mainstay of the planning profession. Community planning is a spatially oriented activity that focuses on many forms of geography (landforms, parcels, structures, and other geographic units, i.e. census tracts). The spatial nature of planning offers an opportunity to use automated geographical information processing systems to enhance participatory activities. The most powerful of these tools is the geographical information system (GIS); the use of GIS to support the community planning process is becoming more common in many communities.

Despite the power and promise of GIS, citizens who attend planning meetings often experience difficulty understanding the spatial relationships portrayed on maps, plans, or projection screens. This occurs regardless of the media (paper or digital) employed. The resulting frustration leads to miscommunication and mistrust amongst all stakeholders including citizens, developers, planners and politicians. Spatial cognition, the knowledge of local geography, can be improved through the use of GIS. As with any computer technology, however, information from the "black box" is often viewed with suspicion and doubt. The use of sophisticated GIS alone may not engender the trust and consensual participatory environment that fosters a representative planning process.

Geographers and planners have begun to consider the practical and societal impacts of using GIS to support public participation (NCGIA 1995, 1996). Under a research initiative entitled Public Participation GIS (PPGIS), their focus is typically traditional GIS[i]. Planners have developed several public participation techniques to elicit public involvement and facilitate public discourse about planning issues. These techniques range from media campaigns and public meetings to design charettes and simulation exercises. Shiffer (1992, 1995), and more recently Hundt (1997) and Pieplow (1998) have demonstrated that several other geographical information technologies (GIT) are capable of delivering audio/visual and multimedia presentations in support of traditional public participation techniques. Arguably these other information technologies are geographic communication tools rather than GIS; however participatory planning is a communicative process. Their ability to convey spatial information and their compatibility with traditional public participation techniques are worthy of research.

Forester (1989), Innes (1995, 1998), and others suggest the emergence of communicative action theory as a paradigm of planning practice. A key assumption of this theory is the formation of a communicatively rational process that is based upon the principle of an ideal speech situation. The ideal speech situation assumes the equitable dissemination of information that can be validated through examination of "speakers claims" (Innes 1998 60). The ideal speech situation enables stakeholders to be empowered through a discursive process that fosters a common

understanding of planning information. Communicative action theory may offer a theoretical framework for researchers to consider issues such as empowerment and marginalization that result from participatory applications of GIS and other GITs.

Given the spatial nature of planning information, combinations of geographic information technologies (GIT) and public participation techniques are capable of "spatially empowering" the planning process. Spatially empowered stakeholders' posses a better understanding of local geography that enhances the discourse necessary for collaborative decision making. Based upon his personal experiences as a professional community planner, the author assesses the ability of several GITs to spatially empower public participation techniques. Using a table wherein the techniques are arrayed against the technologies, subjective assessments are made to initiate consideration of the appropriate uses of GIT with common participation techniques. The author concludes that the criteria needed to make these assessments, and ultimately the design of a communicatively rational participation program should be the subject of research based upon case studies of several applications.

The need for research and case studies with GIT is timely. As information technology advances, there are corresponding public expectations of its application in participatory activities. In Amherst, New York (a suburb of Buffalo), GIT has been successfully used to assist with planning and policy activities. Three applications of GIT supporting: zoning reviews; park planning activities; and wildlife management are presented to demonstrate how participants were empowered by improving their spatial cognition. When considered in the context of communicative rationality, these applications demonstrate how GIT and public participation techniques helped to create an ideal speech situation that enhanced the ability of stakeholders to participate in the formulation and implementation of Town plans.

There are a variety of information technologies that possess the ability to convey spatial information, however, their use can lead to frustration and mistrust. Similarly planners can employ many public participation techniques to involve stakeholders in the planning process, however without an adequate understanding of the local geography their participation may be confused and their input ineffective. What is needed is participation programs that:

1. spatially empower the participation process by employing appropriate geographic information technologies; and
2. employ those technologies with public participation techniques that enable spatially empowered stakeholders to engage in meaningful discourse about planning issues.

Employing geographical information technologies with traditional public participation techniques adheres to the tenets of communicative rationality by encouraging an ideal speech situation. Spatially empowered stakeholders engaging in an ideal speech situation experience meaningful participation and advance equity in the community planning process. Forester's (1993) adaptation of communicative action theory for planning provides a useful framework for consideration of PPGIS and its impacts on society.

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

This paper is based on work that was conducted whilst working with the People and Resource Dynamics Project (PARDYP), at the International Centre for Integrated Mountain Development (ICIMOD), Kathmandu.

## Introduction

Community Forestry is one form of 'social' forestry, that has its roots in the change in development theory from industrial forestry towards local level forestry, geared towards the subsistence needs of local communities. It is a classic example of the transition from top-down development to bottom-up people orientated forestry. It has been said that community forestry has more to do with people than trees, 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:

- 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 economic Non Timber Forest Product's (

These information needs do not replace the need for social information, but extend the range of information that has to be collected, analysed, and collated. It makes the task of feeding this information back to the FUG, in a manner that can be fully understood and is of the most benefit to them, more complex.

A PPGIS is felt to be an ideal way to collate, examine and aid dissemination of the information. The construction of the GIS database is not considered to be as important an issue as identifying

the community information needs, the means of collecting the information, and how to meet the information needs.

**Objectives**

1. Identify information needs. This uses the classic RRA techniques of focus groups, semi-structured interviews, group walks and participatory mapping.
2. Obtain the necessary information using general participatory techniques, geomatics techniques (participatory photo mapping, participatory GPS), and participatory inventory techniques.
3. Analyse information and present it in a format and language that is appropriate for FUG's.
4. Feed it back to FUG's and determine the usefulness of the information to them.
5. Examine the potential and problems of the PPGIS as an empowerment tool for FUG's.

**Participants**

The key participants of this work are FUG's in the Yarsha Khola watershed, Dolakha District of Nepal. There are a variety of ethnic groups, including Brahmins and Chettri in the lower altitudes and Sherpas at higher levels. An FUG's is a representative bodies 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.

It should also be noted that this work also looks at the information needs of other stakeholder groups, including the DFO, National policy makers, and international monitoring organisations. The PPGIS is designed to provide information to all these diverse stakeholders, at an appropriate level.

**Methods**

The methods are broadly covered under objectives, but combine the use of social science participatory techniques with geomatics technology and participatory assessment procedures. The methodology is interdisciplinary, and on the interface between social approaches to community forestry and more traditional quantitative techniques to resource assessment. This is regarded as an essential approach owing to the increasingly demanding and diverse information needs for community forestry in Nepal. 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 beleived that a PPGIS is fundamentally dependent on obtaining community needs, perceptions and ideas.

**Progress of PPGIS**

The information has been collected and entered into the PPGIS, which is now functional as a 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. Files can be called up for each internal compartment that have information on the sustained yield, recommended management practices, community uses and importance of that part 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. For the FUG's who have no access to IT, the appropriate images and management information are used to form the basis of a visual report which the FUG committee can use for its forest management. Feedback on these reports has been received, which will be discussed.

Overall, this paper will discuss an interesting, and generally successful, application for PPGIS. Issues such as the lack of access to GIS for FUG's, and the limitations and potential problems posed by this will also be discussed. Additionally, this paper presents a systematic methodology for developing a PPGIS, and provides an indication of potential means of evaluation for a PPGIS.

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# Using GIS to Empower Community Based Organizations in Hawaii

Hawaii provides an interesting place to examine politics and power relationships arising from the use of GIS technologies. As an island setting, isolated from other communities, it is perhaps easier to trace the development of an innovation such as GIS and to identify how systems have been designed, implemented, and used. Because of a highly evolved planning regime including state and local land use laws, environmental impact assessment procedures, coastal zone management regulations, locally elected neighborhood boards, and other planning apparatus, GIS has been widely embraced. Hawaii is a culturally diverse environment, containing a mix of high and low density urban, rural, and suburban development. Examples of public, private, and non-profit sector uses of GIS in Hawaii are summarized. Government in Hawaii has played an important role in initiating GIS through strategic investments in hardware, software, databases, as well as efforts to standardize collection and use of spatial data At the same time, large landowners, developers, utilities, and various non-profit organizations have also developed their own systems using a combination of public and proprietary data.

This paper consists of three parts. First, a survey of GIS uses in Hawaii will be conducted. The survey will serve two purposes: 1) to present an overview of typical applications in Hawaii; and 2) to summarize who has access to the technology and control over uses of hardware, software, and databases. Second, three case studies involving the development and uses of GIS will be conducted. Third, the role of GIS in community empowerment in Hawaii will be assessed, focusing both on the overview of its uses as well as on the specific findings arising out of the three case studies.

The University places an important role in facilitating the diffusion of GIS technologies through training and education, development of appropriate methods and applications, and serving as a clearinghouse for data. The University also occupies a unique position in terms of its ability to leverage and acquire resources for GIS. Issues such as hardware, software, data use, confidentiality and release of sensitive information, as well as standard concerns regarding the quality and accuracy of information arise within the context of public participation and community empowerment. Efforts to work with marginalized groups in Hawaii, including Native Hawaiians; communities opposed to development or siting of unwanted land uses, and environmental groups demonstrate the nature of conflicts and agreements over the intended and actual uses of GIS technologies and data.

Empowerment through GIS technologies raises many important considerations for communities. How are community interests defined? Who really has access to GIS technologies? How much of the technical knowledge pertaining to mapping (scale, projection, addressing, accuracy, etc.), GIS, and related technologies (e.g. GPS) can be communicated throughout the community? How is knowledge and understanding conveyed between parties who have divergent socio-economic, cultural, and ethnic backgrounds? What is the appropriate role for technical experts, consultants, special interest advocates, GIS industry representatives, and others drawn into a

specific, contested space? Perhaps answers to these questions might be found by examining three different cases in Hawaii where GIS technologies have been utilized in efforts to empower community groups.

In Hawaii, community-based traffic safety programs have provided an important way of introducing mapping and GIS technologies into the community. In addition to providing resources for mapping and identifying problem areas, these programs have also enhanced efforts to promote alternatives to driving, to reduce traffic speeds using strategies such as traffic calming, and to promote more village-scale design of walkable communities.

Protection of endangered plant and animal species has been an important concern in Hawaii, not just for the public and environmental groups, but also, increasingly for many of the large private landowners in Hawaii. Several different stakeholders including the Department of Land and Natural Resources, State of Hawaii, the Nature Conservancy, and various landowners have invested heavily in GIS technologies. Issues related to development, resource extraction, and long-term management of land demonstrate not just how GIS technology has evolved, but also how some of the issues regarding proprietary data, data sharing, and uses of data have been resolved. While the state government maintains a GIS-based environmental hotspots database, other GIS applications to support logging activities, re-zoning and development of conservation lands, and other commercial interests persist.

There are many different struggles that pit the community against developers in Hawaii. Recent cases involve golf course and resort development, the siting of prisons or other objectionable land uses, and other projects often have involved the uses of GIS technology. The electric utility in Hawaii has announced plans to install 100-foot tall transmission towers carrying high voltage 138 KV transmission lines through residential areas. GIS technologies have been used by both the utility in the preparation of an environmental impact assessment and by community groups opposed to the project. An examination of how the utility has used GIS and the community response reveals both "state-of-the-art" practices and how communities can balance power relationships with GIS.

These three cases provide interesting, yet different views of how PPGIS are designed, implemented, and used in Hawaii. While there may be a relatively high degree of agreement over the uses and benefits of a GIS to enhance safety and quality of life in neighborhoods, conflicts intensify as the interests of either regulatory agencies versus developers or utilities and communities widen. In a pluralistic society, with increasingly divergent viewpoints, it may be difficult to reach agreement over how GIS should be used and by whom. Also, when the stakes are great, issues regarding accuracy, quality, and appropriate uses of data become increasingly prominent. Community access to GIS, however, may help to balance power relationships both by providing a new means of critiquing plans and studies, but also in developing reasonable alternatives not yet on the bargaining table.

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# Web Based GIS for Public Participation Decision Making in the UK

Current research examining the potential of the World Wide Web (WWW) as a means of increasing public participation in environmental decision making through the use of the internet is discussed. Example on-line spatial decision making systems in the UK have been developed using real environmental decision making problems. Many GIS have appeared on the Web (Carver, in press) in recent times although the level of functionality among them is variable ranging from simple demonstrations through to more complex on-line GIS and spatial decision support systems. This research has identified key threads developing in this area and a case study example of an on-line PPGIS from inception to its final phase in a public participation process has been undertaken.

By providing access to appropriate data, spatial planning models and GIS via user friendly web browsers the WWW has the potential to develop into a flexible medium for enhanced public involvement in the planning process. In order to achieve increased levels of involvement in environmental decision making the public need to be provided with systems which allow them to create virtual spaces. Such systems should allow participants to proceed through the following four-stage model:

1. explore the decision problem;
2. experiment with choice alternatives;
3. formulate one or more decision choices; and
4. provide feedback and evaluation of the system.

This kind of approach, essentially ‘What if?’ scenarios, are fundamental to many analyses undertaken by a GIS. With this in mind web based GIS should also be capable of allowing the user to:

1. test basic theories/hypotheses regarding their decision alternatives;
2. develop decision models and/or pathways applicable to the decision problem; and
3. approach consensus and/or compromise through comparison and trade-off with users’ ideas.

As decision alternatives are identified and feedback in both directions builds up continuous changes are likely which will be of benefit to the system as a whole and improve the ability to maximise final decisions. The research being undertaken through the use of Virtual Decision Making Environments (VDMEs) which mirror the functionality of traditional participation methods have been tested. The design of the systems revolve around a Java map application called *GeoTools* which allows the user to perform simple spatial query and attribute input operations. Using this Java map applet, users can view a map of a village, perform zoom and pan operations to assist in visualisation and navigation, ask such questions as “what is this building?”

and “what is this road?” (spatial query) and then make suggestions about specific features identified from the map (attribute input).

The research outlined here is on-going and several important issues concerning public access to the WWW are possibly more important than the actual ability to develop systems which the public can understand and use. It needs to be recognised that access to the WWW is still relatively limited in the UK although the potential for increasing this appears to becoming a reality. If planning authorities and other decision making organisations wish to see an increase in public participation they have to realise the need to provide facilities whereby the general public can gain access.

Further questions are often raised about peoples understanding of maps. Many studies have investigated the way people perceive and relate to information displayed on a map and how maps can interpret and display information in different ways (Keates, 1996, Wood, 1993). Evidence from this research so far has suggested that this has not been too much of a problem. It is suggested that in particular planning problems and policy formulation processes participatory on-line systems will become a useful means of informing the public and to allow access to data and planning tools such as on-line GIS as an additional means of public participation in the planning process. These will provide mechanisms for the exploration, experimentation and formulation of decision alternatives by the public in future planning processes and have the potential to move the public further up the participatory ladder.

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## The Praxis of Public Participation GIS and Visualization

Recent interest in GIS and Society has focused attention on Public Participation GIS (PPGIS) conceived broadly as an integrative and inclusive process-based set of methods and technologies amenable to public participation, multiple viewpoints, and diverse forms of information. A closely related research topic is Public Participation Visualization (PPVIS). Visualization is defined as map use involving high human-map interaction wedded to exploratory analyses. Rapid advances in technology - and the World Wide Web (WWW) in particular - is allowing a much broader array of users to engage in visualization-type map use. Users not only access geographic information, but can interactively explore 'what if' scenarios and amend and add information to publicly accessible WWW sites. My work on Public Participation GIS (PPGIS) and what I am calling Public Participation Visualization (PPVis) consists of two interrelated parts. First, I discuss a prototype PPGIS / PPVis WWW site developed with ESRIs Map Objects and Internet Map Server. My second, and more general goal is to begin to delineate a praxis a theorized practice of PPVis and PPGIS. This involves an explicit awareness of concepts and theories of information, its representation, of people, social relations, and power, and how these shape and are shaped by socially-infused technologies such as PPVis and PPGIS.

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# Promoting Local Community Participation in Forest Management through the Application of a Geographic Information System: a PPGIS experience from Southern Ghana

The expansion of Geographic Information System's (GIS) applications into communities outside Western industrialized nations and the increasing use of the system to tackle issues of interest to underprivileged groups in society present a great challenge to GIS practitioners. In particular, the implementation of Public Participation GIS (PPGIS) projects in rural communities in sub-Saharan Africa and the developing world in general, raises concerns over several issues. There are adaptations that need to be made in current GIS methodology to facilitate integration of the knowledge of PPGIS target groups in the region into mainstream GIS practice. There are also unsettled issues about empowerment of the communities and the establishment of safeguards to ensure full participation of local people in PPGIS projects. This paper explores the above issues and other obstacles to PPGIS practice imposed by the culture and belief systems of target communities. The discussion is part of the presentation of results of a PPGIS project that was implemented in three rural communities in Southern Ghana. The study was undertaken to facilitate the establishment of collaborative forest management institutions in the country. A description of the GIS-based methodology designed for the project is followed by a detailed account of how the project was implemented in the three communities. The findings of the study and lessons drawn from them are then presented and discussed. The results showed that the system promoted the search for factual information during deliberations thereby reducing speculation in discussions held among representatives of different interest groups. The GIS maps also placed topics under discussion into proper contexts as they helped merge the different thoughts of discussants into a common shared vision of the issues. Ultimately, the system provided opportunities for resolving conflicts and building consensus among the representatives. These contributions notwithstanding, the attitude of local elite, cultural and traditional practices of the people, unequal representation and participation of women and lack of local GIS experts could hinder the successful implementation of PPGIS projects in the country.

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# Marginal Societies and Geographic Information Systems

This paper addresses two specific aspects of the use of geographic information systems (GIS): equity and access. In addressing these two areas, three case studies are described: two of these case studies are concerned with the development of culturally relevant GIS for communities in New Zealand (the Maori communities of Panguru, Pawarenga and Whangape in Northland, New Zealand) and the United States (Arapahoe-Shoshone Indian Nations of the Wind Rivers Reservation, Wyoming); the third case study discusses training K-12 teachers for using GIS in the classroom (Poudre School District, Ft. Collins, Colorado).

Local knowledge is increasingly recognized as critical to resource management issues but has not been adequately integrated into management strategies. The two case studies involving indigenous peoples contribute to current work being conducted internationally to include indigenous biological knowledge within the Western framework of computerized knowledge systems for resource management. Additionally, these project explore the different types of geographic information that is derived from explicit cultural groups. An important thrust in recent geographic literature is environmental equity for disadvantaged and marginal populations. Increasingly, technology is a critical factor in allowing access to decision-making through the use of GIS and information systems for resource management and development issues. Such databases must be constructed with equity in mind for all societal groups; therefore, methods need to be developed that allow access and empower such groups through appropriate training and education. The case study involving K-12 GIS education provides a model for developing appropriate methods for particular users.

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## Models For Making GIS Available to Community Organizations: Dimensions of Difference and Appropriateness

One major question addressed by Public Participation GIS concerns the appropriateness of GIS technologies for supporting and furthering the goals of neighborhood and grassroots organizations, addressing issues of access and whether or not such technologies can empower such groups. The work reported here is based on our experiences with different models for making GIS available to community organizations in Minneapolis and St. Paul. Besides describing six different models - community-based (in-house) GIS, university/community partnerships, GIS facilities in universities and public libraries, local government map rooms, Internet map servers, and a shared neighborhood GIS center - the paper provides a conceptual framework for identifying dimensions of difference among these models. We identify these as the Providers/Stakeholders involved, the geographical location of the GIS, the nature of the interaction of community organizations with the GIS, the nature of communication structures, and legal and ethical issues that arise. We suggest that differences on these dimensions are associated with advantages and disadvantages of the different models for neighborhood organizations. Broadly speaking, the advantages and disadvantages seem to be of two types: those addressing the question of how flexible and responsive a model is likely to be to the needs of community organizations; and those addressing the constraints of implementing and maintaining GIS provision. It is worth noting that in order to overcome resource constraints and to maximize the utility of GIS for serving their needs, neighborhood organizations generally attempt to draw simultaneously on different ways of gaining access to GIS, altering these strategies over time.

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# There Must Be a Catch: Participatory GIS in a Newfoundland Fishing Community

## Introduction

Since 1992 when the Atlantic Groundfish Moratorium was declared, the inshore fishing communities of eastern Canada have worked to protect remaining species and the way of life that depends on them. Newfoundland has been hit especially hard by the collapse of the cod stocks. Fisheries interests, the primary coastal stakeholders in most of the province, expect to participate actively in the design of new management measures involving spatial limitations to harvest. Reacting to industry demands that government managers and conservation agencies acknowledge and incorporate local knowledge, a GIS project was undertaken to capture traditional fishing patterns in Bonavista Bay. The project evolved as a collaborative effort with input from several government agencies, a regional fishermen's committee, a geomatics training program and a software firm. A prototype basemap depicting topographic and hydrographic features was produced, and as a pilot project, this chart was used during mapping sessions with harvesters to delineate fishing grounds, spatial management controls and local toponyms. Multiple harvest area maps were compiled and digitally rendered to produce thematic coverages of the area.

## Objectives

The primary objective of the project was to collect and visualize marine resource information with fishers for use in their own deliberations and in their dealings with outside agencies. GIS offered a graphic means for resource users and government agencies to begin a dialogue of site and species specific concerns. The cognitive impression of environments–often referred to as indigenous knowledge, traditional ecological knowledge or naive geography–is sometimes the only detailed information available in many rural areas and such was the case in Bonavista Bay. By using GIS, information that was once dismissed by scientists could be converted into a cartographic format that was harder for government planners to ignore. Geo-referencing not only took the local fisheries knowledge out of the "anecdotal" realm, it also made it more compatible with accepted "scientific" forms of spatial knowledge (e.g., temperature, salinity, subsurface geology). With visualization tools, harvesters were able to demonstrate informal management measures as well as local conservation priorities to neighbouring communities, scientists and government partners.

## Participants

The GIS project described here evolved out of ongoing investigations in northeast Newfoundland by Parks Canada and the federal Department of Fisheries and Oceans. Against the backdrop of the fisheries crisis, government personnel, academics and fish harvesters opened a dialogue to

explore precautionary approaches to the management of living marine resources in Bonavista Bay. Marine protected areas attracted considerable attention from harvesters and scientists alike, especially for the conservation of sedentary species and supporting habitats. An assessment of existing marine resource information, however, showed that current knowledge was inadequate for purely biophysical approaches to conservation planning. Information on human activities was also lacking; in particular, areas fished by small boats were largely uncharted and unknown to those outside the fishery. Moreover, the existing nautical chart for the Bay–produced by the British Admiralty in 1869–was unsuitable for further inventory purposes.

An opportunity for multi-party GIS collaboration arose when members of the Eastport Peninsula Inshore Fishermen's Committee initiated voluntary measures to safeguard the lucrative lobster fishery that remained open in their waters. Although government agencies provided funding, computers, data and in-kind support, the project focus shifted towards the community partners who would ultimately provide information about their fishing grounds. The research evolved with digital contributions from several other organizations including the Canadian Hydrographic Service and the Newfoundland Department of Natural Resources. Universal Systems Limited of Fredericton, New Brunswick, made available a complementary version of CARIS (Computer Aided Resource Information System). Finally, instructors and displaced fisheries workers training for a GIS diploma provided technical assistance and plotting services.

**Methods**

Technical support was provided to the Eastport Fishermen's Committee in an interactive and adaptive fashion. The intent was to build a geographic database that better reflected the members' world view, a view that relied on terrestrial features for navigation and experiential knowledge of water depths for fish detection and gear placement. Meetings were held with Committee members to review data sources, to demarcate the Eastport territory and to determine basemap features. CARIS was then utilized to combine topographic and hydrographic data sources for the area. By using the tools available with GIS, it was possible to customize data for the harvesters. For example, metric depth soundings were converted to fathoms–still the standard measure in the fishing industry. Successive composite land-sea maps were generated, plotted, reviewed by fishers and reworked to produce a basemap.

To capture information about fishing grounds, individuals and small groups used mylar to create thematic overlays. Mapping methods were inspired by research in participatory rural appraisal, indigenous countermapping and the bioregional movement. Practitioners in most of these fields have stressed the importance of relaxed rapport and informal check-lists of potential items to be mapped. The outside "specialist" in the Bonavista project facilitated the mapping sessions, occasionally prompting for categories of information, but participants did the actual sketching and map delineation of features and activities. In most cases, participants had a clear idea of what information they wished to capture. There was a form of built-in peer review when mapping sessions were conducted by groups of fishers; as the information was filled in, the group automatically performed checks to make sure that the map was "complete." Multiple sheets were compiled for digital rendering and map production.

## Progress To Date

In addition to a 1:25,000 prototype basemap, draft place name and harvest area maps have been generated and laser-printed on 11" x 17" paper to enable low-cost reproduction and wide distribution. These maps have been used in community discussions and in meetings with scientists and managers. The Eastport Peninsula Inshore Fishermen's Committee has used maps of their lobster fishing grounds to establish harvest refugia and define community boundaries. The obvious next step is field truthing with GPS. Government agencies have identified uses for the database such as oilspill response and aquaculture siting. Several issues have yet to be resolved including ownership of the contributed knowledge and data, continued funding for the project and distribution on electronic media.

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# Empowerment, Marginalization, and Public Participation in Community-Based Biodiversity Conservation: Mexican and Canadian case studies of spatial information management.

"Sustainable development" has come to summarize the acknowledged importance of nondestructive land use. The challenge is: ***how can dynamic communities with changing needs, aspirations and technologies maintain a sustainable linkage with an environment that is itself dynamic and constantly changing?*** This clearly requires an adaptive process. The first practical step towards achieving it is to make public participation in local environmental decision-making more effective. Biodiversity may be the most sensitive, robust and significant indicator of environmental change and so it provides an interesting and valuable context for research in environmental decision-making. But it is difficult to measure and monitor and therefore issues surrounding biodiversity conservation present particular challenges for public participation.

This paper describes community-based research intended to bring local spatial information into public consciousness and build local capability to manage and use that information. It focuses on two initiatives in mountain forest villages: one in Invermere, British Colombia, Canada, located between the Rockies and the Purcell Mountains within a few miles of the headwaters of both the Kootenay and the Columbia Rivers in an area that is very diverse ecologically, largely unspoiled, but under competing land-use pressures. The other is in Huitzilac, Morelos, Mexico, in an area of spectacular mountain forests less than two hours drive south of Mexico City.

The paper explores two particular issues: barriers to information flow and the impact of access to information on the dynamics of communities. In both cases, the projects are managed by groups that involve academic researchers and local citizens. The unifying context for these two case studies, mountain-forest communities experiencing rapid change, is described first. The conclusions of the paper are three: 1) that public participation is essential; 2) that with GIS, the best technology will always, by definition, be ahead of the public's ability to participate; 3) and with PPGIS, the "process is the product", that is, by the time the public has become involved in generating or understanding a system, the educational and analytic benefits of public participation may already have been achieved.

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# HUD's Community Connection for Local Empowerment

GIS have become part of the mainstream. From their early days as expensive custom-built luxuries, they have been tweaked and prodded until they are off-the-shelf necessities for all manner of public and private organizations. Recently, GIS research has broadened considerably and purely technical issues have given way to research on institutional and societal implications of the technology. Among societal issues, concerns that all voices should be heard in a democracy have sparked recent research into "public participation GIS" or PPGIS.

I am fortunate to have been a small part of the evolving research on public participation in GIS. My earliest work in this area is the paper I presented at the 1991 European GIS conference in Brussels, Belgium, titled "GIS in A Democratic Society." In that presentation, I discussed the prospects for GIS as either a democratizing or disenfranchising force in post-modern society. After later revisions, this paper was published in the Proceedings of the NCGIA "GIS and Society" workshop in 1993. My concern for this issue has not wavered over the years. As a follow-up to this early paper, I wrote and presented a second paper, "Spatial Conflict in the Information Age," in which I challenged the then-common suggestion that the use of GIS would decrease conflict surrounding public land-use debates by providing more and better information. My hypothesis was that, rather than decreasing conflict, increasingly available GIS would, in fact, increase such conflict because it would enable more non-governmental organizations (NGOs) to participate in public policy debates on a more-or-less equal footing with the powers that be. I concluded that any increase in conflict was actually in the best interest of democracy, because such conflict would provide evidence that more individuals and groups had been active participants in the democratic process. Both these theses were presented as chapters in the 1994 book I co-wrote with Jeffrey Pinto, "Managing GIS

My more recent work has followed up on these ideas. In 1995, I was awarded a Research and Planning Grant from the National Science Foundation to develop a full-blown proposal for my "Spatial Conflict" research. I am still in the process of developing this proposal for research, in which I hope to combine survey and case study research to (1)assess the extent to which non-governmental organizations are using GIS to influence public policy in the United States, and (2)assess the effectiveness of such use. Participation in the upcoming PPGIS workshop would help me advance this research. ." In 1997, I also made presentations on the use of low-priced GIS software made available to the general public by the U.S. Department of Housing and Urban Development, and plan to continue to monitor this initiative, which HUD renewed a year ago, when it introduced new software based on Caliper Corporation's Maptitude product. Most recently, I served as guest editor for the April 1998 issue of Cartography and Geographic Information Systems, which featured six articles on Public Participation GIS.

As one who hopes to participate in the PPGIS specialist meeting in October, I believe I bring a history of interest and activity in this area. I am eager to continue my research in this area, and believe I would benefit greatly from this meeting. My goal in participating in this meeting is to

identify a suitable universe of NGOs that have used GIS to influence the public policy process for the purpose of administering a survey and developing a series of case studies. I sincerely wish to continue to be a part of this initiative, and respectfully request that I be allowed to participate in this workshop.

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## Legal Access as a Necessary Prerequisite to Participatory Processes

The concern exists that access to official or public records after decisions already have been made or while decisions are being made is an insufficient condition for truly democratic participatory processes. Now that we have legal access to government information and other forms of information, we want more. We want access that is timely and in understandable forms so that interested groups may constructively participate with government in arriving at consensus decisions. We want technical access to data that is efficient, effective, and responsive to our specific needs. We want procedural capabilities and methods that will allow groups affected by decisions to be engaged with each other in constructive dialogue. This paper argues, however, that the assumption of legal access to information from which most participatory approaches extend is rapidly losing validity. The foundations of legal rights to access information are being undermined as we move into networked digital data environments. While citizen groups are looking forward to more meaningful dialogue they should also be aware that past gains made towards increasing the transparency of government operations and gains made in the ability to access and build upon the works of others are being eroded. This article provides examples of that erosion and suggests some approaches for reversing the trend and for expanding citizen rights in information.

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# Living Neighborhood Maps: The Next Wave of Local Community Development

## Introduction

The essay will present a case study of how the South of Market community in San Francisco has developed a dynamic GIS model, or a "living neighborhood map," and has used it towards modifying zoning controls and in developing several Internet-based applications designed to strengthen the local economy through daily transactions among local merchants and residents. A "living neighborhood map" is a simulation of a community's people, businesses, and buildings and serves as a continuous archive of its growth. It is a tool which empowers communities to control their own economic and physical development. It enables up-to-the-minute planning and supports creating applications tailored to fit local development needs.

A living neighborhood map's unit of analysis is the parcel or individual building. Tabular information about businesses, residents, buildings and land values can easily be linked to a parcel map. The small size of a parcel allows infinite flexibility in terms of size of area to be analyzed. Geographical boundaries for inquiries about specific areas can be assigned arbitrarily, allowing one to pick any number of blocks, portions of blocks or individual parcels and buildings. Data can also be freely analyzed and mapped by attribute, such as business type, household income, number of employees, or whichever variable (or combination of variables) are of interest. These types of detailed analyses are critical for market studies, for gauging the effectiveness of zoning controls, and for determining where to assign special funding boundaries (such as Enterprise Zones or Redevelopment Areas).

## Case Study: Two Applications in the South of Market Area

### *Community Empowerment*

The South of Market area in San Francisco (SoMa) resembles old industrial districts in many American cities. Yet, unlike many American cities where the economic usefulness of these districts has long since disappeared, SoMa has re-emerged as a powerful and unique economic engine for both the City and the San Francisco Bay Area region, hosting over 9,000 small businesses.

A network of non-profit neighborhood service providers caters to the needs of SoMa's small businesses and low-income residents. This network provides job training and placement, builds affordable housing, serves small businesses, provides healthcare and childcare, and provides recreation and education programs for innercity youth. One of these non-profit service providers, the South of Market Foundation, developed a GIS model of SoMa, linking information about buildings, businesses and residents to a dynamic physical map. This map, in turn, has been an important tool in helping the community to battle uncontrolled residential gentrification.

The South of Market Foundation used its GIS model to document the impact that residential construction was having on the local business climate. They measured business and job displacement, the change in commercial rent prices, and important economic links being broken due to job and business displacement. Without GIS, this type of analysis would have been impossible to do. It provided valuable ammunition against the claims of developers who stated "they did not displace one single job."

The community used this map and formed a Coalition of over 500 residents, small businesses and artists to propose appropriate zoning controls for the area. The Coalition designated new zoning boundaries by mapping business and residential clusters within the area. These zoning boundaries allowed various types of loft development where appropriate and prohibited it in areas where it would destroy the delicate balance of the local economy. The Coalition then used its size and coverage and took this plan before City regulators.

***Neighborhood-based Electronic Commerce Applications***

The following applications either have been or will be developed by the South of Market Foundation to strengthen the local economy by facilitating everyday transactions among local businesses, property owners and residents.

**Affordable Space Locator Service**

The Affordable Space Locator Service (ASLS) is a commercial listing service that helps businesses find affordable space in San Francisco's rapidly changing real estate market. It constitutes a local economic development tool integrating business information, local economics, demographics, transportation and real estate brokers' information to help businesses locate in the best possible location for the local economy and for the business.

**On-Line Neighborhood Guide, Community Buying Cooperative and Local Job-Link**

A printed "neighborhood guide" captures the character of South of Market through photo collages and essays and then displays all walk-in businesses on colorful maps. This guide is available all throughout the City and was mailed to all businesses in the area. The intention of the guide is to strengthen the local economy by making residents and businesses aware of the gamut of products and services which are available within a 5 minute walk from their location.

Eventually, the goal is to list all businesses, their stock and prices on an "online neighborhood guide. " Businesses will be able to add information about themselves as well as directly order products and services available throughout the neighborhood. Businesses can arrange their own collaborative buying arrangements, helping to compete with national wholesalers and chains. In addition, via a neighborhood "job-link," businesses could post job notices, and neighborhood job-seekers could also post their availability and skills. Each party could query to make a match. The network will be available all throughout the neighborhood via public kiosks. Individuals can also dial directly into the network from their personal computers.

**Conclusion**

Living Neighborhood Maps hold great potential as aids in community development. They can assist a neighborhood in writing its own zoning codes for growth (or non-growth). They can also

serve as the platform for entrepreneurial electronic commerce applications which help to strengthen local economies. Networking local businesses and residents can help encourage important links and collaborations. Placing available space in its economic, demographic and physical context greatly assists small businesses in making locational decisions and will be a great aid in business attraction to an area.

Given drastic cutbacks in city budgets, the future for the development of our cities lies within communities. Living neighborhood maps provide community leaders with an important tool they can use to grasp onto this reality both with certainty and with confidence.

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# Empowerment, Marginalization, and Public Participation GIS

Investigating the history of the book, a communicative technology whose impact on the world is sometimes invoked in discussing the social and cultural changes wrought by geographic information technologies (Tosta 1995), Hall argues for a research strategy of "double vision, a perception both of what the powerful were providing and of how those at the margins reworked or resisted these seemingly authoritative messages." (Hall 1996, 2) With one foot in the world of power--as a federal employee concerned with the adoption and use of geographic technologies--and another in the world of research--as a Ph.D student investigating the use of GIS by environmental groups--my interests exemplify this double vision. The potential for these two perspectives to contribute to the PPGIS initiative are discussed in turn.

## Federal outreach initiatives in geographic information technology

There is ample data to construct a picture of what those in power consider to be the needs of the PPGIS communit(ies). Spurred by public concern to reduce government spending and to mitigate the impact of federal decisions on local communities, many agencies in the past five years have reached beyond their traditional customers and partners to attempt to include a broader public in decision processes. Agencies that use or produce geographic data have seen the integrating power of geographic information technologies as a way to invoke the multiple viewpoints of stakeholder groups in land management and community impact decisions. Some initiatives, such as the Federal Geographic Data Committee's advocacy of a National Spatial Data Infrastructure (NSDI), are very broad ranging. The NSDI, which describes geographic data through the "infrastructure" metaphor, posits geographic data as a common good much like a transportation or utilities system. Through the NSDI initiative, funding has been directed to state, local and tribal governments, and the non-profit sector, to use information technology for sharing geographic data, to include community viewpoints in standards development, and to build data sets that are locally based and maintained but that link to a broader national network of distributed data--the virtual dataset commonly referred to as framework. Similar broad federal efforts would include the National Science Foundation's Digital Government Initiative (The National Science Foundation 1998) and the Environmental Protection Agency's Empact program (U.S. Environmental Protection Agency 1998)

Some federal agencies have launched more narrowly focused programs that fall within the PPGIS arena. For instance, the Department of Housing and Urban Development has produced a specialized GIS desktop viewing software targeted at communities. Community 2020 is touted as "push button" easy and "colorful"(U.S. Department of Housing and Urban Development, 1998), but appears to be a vehicle for sales of government data, as does Landview, a product of Bureau of the Census, the Environmental Protection Agency, the National Oceanic and Atmospheric Administration and the U.S. Geological Survey (U.S. Department of Commerce, Bureau of the Census, 1998). The deployment and use of these mapping tools, the promises they make, and the constraints they impose for communities could be examined from a PPGIS perspective.

Within the NSDI there are several narrowly focused efforts that may yield data for researchers on PPGIS themes. The Federal Geographic Data Committee and the National States Geographic Information Council have engaged a large community of GIS users from state and local government, the private sector, non-profit organizations, and community groups in a participatory survey of data. What differentiates this effort from past GIS surveys the large number of local data producers and users who have gathered the data, and the large number of surveys (15,000) sent out and returned (5500 to date). Anecdotal evidence suggests that participation in the survey is being viewed as a token of membership in a larger network or community. Although the survey is still in process, early results indicate that much will be learned about the geographic distribution of data holdings, relationships between different types of organizations, the existence or non existence of data sharing policies, how organizations coordinate, how much money and manpower is being spent on geographic data production in local communities.

The NSDI Benefits Program is a program, sponsored by the Federal Geographic Data Committee, that funds projects using shared data to solve community problems within a particular geography. This project has funded such data sharing as a watershed protection project by the Henry's Fork Foundation in Idaho; a collaborative between the Medical College of Charleston and the Environmental Protection Agency to empower local residents to investigate health risks from industrial contamination; and an effort by the Sitka Conservation Society to use Forest Service Data for economic development of alternative forest products.

There are numerous other government programs that could be considered part of the turn towards use of GIS to increase public participation in local decision-making. Any or all of these initiatives should be considered when discussing public participation GIS.

**Themes of integration in environmental use of GIS**

My dissertation research at the University of Maryland will focus on the use of GIS among environmental groups that define themselves as bioregional. The bioregional movement distinguishes itself from the broader environmental movement by focusing on reinhabiting a specific place (Alexander 1990). Not of necessity driven by a specific ecological crisis, bioregionalists use the concept of place to raise the consciousness of its inhabitants and promote social change in addition to addressing pressing environmental problems. Many of these groups have a history of successful map and GIS use. Aberley describes the mapping of the Toronto Bioregion in 1992. The map he describes is not handed down on high by a government agency, although it may draw on government data sources. It is produced by the inhabitants of a place and captures their stories, songs and home knowledge. For bioregionals groups, mapping, whether on paper or with GIS, is a participatory medium that is intended to integrate not just various data themes, but intangible knowledge, feelings, and attitudes." (Aberley 1993, 23)

Integration is an important theme in the GIS literature, as well. The integrative powers of GIS are frequently seen as a way of revitalizing the discipline of geography. (Dobson 1983, 1993) I will examine such questions as: Do the bioregionalists and the GIS apologists mean the same thing when they say "integration?" Has the technology proven to be an integrative force in practice?

Does the authoritative structure of the technology allow these groups to "resist authoritative messages" or do their aims change once they are committed to GIS use?

The theoretical underpinnings of my work are in French critiques of technology, especially Baudrillard--in particular his notion that "the ambition of objects [and here he would include anything manufactured such as computer programs] is to act as replacements for human relationships. It its concrete function the object solves a practical problem, but in its inessential aspects it resolves a social or psychological conflict." (Baudrillard 1996, 127). The emerging social science discipline known variously as social studies of technology (SST) and the sociology of scientific knowledge (SSK) will provide an investigative attitude--Pickering sees science as a performative practice " regarded as a field of powers, capacities, and performances situated in machinic captures of material agencies." (Pickering 1995, 7) Within this investigative attitude, I will use depth interviews and document analysis to discover the practices of these particular bioregional actors in particular locations.

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## INFOSHARE - A Community Data System for Community Use

The invention and proliferation of personal computers has made possible great advances in the dissemination and analysis of data. However, access to this data has been limited to those with access to the new technology and the trained staff to use it. The result is that increasing amounts of information are available but many of those who could benefit from its use are unable to take advantage of it. The INFOSHARE Community Data System was designed to overcome this paradox.

It is easy for the average citizen to become overwhelmed with the amount and scope of information available on demographics, economics, housing, health care, environment, land use, or public services. Data are often not comparable, access is difficult, and putting it into useful form can be costly and time-consuming. Thus, local service organizations such as community health centers often run into difficulty in finding, translating, and analyzing the wealth of information potentially available to them. As a result, services for the poor, the elderly, the homeless, the sick, new immigrants, and ordinary citizens are less effective than they might be.

The INFOSHARE Community Data System was designed to address these problems. Its principal features are (i) ease of access to a wide range of community data, (ii) automatic data presentation for a variety of special-purpose districts defined by different city agencies, and (iii) translation of data into a form suitable for graphing, mapping, and other application software. Users can define their own communities or service areas utilizing census tracts or zip codes. They can make comparisons to other areas and produce graphs, tables, spreadsheets, or maps utilizing software programs with which they are familiar. INFOSHARE utilizes simple menus which make the process of data selection and extraction straightforward and quick. This allows the user to select easily from a wide range of data for comparative analysis and mapping. This makes the process of documenting community conditions and performing needs assessments fast and flexible.

The INFOSHARE system currently incorporates over two dozen local, State, and Federal data sets describing socio-economic and health conditions in New York City. Its set of data files is being expanded to include data for all of New York State.

INFOSHARE users can view and extract information on the demography, socio-economic status, vital statistics, hospital admissions, and other data about any community. Racial, ethnic, and income distributions, birth and death trends, communicable disease incidence, and hospitalizations can be analyzed. Profiles of individual geographic areas -- descriptions of the social, economic, and health status of a zip code or a community health center service area -- can be displayed, printed, or stored in spreadsheet and ASCII data files.

Data Conversion Modules allow users to incorporate their own data into INFOSHARE, including specialized data bases such as patient listings. Once integrated into the system, these data sources have all INFOSHARE features, including automatic aggregation to larger geographic levels, creation of spreadsheet and other files, and preparation of maps and other forms of visual output.

INFOSHARE has been used to conduct a variety of needs assessments. Demographic and health profiles of individual community districts have been generated, and these communities have been compared using many of the data sets in the INFOSHARE files. Some users of INFOSHARE incorporate their own data, such as patient information, into the system, so they can compare this data with the characteristics of the population in their service area.

In the past year we have provided data on infant mortality, unemployment, and projections of race and ethnic composition for a Dominican community organization, supplied a range of health indicators for a private commission studying the health needs of the uninsured, developed a profile of elderly Asians in New York City, and prepared multi-dimensional "Report Cards" on the 51 City Council Districts of New York City. Much of this work was supported by a continuing grant we receive from a New York-based foundation, under which we are charged with meeting the data needs of their community-based grantees.

Community Studies of New York, Inc., a non-profit organization with a small staff of planners and geographers, assists users in formulating specific questions and in using INFOSHARE to provide answers and present information in the most effective manner. In this way, clients with only limited expertise in social service planning can, with our help, utilize INFOSHARE to acquire the information they need.

We have spent the past ten years, not only developing the INFOSHARE system, but also breaking down many of the barriers we encountered in persuading government agencies to release this kind of community-based information. As the technologies for data dissemination, especially the CD-ROM, have become cheaper and more convenient, we have found these barriers to be dropping. However, obtaining ongoing funding for this kind of public-interest data access continues to be a problem. Likewise, information overload makes it difficult for community advocates to segregate the most appropriate data for their constituents. We find that we must continue to educate our users on the availability, the definition, and the relative degree of reliability of the data that is available on their communities.

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# Understanding the Breadth and Depth of PPGIS Supply

Many of the key themes of the October Varenius specialist meeting revolved around knowing who produces and who consumes small area GIS products. However, many of the questions that were posed are difficult to answer because we did not have comprehensive inventories of either PPGIS providers or consumers. Two exceptions are Craig's inventory of consumers (community groups) in the Twin Cities, and the Urban Institute's 1996 list of 30 citywide neighborhood data providers. Neither is comprehensive, nor were they meant to be. However, they did provide a start. We attempted to provide such an inventory with the results of our survey.

The concept we used to generate an inventory of PPGIS organizations employed the following language: "We are looking for organizations that:

(a) collect demographic, administrative, environmental or other local-area databases,
(b) do something to the data to make it more useful locally (e.g., address matching of individual records; creating customized tables), and
(c) provide this information to local nonprofit community-based groups at low or no cost. This can include local non-profit community groups that are collecting and processing data in-house, or data "intermediaries" that process and analyze data for others ("data intermediaries" might be government offices, nonprofit groups, university-based centers, etc.)."

Our working definition generated some discussion among PPGIS participants. Some of the critical dimensions of our definition and the reasons we had for employing them follow.

*GIS and IT, or Just GIS?* We decided that we were not attempting to inventory all IT activities, but rather were searching for organizations with a significant spatial analysis component.

*What Geographic Scale?* A "community GIS activity" would analyze data for what geographic scale? "Community" has many possible meanings. We take "community" in this context to be a spatial, not a social term: a relatively small, roughly defined area, populated by people who feel themselves to have something in common. We were thinking of it interchangeably with "neighborhood" and perhaps "small town." We exclude virtual communities, though we include organizations comprised of members with non-contiguous residence whose object of analysis might be a particular small place.

*Whose Data?* It seems that if "community GIS activity" is to mean anything, it must go beyond redistributing the work of other organizations.

*Whose Analysis?* A major distinction is between organizations that take a "supply-side" approach (e.g., that post data on the Web but have little or no contact with data users) and

organizations that are demand-driven (i.e., that provide data to individual clients in response to specific requests). The existence of supply-side organizations is too extensive to ignore, suggesting that "analysis" should be viewed as a continuum, with organizations that disseminate data with little analysis at one end, and organizations that perform custom queries for individual clients at the other. We are clearly more interested in organizations that engage clients.

We learned two types of lessons from our survey: lessons about the process of surveying these groups and lessons shared with us by the respondents about their work. Among the more important ones were the following.

There are a variety of PPGIS activities going on around the country, some throwing data over the wall to the public, some working with neighborhood groups to respond to their expressed needs, with a variety of databases, in a variety of sizes.

> Community organizations don't know how to make use of data.
>
> Community groups don't attach much significance to the data that social scientists find interesting.
>
> Information is (not necessarily) power. Knowledge is power, no doubt, but knowledge of the demographics of a neighborhood is not necessarily very powerful knowledge.
>
> Grassroots organizations spend a lot of their time seeking grants to keep themselves alive, leaving very little time to actually do anything (like use GIS) to make a difference in the community.
>
> One of the most basic issues is whether to charge for services. There is a practical aspect; how will a data intermediary organization maintain itself if it doesn't charge for its services? There is another aspect, rationing service: without any charge for its services, a group may be overwhelmed by requests, beyond its capacity to respond in a timely fashion.
>
> There is real value to grassroots groups internalizing GIS capacity, but is it a better use of their resources to focus on other things (such as learning to ask the right questions)?

Our inventory reflects our original definition, though we included everyone who responded, some of whom do not seem to us to be PPGIS organizations, but identified themselves that way. We do not claim that our inventory is comprehensive; it includes organizations that do not quite meet our criteria, and certainly omits some that do. And given the progress of desktop GIS technology, more organizations may be getting into PPGIS work every month. But we feel that this list will provide a good starting point for further research into the breadth and depth of PPGIS activity today. We hope to pursue these providers, learning more about their operations. With additional support we may also evaluate the effectiveness of their operations by surveying their clients.

A list of PPGIS suppliers is provided in Appendix 1. Since the list continues to grow, we plan to post updated lists of PPGIS suppliers, along with their responses to our survey, on the PPGIS website.

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## Asserting New Rights to Know, Toward Community Self-Discovery

This paper aims toward constructing a theoretical frame and method that can be appropriately applied to community-based information seeking and use. Adoption of the phrase "community information seeking" may presume notions of community or of information that could interfere with successful community-based learning. Examining the logic and language of information systems in community contexts is part of the exploration proposed here.

The proposed strategy of action, termed "community self-discovery," is motivated toward the resolution of certain informational dilemmas and imbalances that now face individuals and communities. It is based in a view of information that equates access with inclusion in public discourse across all media, including the spatial information technologies such as GIS. Rights of inclusion in the information process are asserted that are not generally binding today, but which may prove to be essential toward achieving justice in any future information society. These "rights of representation" are conceived as belonging to individuals and groups, and as applying equally to the representations that are produced by the information systems of public and private institutions.

This approach to information departs from the common emphasis on the object-nature of information, which tends toward classification of information as a "resource" that can be owned, exploited and sold. While information when encountered in its most elemental form as "data" may exhibit some of the characteristics similar to material objects, the alternative focus presented here views the output of information systems as being representations or patterns. These non-material sets of relations emerge in the form of system outputs in response to questions that have been allowed.

Seeing information as emergent in patterns or representations requires that a distinction be maintained between two integral aspects of the information process. These are presented here as "common information" (the material from which system-generated representations are made) and "counterpart information" that is tied to the originating questions that are asked and to the contexts of interpretation within which information systems operate.

The redefinition of information rights that is presented here has two essential components, each of which is intended to be applied equally across private and public sectors. First, any individual or group has a right to know how they are specifically represented at the data or record level, in any database. Second, each also has the right to know the rules by which any system creates the information out of the intrinsically valueless data elements out of which it is derived.

Finally, an attempt is made to identify those individuals in any community who are likely to ask questions in assertion of these rights. Leaders of grassroots organizations or established professionals such as adult educators, librarians, planners and journalists seem to be the most likely candidates. In parallel, academic researchers may find opportunities to assist those

individuals in their attempts to ask meaningful questions of and about the information systems in which their communities are embedded.

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# Geographic Information Systems in the Environmental Movement

## Objectives

Geographic Information Systems (GISs) and related spatial technologies have become important tools for land management agencies to administer resources and protect the environment. Increasingly environmental nonprofits use GIS in their own activities to better understand and advocate for their communities. Current applications range from inventories of spotted owl locations, thematic comparisons of toxic lead and poverty, and models of sustainable forest harvesting, to scenarios of urban sprawl/growth control. GIS, like many computing applications, holds great promise for environmentalists to maximize their traditionally limited resource base. Just as the word processor and desktop publishing have helped to publicize causes, and the Internet has provided the avenue for mass mobilizations, GIS allows groups to present a visually compelling image of an issue and quickly analyze data from disparate sources. Improvements in the technology make GIS increasingly affordable and easy to use. Coupled with expanding amounts of spatial digital data, GIS could provide a critical implement to groups struggling to impact politics and empower environmentalist for social change.

Given the fragile resource base of these groups, however, they may struggle with system adoption and data acquisition. Many survive on hand-to-mouth existence of one-time grants, volunteers, and paid staff/student interns who could demand better money with newly found GIS skills. GIS exhibits a high learning curve and requires extensive data entry and database management skills. To some environmentalists, GIS is one more manifestation of capitalist-induced rationality; certainly, it could be the antithesis of passionate activism. Overall, activists may find their time better spent understanding politics or acquiring new funding sources.

My research attempts to find a path between the promises and the perils by tracking the use and value of GIS in the environmental movement. As part of this research, I pose several questions. What are the actual applications of GIS and computing technology by environmentalists? How does their usage compare to the literature on GIS diffusion, implementation, spatial data acquisition and sharing? How are groups applying GIS to their goals and missions? What role does the technology play in impacting public policy? Is, as often purported, GIS delivering on its promises or does it trap activists in a rational and capitalist- induced technology? Finally, what is the role for policy makers in enabling (or disabling) groups' effective adoption? Of all social movement or community-based organizations, the environmental movement may be uniquely positioned to take advantage of GIS capabilities and consequently may provide an appropriate base of study. The environmental movement has long been engaged in data collection, computer usage, scientific analysis, and cartography production. Their experiences with GIS could inform and assist in the further diffusion of GIS to other social movement groups.

## Methods and Participants

The research upon which I will report constructs a framework for necessary and sufficient characteristics of effective GIS usage by small environmental nonprofits. This framework then proposes roles for interested external parties. It combines a review of literature on GIS implementation/data sharing and social movement issues with fieldwork. Fieldwork begins with a mail survey of computer usage of 100 environmental groups. Seventy four mail survey responses and 25 expert interviews with vendors and conservation GIS leaders assist in locating five cases for in-depth study of GIS usage. Work has been conducted in California and the Pacific Northwest over a two-year period.

## Progress of PPGIS Project

The above research into the use and value of GIS in the environmental movement is complete. The mail survey of groups revealed a microcomputer diffusion rate near 100 percent and a GIS diffusion rate over 20 percent. Case study work showed that, because these organizations were generally limited in resources, they employed strategies of GIS implementation that differed considerably from traditional implementation in local government. These strategies involved resource substitution including the use of knowledgeable volunteers, outsourcing, reliance on spatial data access, and the formation of technical assistance networks. The last strategy emphasized the pivotal role that universities and other professionals played in groups' successful utilization of GIS. Substitution demonstrated that resources did not represent a barrier to GIS implementation. This was not the case for acquiring digital data, however, which favored groups engaged in proactive and non-confrontational agendas. Overall, GIS helped groups promote their vision in two ways. To the extent that public policy was based on science and the determination of accurate correlation, GIS helped activists by promoting the value of lay science and exposing weaknesses in institutional data. To the extent that policy in the political sphere was driven by other agendas, then GIS was used to bypass policymakers and reach out to the public in the visual sphere.

Research into the use of GIS by environmental and social movement groups is ongoing. Findings from the above research are currently being tested in community development corporations. A recently completed project (with Mark Wheeler) investigates the feasibility of using a nonprofit Cooperative Extension as a GIS service center for small municipalities engaged in land use and environmental protection.

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# Information Technologies, PPGIS, and Advocacy: Globalization of Resistance to Industrial Shrimp Farming

This presentation investigates the potential of Public Participation GIS (PPGIS) to empower local communities, enhance global civil society, and contribute to public advocacy – especially in the Third World. It is based on lessons learned during an ongoing applied research project involving the role of information technologies in the globalization of resistance to industrial shrimp farming in tropical, coastal zones of Asia, Latin America, and Africa. The project is multidisciplinary and highly collaborative – including the efforts of academics/scientists, non-governmental organizations, grassroots groups, and private/public donors – and is aimed at integrating research and practice. The presentation will pay particular attention to the problems, issues, and feasibility of scaling-up: i.e., linking local/community level PPGIS into a global PPGIS.

To date, project activities have focused on conducting ethnographic and survey research with funding from the National Science Foundation, The University of California Pacific Rim Research Program, and the Rockefeller Brothers Fund. This preliminary research focused on: 1) evaluating contending social science explanations for the emergence of local grassroots resistance movements; 2) determining the processes by which local grassroots and national non-governmental organizations have been able to transcend their locality and diversity in terms of culture and nationality and become part of a global network; and 3) conducting a preliminary assessment of existing access and use of advanced information technologies by individual coalition members, the global resistance coalition, and the worldwide network of industry supporters (the backlash movement). Major project activities also included a series of meetings and workshops for project collaborators. Preliminary research results suggest the crucial role played by advanced information technologies (electronic mail, the Internet, and the World Wide Web) in the formation and maintenance of both the resistance and industry networks, in facilitating vital communication among members of each network, and in each network's strategy for achieving short and long-term objectives. Preliminary work also reveals the virtually universal desire by the grassroots/non-governmental coalition members to increase access to, training in, and use of, spatial information technologies (maps, remotely sensed data, and GIS) to be used together with other information technologies (e.g., e-mail, the Internet, the World Wide Web) to achieve individual organizational and shared coalition objectives.

Funding recently was approved for a second NSF grant, a planning grant to assist in the preparation of a multidisciplinary proposal to be submitted to the National Science Foundation funding opportunity, *Information Technology, Culture, and Social Institutions*. The scholarly aim of this phase of the project is to determine the social context and impacts of communications and spatial information technologies on the formation, strategies, and effectiveness of an emerging global coalition of non-governmental and grassroots organizations that is resisting the expansion of the shrimp farming industry. This is being done in concert with a parallel examination of the globalization of industry efforts designed to counter the efficacy of the global

resistance network. Equally important, are the applied objectives of the project - enhancing access to, and effective use of, these technologies by local people/communities/groups. Current project activities include the creation of a pilot World Wide Web site. The initial objectives, structure, and content of this site were agreed upon after a long process of discussion and consensus building among the many diverse collaborators. Spatial data are an integral part of this site. This activity involves a cooperative effort to collect, interpret, and communicate ecological information; to share information; and to integrate scientific data with local knowledge. Simultaneously, field research is being conducted at the local level in a sample of sites in Asia, Latin America, and Africa in order to identify information/data needs and assess how information technologies, including PPGIS, might meet those needs.

By using an empirical approach that takes advantage of a dynamic, global phenomenon, this stage of the project will aim to enhance understanding and general explanations of important aspects of information and spatial technologies: 1) the obstacles and incentives associated with the relevance, access, and use of these technologies by social actors with differential power; 2) the roles that these technologies play in building global coalitions - particularly those associated with social, economic, political, and environmental conflict in contexts of significant inequity in power relations among contending stakeholders/interest groups; 3) the relationships among local knowledge, information technologies, and development; and 4) the potential of these technologies for civil advocacy and to advance alternative development. Such understanding is crucial for the design of more appropriate, accessible, and democratic information technologies and systems.

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# Environmental NGOs: Community Access to Technology as a Force for Change

In recent years, a series of environmental non-governmental organizations (NGOs) have emerged as empowered GIS users in New Jersey. These NGOs have found a variety of publicly available data and specially-attained "free" licenses of GIS software as a foundation for inexpensive geographic information system (GIS) development. Financially challenged organizations have been able to convert this assistance into newly developed systems better enabling them to participate in public decision-making processes.

An important forcing function in New Jersey comes from the state's tradition of strong home rule. As a result, the state has 566 independent municipalities controlling land use and related environmental issues with only a few able to support local development of GIS. This creates a particularly difficult challenge for the development of NGO systems, because local governments have proven an important source of initial spatial datasets in other parts of the country.

The primary source of this assistance has been the New Jersey Department of Environmental Protection (NJDEP). The NJDEP, acting through the New Jersey State Mapping Advisory Committee (SMAC), has published a series of CD-ROMs providing a variety of statewide coverages (by county) including transportation, land use/cover, soils, wetlands, and floodplains. New Jersey is believed to be the first state to complete such coverage for the entire state at this scale. In addition, the NJDEP has made a limited number (so far around 200) of ESRI ArcView licenses available to local government and NGO offices that have desktop computing hardware.

A secondary source of support for smaller NGOs in New Jersey, is the New Jersey Non-profit GIS Community (NGC). This group was formed by various NJ NGOs and designed to provide support for NGOs struggling with GIS problems. While the more sophisticated users in the state use the NGC as a GIS users group, less sophisticated users are able to go to this group for the actual hardware and software needed for geospatial analysis.

As a result of this support, NGOs throughout the state have become very active in system development. In many cases, NGOs are providing political and technical support for the development of systems at the municipal level. This was evident when the SMAC produced a state guidebook for parcel mapping; the volunteer editor/coordinator and many of the contributors were NGO employees.

The primary goal of this study on the empowerment of New Jersey NGOs is to identify the conditions that have promoted these systems and to describe the ways in which these environmental groups have used these systems to accrue benefits for the communities they claim to represent. This study is being undertaken with the combination of two different techniques: the author is engaged in assisting a new NGO in its development and use of a GIS with essentially no available resources, and the author is in the process of multiple interviews with

system developers at several NGOs. Using primarily publicly available data and working, in part, with the NGC as a source of computing resources, the author has been helping the newly formed Lawrence Brook Watershed Partnership (LBWP) in its use of geospatial technologies as a means for identifying environmental patterns and issues that exist within its jurisdiction. The case study/interviews include system developer/operators from the Passaic River Coalition, the Upper Raritan Watershed Association, and Great Swamp Watershed Association. Also included in this study is an interview with the founder of the New Jersey Non-profit GIS Community and the director the NJDEP GIS program responsible for the public distribution of the state's geospatial data and ArcView licenses.

Current status of the projects is that the case study interviews have begun and will continue through at least August. The project with the LBWP is still in early stages, however, in the next eight weeks the author will be providing LBWP with some preliminary analysis and a CD-ROM compiling various datasets for easy use by members of the partnership. This combination of methodologies ensures that the author will have both a deep, project-specific experience – from working with the LBWP -- and a broad observation-based understanding of the issues – from interviews and visits with the other NGOs.

For Project Varenius, this approach provides a template for providing a jumpstart to groups in an area that might otherwise find themselves unalterably impeded by financial limitations. These examples provide an important demonstration of the value of publicly accessible data as a possible antidote to communities (like Louisville, KY) that insist on charging millions of dollars for access to public data in the name of cost recovery. It also provides insights as to how these groups are using their access to the data to alter outcomes of public decisions.

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## GIS-Enhanced Land Use Planning in Dane County, Wisconsin

The role of spatial information technologies in decision-making has been debated almost since the inception of their use in local government land information systems. Little empirical evidence has been reported to define or describe the role of land information in land use decision-making in the contemporary US local government context. Questions about the use of land information systems have been difficult to resolve because characterizing the decision-making process has been and continues to be difficult to ascertain. Moreover, the use of the technologies is rapidly evolving. Initial efforts were focused on data automation. When the use of land information in multiple organizations was considered, issues of data sharing emerged. In the 1990s, improved telecommunications systems moved the focus to issues of data access. Now, we recognize that systems have evolved such that individuals, groups, and communities previously locked out or disengaged from decision-making processes can use spatial information technologies for advocacy and for more effective participation in public decision-making processes.

Our project contributes to the discussion about the role of data and land information in land use decision-making by purposefully improving the type, quality, and availability of land information and analysis in a jurisdiction with an on-going and highly charged land use decision-making scene. It is, in essence, an attempt to move toward data advocacy and perhaps a higher degree of “democratization” that this implies. We attempt to gauge the influence and impact this has on land use decision-making processes and outcomes through first-hand observation, post-decision reconstruction, surveys, and other methods.

Dane County, Wisconsin is a rapidly growing area with highly charged land use debates. With the cooperation of the County government, we have simultaneously been observing how decision-makers and interested citizens and organizations react to and use geospatial technologies and information products. These can be thought of as experiments about the form and access to information. Activities include public presentation, a “what do you like" experiment, an allocation exercise, Web-based presentation and feedback, free GIS-software for land use training, land use planning software development, and a public access interface (kiosk and Web-based).

The overt goal for our activities is to make geospatial data and information readily accessible to anyone interested in using it for local land use planning and related applications. The covert goal of our project is to determine if this unprecedented access to and education about geospatial technologies and products makes any difference in the planning process. We are surveying and interviewing participants to directly find out how individuals and factions/organizations perceive

the impact and utility of geospatial technologies. We are also gathering indirect evidence such as where and how GIS-derived products and facts are used in documents and meetings, whether these are used to help make decisions or used to justify decisions, and which factions or organizations seem to be able to make most effective use of them.

Preliminary evidence indicates a high degree of interest in improved land information analysis and visualization from County staff and other actors typically involved in land use decision-making. It is too early in our experiments and observation to say whether our infusion of better land information has engaged more people in the decision-making process or influenced land use decisions. Clearly though, it has been an important component of the County's process. The extent to which other actors in land use decision-making adopt and use the products and the technologies remains to be determined.

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# Catching the Wave of Capitalism in the Wake of the Nuclear Age: Mapping Subsistence, Development and Environmental Security in French Polynesia

## Research Problem

The United Nations Convention on the Law of the Sea (UNCLOS) precipitates regional conflict over marine resources because it does not take into account local laws, histories, and perceptions of the marine environment. This project examines local and international politics over marine space in French Polynesia, particularly the ways in which local gendered conflicts between subsistence and commercial fishing relate to regional conflicts over diminishing commercial fisheries. Fishing grounds are often the site of local and international conflict because all but two of the world's principal fishing grounds are considered over- or fully-exploited.

GIS provides a useful vehicle for comprehending and mapping the intersections of local and international perceptions of marine use in order to address the failure of multilateral marine governance and the political relationships which underlie it. I raise questions about the gendered and class politics of access to GIS technology, such as who constitutes the data, and for whom natural resource data is analyzed and used (Lake 1993, Pickles 1995, Sheppard 1995). This project also engages debates in the PPGIS forum about the ability of GIS to accommodate multiple epistemologies in terms of assumptions about space and science, representations of the world, and the privileging of certain forms of knowledge (Aitken and Michael 1995, Curry 1994, Rundstrom 1995).

In the aftermath of the nuclear testing era, the government of French Polynesia has embarked on a development plan, "Le Pacte de Progres", which aims to strengthen and diversify French Polynesia's local economy. This ten-year plan targets the sectors of fishing, agriculture, and tourism. Subsistence fishing which is primarily performed by women in lagoons, provides up to 70 percent of animal protein in the Polynesian diet, yet women's contributions to the economy are not recognized or promoted in regional development plans. This project investigates the ways in which women's subsistence fishing is being transformed by the increased pressure placed on natural resources, due to the restructuring of French Polynesia's economy. Theoretically, I focus on the ways in which gender becomes a key component of both economic and environmental change through the commoditization of peasant production in the Third World. I anticipate finding that the intensification of fishing, agriculture and tourism results in increasing scarcity of resources, the marginalization of women's subsistence fishing, a breakdown in sustainable marine resource management practices, and new forms of local and regional environmental conflicts.

The decline of women's fishing is an excellent and previously ignored reference point to examine economic and environmental change because I hypothesize that it is a measure of a. the

degradation of lagoon and reef habitat by runoff from agriculture, overfishing, population growth, and regional/global environmental change; b. the decline in nutrition and health of French Polynesians as subsistence production yields to dependency on preserved imports; and c. the colonization of lagoon space by resort hotels, pearl farms, and yacht and cruise moorings.

This decline in subsistence fishing is coupled with an increased demand for fish from local open ocean fishing grounds, resulting from "Le Pacte de Progres". The local commercial fishing sector is being expanded and modernized, while simultaneously more licenses are being sold to foreign fleets for access to French Polynesia's 200 mile Exclusive Economic Zone (EEZ). Because "Le Pact de Progres" also targets tourism, more fresh fish is required by the increasing population of tourists and ex-pat employees. These development plans are ironic given that locals can no longer afford the prices for fresh fish in the local markets. Moreover, the southern Pacific is considered a fully-exploited fishing zone, and the waters around French Polynesia are considered a relative "desert" of marine life due to the lack of significant cold currents and upwellings.

To interrogate issues of multilateral governance, local subsistence, and environmental security in French Polynesia, it is necessary to ask questions such as: How do factors such as gender, race, and class constitute "different ways of knowing" and conflicting perceptions of marine space and use? How and for whom is international fisheries law, science, and technology constructed as universally valuable? To what extent are the interests of coastal communities in the developing world reflected in or protected by international and multilateral laws and treaties which govern marine use? How has the global market for fish incorporated "southern" coastal communities? How do the local, historical resource politics in a particular coastal community shape its integration into global patterns of marine degradation, conservation, and resource conflict?

**Mapping Environmental Conflicts: Research Setting and Methods**

The fieldwork for this project will take place on the islands of Moorea and Raiatea. These provide a useful comparison because while they are similar in size and population, Moorea is quite developed and Raiatea is relatively un-developed. However, much of the tourism and agricultural development planned for the next ten years will take place on Raiatea.

In September 1998, I shall begin a two-year post-doctoral fellowship at the University of California at Santa Barbara. During the first academic year, I shall train in GIS in the Department of Geography. From July 1999 to April 2000, I shall conduct research in Moorea and Raiatea, where I will conduct interviews and participant observation in conjunction with collecting digital data for the GIS that I am currently designing. This time-frame encompasses extremes in climate and precipitation, high and low tourist populations, and fish spawning cycles. The following methods will be employed:

1. To understand different and conflicting perceptions of marine use, I shall interview approximately 50 fisherwomen on each island, asking questions about where and how often they fish, how their fishing practices have changed over the last decade, and their perceptions of environmental use and conservation. Attendant to these interviews, I will map the locations and frequencies of actual lagoon fishing and marine use by women. I expect the

frequency of fishing to fluctuate depending on patterns of environmental degradation, pollution and weather; agricultural cycles; tourism flows; and fish spawning cycles. In the case of Raiatea in particular, this data will provide an excellent baseline study against which change over the next decade of development can be compared.

2. To understand competing uses of marine space, it is necessary to map lagoon and coastal use by men's commercial fishing, tourism and aquaculture. I will also map sediment run-off and pollution from agriculture and construction, particularly during the rainy season. In addition, I will conduct interviews with a stratified sample of approximately 20 commercial fishermen to contrast gendered perceptions of marine resources and use.
3. In order to situate French Polynesia's political ecology of fishing into wider economic, political, historical, and environmental patterns, I will collect regional fisheries statistics related to catches, foreign vessel licenses, exports, and local employment. I shall also interview development officers in regards to national perceptions and development plans for French Polynesia's marine resources.

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# GIS through community-based collaborative joint venture: an evaluation of impacts in rural Australia

Fostering effective use of GIS amongst a broad range of stakeholder groups and in the community as a whole requires investment in capacity building as well as in data integration and provision. Community-based collaborative joint ventures can achieve both these objectives. This paper reports the evaluation of one such initiative in tropical Australia and, on the basis of this experience, infers a set of issues that may determine the success or otherwise of similar ventures elsewhere.

Sustainable resource use and participative democracy have emerged as increasingly influential paradigms in the evolution of approaches to resource use planning and management in the post-war period. Traditionally, most decision-making has been vested with regulatory authorities. In recent years significant changes have occurred to involve the community in the decision-making process (e.g. McKenna 1995). Assumptions about what is required to achieve sustainable resource use, particularly the role of technocrats, resource users and the broader community in resource use decision-making have been challenged accordingly. In the Australian context, a rhetorical move towards participatory resource planning has underpinned much policy (legislation and funding) in natural resource management and rural development for the past decade (Dale & Bellamy, 1998). This puts Australia at the forefront of international experience.

Experience suggests that in order to enable effective community participation in resource planning, four fundamental requirements must be met. Stakeholders must have :

- effective access to information pertinent to resource use planning;
- access to the analytical tools required to make effective use of that information;
- the capacity to make appropriate use of those analytical tools and data sets; and
- a legislative and institutional environment that fosters effective participation.

Community-based decision-making represents a change in the organisation and operation of information systems. A planning strategy is an aggregate of: (a) knowledge about the state-of-the-environment as a rolling audit of existing conditions and resource issues, (b) a management plan showing planned activities, (c) information services to analyse design constraints and options, and (d) evaluation to refine and modify the progress of activities. In the traditional agency-driven approach to resource use planning, the community is informed about the state-of-

environment and the consequent plan. Increased community involvement may result in consultation or even negotiation about the interpretation of the former and the structure of the latter. However, delegation to the community means that they have to be responsible for these processes and have the capacity to undertake analysis and evaluation. So, the key distinction between an agency driven approach and a community driven approach is control of the information, evaluation and decision-making process. Empowerment of community based groups means they have involvement and ownership of both information and decision processes.

Appropriately structured community-based organisations can play a lead role in fulfilling these requirements. Historically, the local axis of industry representative bodies (such as the United Graziers' Association and Canegrowers) and other special interest lobby groups have played this role. More recently, advances in information technology have opened new opportunities for improving local capacity and participation in planning. As a result, a number of initiatives to create community resource information centres have arisen across Australia. Many of these initiatives are not specifically aligned with particular interest groups but aim to foster broader community sectors to participate in planning and decision-making. In this paper, we report on one such initiative and use consideration of this case study to identify key issues to be considered in establishing such ventures.

While many regional planning activities promote a consultation process, few have been successful in mitigating the decision-making process completely to community stakeholder groups. The Herbert Resource Information Centre, is an example in which community groups have control and ownership of resource information and related decision-making. This initiative is an exceptional example of community based decision-making, and exemplifies an emerging trend for self determination and community empowerment in undertaking the planning process. The most distinctive features of the HRIC are its capacity building function for stakeholders and the enthusiasm and willingness to learn on the part of the participants. Both are derived from a healthy balance between individual (agency) interests and community spirit. Commitment to joint projects was directly related to a sense of ownership and involvement in the decision-making process. It is reasonable to assume that this level of interest maybe more difficult to instigate and sustain in more complex regional communities. The HRIC model will not be applicable across all circumstances – the level of community involvement that can be attained is likely to remain across a spectrum of possibilities from community consultation to community initiated ventures.

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# Disability, Marginalization, Empowerment, and GIS

This paper concerns the potential of GIS for disability groups. It suggests there are three distinct domains where GIS may empower disability groups. First, GIS is a method that may be used by policy analysts, governmental agencies, and public utilities in order to analyze and map whether such resources as schools, restaurants, recreational facilities and transport networks are accessible and are appropriate given the size and scale of the catchment areas for populations with disabilities. In some areas, such resources may not even exist. Furthermore, GIS may be used to map and ascertain whether there is differential compliance with such legislative initiatives as the ADA (American Disability Act). Compliance to the ADA and similar regulatory acts may vary by area of the country (north vs. south, east vs. west), urbanization (city vs. rural, downtown vs. suburb), and topography (coast vs. inland, mountain vs. plains). One may make maps showing the spatial distribution of people with disability with "regular employment", "sheltered employment" and "no employment". These may indicate particular areas of discrimination. . Furthermore, do people cluster by accessibility and therefore does there exist in North American cities invisible ghettos of disability. If one maps according to type of disability, there may be systematic geographic shifts in these "ghettos".

In particular, the authors are able to show that there was a geographic differential in the use of the Job Accommodation Network (JAN). They spatially examine the data across time (1994-1996), sector of economy (services, government, manufacturing, transportation, wholesale, and other industries), type of impairment (motor, neurological, sensory, behavioral and other) and relative institutionalization.

Irrespective of the type of occupation there was a "U" shaped distribution in which there was more use on both coasts and the southern perimeter of the 48 contingent states. In the central U.S, throughout the mid-west, and along the Mississippi, there was clearly less use of JAN, a finding that correlated with an increased percentage of institutionalization. The following figures show examples of the type of distributions found.

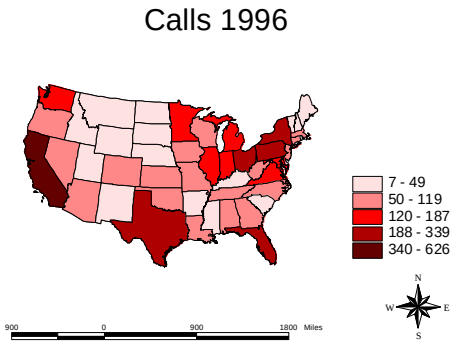


Figure 1. The number of JAN Calls in 1996 distributed spatially

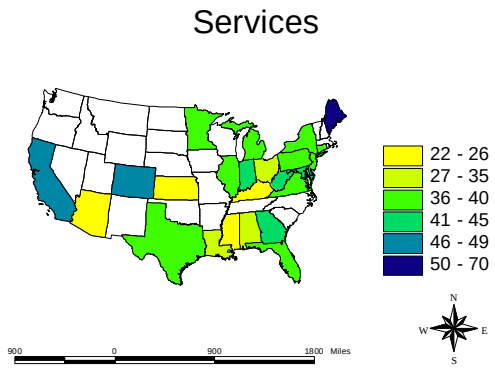


Figure 2. The number of JAN Calls Related to the Service Industries in 1996

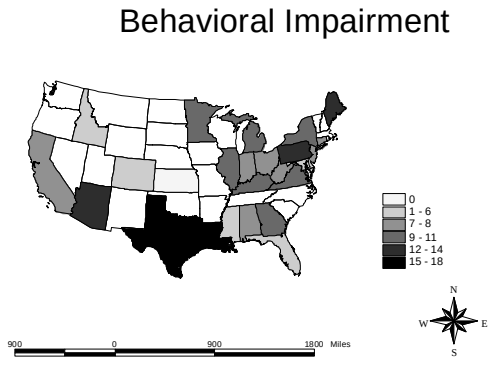


Figure 3. The number of JAN calls related to Behavioral Impairment

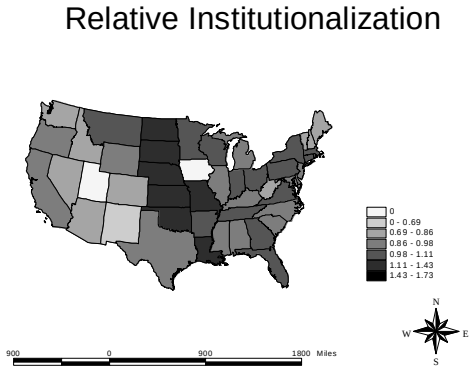


Figure 4. Relative Institutionalization of people with disabilities in the United States

Second, GIS is a method by which members of disability groups can empower themselves and make sure that their human rights are being respected in decisions that governmental agencies are making. Presently, allocating, measuring, and distributing resources spatially appears to be only available to those without disabilities. Populations with disabilities are not only being excluded but it appears that in the major mapping initiative being developed by the United States and Canadian governments the appropriate data are not being collected nor the appropriate variables defined. It is one thing for GIS's to define roads, postal codes, tax areas etc. based upon DEM's, Tiger Files, and such. But, if such data as accessibility are not collected and such variables as inclusion are not defined, then populations with disabilities will be excluded in the next millennium. It is incumbent on disability groups and others to make sure that this information is collected."

The third domain is making GIS accessible to people with physical or intellectual disabilities. Presently, the designs of GIS visualization and front end interfaces are not "user friendly" for people with disabilities. It will require an entire new look at existing systems as well as the redesign of GIS input and output systems. By making such systems accessible, one hopes to train people with disabilities in GIS technology. This will not only open up new and exciting job markets but will enable people with disabilities to do their own enabling research for advocacy purposes.

In short, the authors argue that GIA and GIS are powerful tools for policy studies for marginalized peoples because there is the potential to empower civil society through GIS. It provides information in a form usable for advocacy purposes while at the same time supporting community and organizational development through an interactive process. It provides a method for connecting different groups with different agendas through a common data source. GIA and GIS can uncover human rights violations and abuses as well as show patterns of discrimination. Used positively, it can enable policy coherence.

# VIII Conclusion

There is rapidly growing interest in the use of GIS for projects that intend to help empower historically marginalized people and communities. These PPGIS projects include applications from a diversity of social contexts. Some of the earliest efforts involved indigenous natural resource mapping in arctic and tropical regions within the Americas. Furthermore, there is presently a growing network of planning professionals interested in how PPGIS can enhance community participation in the context of community/neighborhood development and urban-based spatial decision-making. Environmental groups are also now experimenting with PPGIS in association with efforts to promote "environmental equity," while also struggling against environmental racism. NGOs, aid organizations and governmental agencies are also now looking towards PPGIS in an attempt to promote more populist and sustainable "development" projects.

What these very different applications have in common is that GIS is being used to broaden community participation in spatial-decision making and for a more inclusive understanding of local landscapes. PPGIS is, therefore, an attempt to integrate GIS within participatory research and planning and this necessitates that local knowledge(s) be incorporated into GIS production and use. This suggests that there are formidable social and technical challenges for the successful design and implementation of PPGIS research and projects. The Varenius "Empowerment, Marginalization and Public Participation Workshop" demonstrated that PPGIS is in its infancy. As a result, the enthusiasm for undertaking PPGIS is complicated by the realities of how it might actually be achieved. The Varenius PPGIS workshop was an important first step because for the first time, a group of PPGIS researchers and implementers were brought together. What we have learned is important and will benefit the PPGIS community in a diversity of locations and social contexts.

The meeting stimulated many new ideas and brought people together to initiate new projects. Within one month of the meeting, nine proposals were submitted to the Varenius initiative. Six were accepted for funding. These are:

- Susanna McMaster, Helga Leitner and Sarah Elwood,: *Developing Methodologies for Evaluating the Efficacy of GIS for Community Development.*
- Renée Sieber and John Krygier: *Mapping Local Knowledge of Defensible Space.*
- Kheir Al-Kodmany: *Interactive Design Decision-Making in a Virtual Urban World*.
- Barbara Walker and Paul McNab: *Marine Fisheries Information Technologies and Fisheries Degradation.*
- Peter Kwaku Kyem and Gavin Jordan: *An Examination of the Framework and Evaluation Criteria for PPGIS in Community-Oriented Natural Resource Management.*
- Nancy Obermeyer and Renée Sieber: *Planning a PPGIS Conference.*

The seed grant for *Planning a PPGIS Conference* is a group effort that will be coordinated by Nancy Obermeyer and Renée Sieber. The intention of this conference is to bring together a much larger group of PPGIS researchers and implementers and to broaden the interface between PPGIS applications from within and outside of the academy. It is expected that GIS venders will

also participate. Another outcome of this meeting will be the publication of a PPGIS book. It is anticipated that a number of research proposals and journal articles will also be produced.