Public participation geographic information systems (PPGIS): challenges of implementation in Churchill, Manitoba

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Public participation geographic information systems (PPGIS) increasingly are utilized in geographic research, yet researchers rarely are provided with guidance on how to implement PPGIS in an appropriate and effective manner. This article reports on the process of research that explores responses to current and future local tourism development offered by a sample of residents using a modified PPGIS approach called ‘community action geographic information system’ (CAGIS). The conceptual development of CAGIS is reported and the challenges encountered during its implementation in Churchill, Manitoba during 2005–2007 are reviewed. It is suggested that researchers wishing to conduct similar research should undertake thorough preliminary fieldwork to assess the likelihood of finding agreement on a common problem; acquiring adequate resources; establishing collective responsibility for the project’s outcome; attaining stakeholder support; developing trust and meaningful relationships; and incorporating indigenous knowledge appropriately. Feedback of results to...
community members also should be an integral part of the research process. A number of feedback mechanisms are reported, including an interactive weblog, which helped facilitate communication between heterogeneous groups in Churchill. Although ambitions for a truly participatory GIS approach to this project have been set aside, it is held that PPGIS can yield positive outcomes for communities and academia. Sharing this research experience will be useful to others who venture into PPGIS research, especially in northern communities.

Key words: Arctic tourism, community perceptions, participatory action research (PAR), public participation geographic information systems approach (PPGIS)

Introduction

Mistrust and suspicion of researchers still lingers in some indigenous communities (Smith 1999), a situation created by decades of ‘helicopter research’ whereby investigators arrive in a community, collect their data and leave (Freeman 1993, 193). In northern Canada, communities have become the subjects of an increasing number of research projects, yet in many instances have failed to benefit from their involvement, leading some to claim that communities are suffering from ‘research fatigue’ (Parlee 2006, 33). However, since the late 1970s, considerable progress has been made to ensure that researchers working in northern Canadian communities adhere to principles for the conduct of ethical research, which emphasize ‘the need to create meaningful relationships with the people and communities affected by research’ (Association of Canadian Universities for Northern Studies 1998, 3).

The antithesis of helicopter investigation, participatory research, is an overarching term for enquiry that aims to empower community members through active engagement in research processes (Taylor et al. 2004). Development of trust between researcher and community (Harvey 2003), and active participation of community members in planning, implementation and/or evaluation of research, are some of the foundational elements of participatory research (Israel et al. 1998; Taylor et al. 2004; DeLemos 2006). A wide range of research approaches is evident in the literature, labelled variously as participatory action research (PAR), community-based, community-wide, community-centred and community-involved research depending on the extent to which community members are active, or share power, in participatory research processes (Israel et al. 1998; Bloodworth et al. 2004). However, PAR is distinguished from the other approaches previously listed as it specifically facilitates social action and change by and for
Public participation geographic information systems (PPGIS) is one research tool that fosters the ideals of PAR. Considerable progress has been made since 1998 in the partnering of geographic information systems (GIS) and participatory research methodologies (Aberley and Sieber 2002; Sheppard 2005). The term PPGIS describes the many and varied forms of this partnership and first came into widespread use after the 1998 International Conference on ‘Empowerment, Marginalization and Public Participation Geographic Information Systems’ (Aberley and Sieber 2002; Craig et al. 2002). PPGIS initially was designed for a specific purpose, namely to examine how GIS technology could support public participation for variety of possible applications (Aberley and Sieber 2002). Since then, there have been many variations in application of PPGIS, but all uses share the need to capture diversity of local knowledge and to empower people to participate in spatial decision making exercises (Craig et al. 2002; Hasse 2003).

Although PPGISs are becoming more commonplace in geographic research, the challenges of implementation rarely are reported (Sieber 2003). As a result, PPGIS researchers possess few resources to help resolve tensions and answer practical questions arising from their research, particularly in the early stages of implementation. As in the wider field of participatory research, there is a need for open and honest reflection on the ‘unique challenges and obstacles that community members and researchers confront...and the lessons learned from such interactions’ (Taylor et al. 2004, 6). This reflective exercise requires a self-critical outlook so that the significance of conducting PPGIS research with and for communities, instead of ‘on’ communities, can be realized. The purpose of this paper is to reflect critically on the challenges and obstacles of implementing a PPGIS variant called ‘community action geographic information systems’ (CAGIS) in a research project examining resident attitudes to tourism development in Churchill, Manitoba.

A brief overview of GIS and PPGIS is followed by a review of their applications in a tourism context. The tourism research project is presented as background context to the development of CAGIS. The challenges of implementing CAGIS in the case study site are discussed but, ultimately, the seriousness of these implementation challenges required a modification of CAGIS. The paper continues with a brief discussion of how the project has evolved and a review of the lessons learned from this research experience. Although our specific research setting was northern Canada, the problems experienced and insights gained are of broad utility to other researchers working with PPGIS.

**PPGIS**

Geographic information systems are a collection of tools and approaches that have been used widely to deal with complex planning environments through the system’s capability to store, analyze and display large quantities of spatially referenced data (Hasse 2001, 2003; Hasse and Milne 2005). Since the late 1980s concerns were raised in the academic arena about the accountability of GIS from political, economic, societal and ethical perspectives. Specifically, the disquiet focused on the social implications of how people, space and the environment were represented in GIS. Captured in what has become known as the ‘society and GIS’ debate, these concerns centred attention on whether GIS could be either a democratizing or disenfranchising force (Rundstrom 1995; Obermeyer 1998). Some authors argue GIS is a contradictory technology that simultaneously marginalizes and empowers peoples and communities (Craig and Elwood 1998; Elwood and Leitner 1998).

The current PPGIS movement, sometimes called GIS-2, or GIS-two, emerged from the ‘society and GIS’ debate and seeks to develop GIS technology and applications that are more adaptable to different types of data. PPGIS represents the vision of those interested in the sociopolitical contribution of GIS to communities, and this vision includes tools that are easily used and understood by community members, relevant to public policy issues and available to all sides of public policy debates (Barndt 1998). The defining characteristics of PPGIS are summarized in Table 1.

A growing number of projects have been implemented under the PPGIS banner as ‘public
Public participation geographic information systems (PPGIS) often are:

- interdisciplinary research, community development and environmental stewardship tools grounded in value and ethical frameworks that promote social justice, ecological sustainability, improvement of quality of life, redistributive justice, nurturing of civil society
- practiced in streams relating to place (urban, rural), organizational context (community-based organization, grassroots group, nongovernmental organization, local government, regional government, state/provincial government) or sector (transportation, watershed restoration, food security, housing, public health, etc.)
- endeavouring to involve youth, elders, women, First Nations and other segments of society that traditionally are marginalized from decision making processes
- functionally and holistically based; that is, can be applied to help solve problems in specific sectors of society, and/or to provide broader integrated assessments of place-based or bioregional identity
- best applied via partnerships developed among individuals, communities, nongovernmental organizations, academic institutions, religious or faith-based institutions, governments and the private sector
- endeavouring to always include a strong capacity building dimension in their application
- linked to social theories and methods originating in planning, anthropology, geography, social work and other social sciences
- linked to applied qualitative research tools including participatory action research, grounded research, participatory rural appraisal, etc.
- a tool that is best applied in a wide variety of manual, digital, two-and three-dimensional formats and data types (digital, oral, image)
- enabling public access to cultural, economic and biophysical data generated by governments, private sector organizations and academic institutions
- supporting a range of interactive approaches from face-to-face contact to web-based applications
- promoting development of software that is accessible to broad acquisition and ease of use, and
- supporting lifelong learning of its practitioners in a manner that helps to bridge the divides that exist among cultures, academic disciplines, gender and class; is about sharing the challenges and opportunities of place and situation in a transparent and celebratory manner

GIS and PPGIS tourism research

Although much data analysis has taken place in tourism research without the use of GIS, McAdam (1999, 79) argues that ‘since most tourism planning problems have spatial or geographical characteristics, and tend to be multidimensional and complex, it is likely that projects could be more accurately managed using the techniques and tools found in a GIS environment’. Despite the 1975 development of a GIS, known as the ‘Tourism and Recreation Information Package’ (TRIP) for various Scottish agencies, to date the application of GIS in the tourism field is limited and patchy (Boyd and Butler 1996; Forer and Simmons 1998; McAdam 1999; Nicholls 2001; Tremblay 2005). A dearth of tourism GIS applications existed from 1975 until the mid-to-late 1990s when a variety of GIS applications began to be made in the tourism context (Bertazzon et al. 1997). These included GIS as a means to integrate international and domestic tourist supply and demand data to assist regional and local planning in New Zealand (Forer and Simmons 1998; Van der Knapp 1999); GIS to help in the analysis of tourism spatial patterns (Van der Knapp 1999); GIS as a marketing tool for the tourism industry (Bertazzon et al. 1997); GIS techniques applied to wildlife tourism (Tremblay 2005); and GIS as a mechanism for inventorying, monitoring, analyzing and planning for the management of protected natural areas (Boyd and Butler 1996; Briggs and Tantrum 1997; Landres et al. 2001).

In the late 1990s, tourism researchers became interested in public participation GIS (PPGIS) as a tool to enhance citizen participation in tourism planning and development (Bahaire and Elliot-White 1999; McAdam 1999; Hall and Page 2002). Research by Hasse (2003) and Hasse and Milne (2005) pioneered the application of PPGIS in...
CAGIS

Given that there are few clear indications of how to integrate the views of host populations within a sustainable tourism planning framework (Din 1999), new tools and approaches need to be developed to facilitate consensus and communication among heterogeneous groups within host communities (Simmons 1994; Jamal and Getz 1995; Hasse 2003; Hasse and Milne 2005). Proponents claim PPGIS helps lead to sustainable tourism development because it has ‘the potential to facilitate a better understanding of stakeholder perceptions towards tourism and improve community participation in tourism planning’ (Hasse 2003, 1). The link between sustainable tourism and PPGIS is important, because if the tourism industry in northern Canada aspires to be sustainable, then decision makers need to understand and integrate local knowledge into the planning process. A critical research focus, then, is to determine how to achieve sustainable tourism in Churchill that is acceptable to local residents. Developing from this aim, the research reported in this paper has a number of interrelated objectives that are summarized in Table 2.
Table 2
Interrelated research objectives

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<th>Theory</th>
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<tr>
<td>■ Draw together the fields of participatory development and tourism planning to further understand the pivotal role of community members, and the importance of their perceptions, in the tourism system</td>
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<td>■ Understand more fully how communities give meaning to place and how this meaning is articulated in spatial decision making processes</td>
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<th>Method</th>
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<td>■ Develop, in partnership with a local community, an appropriate participatory action methodological framework to integrate and ‘blend’ different responses made by community members to issues of tourism development</td>
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<tr>
<td>■ Further refine public participation geographic information systems (PPGIS) approaches and methodologies in addressing community concerns and preferences surrounding the sustainable management of natural resources</td>
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<th>Practice</th>
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<td>■ Work in partnership with a community to help identify and investigate the perceptions of community members towards tourism and its future development</td>
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<tr>
<td>■ Provide and develop a tool with, and for, the community (and the skills to use and update it) that has the potential to help facilitate meaningful dialogue in tourism planning debates</td>
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The intention of CAGIS is to ensure community members are given the opportunity to take ownership of the research, its questions and design, in a way that will leave the community with a dynamic tool and the skills to aid decision making now and in the future. This approach to research has the potential to generate action that may, in turn lead to refinement of the GIS technology and, more importantly, to empowerment of the community. The underlying principle for such a collaborative approach was to involve community members, at a minimum providing them with the opportunity to be involved in the evolution of the research. Furthermore, the results were to be shared and discussed with community members whenever possible. By approaching the fieldwork in this manner, it was hoped that the process, as well as the outcome of the research, would be of relevance to the community being studied and that community cooperation might be more forthcoming if the research were discussed openly (Lewis 2003; Hardy 2005).

Fundamental elements of the CAGIS are illustrated in Figure 2. The principal idea of CAGIS is ‘to utilise GIS technology in the context of the needs and capabilities of communities that will be involved with, and affected by, development projects and programs’ (Abbot et al. 1998 in Hasse 2003, 56). The essence of GIS remains central (as a tool to store, manage, analyze and display spatial information), but the intention is that CAGIS is developed in partnership with a community, so that local knowledge is used sensitively and managed appropriately in that technology. Hasse (2001, 2003) collected local knowledge about tourism activities and development using a community mapping exercise. She asked a cross section of local residents to mark locations on a topographical map where tourism activities were deemed either acceptable or unacceptable. These locations were then plotted onto a map in ArcGIS, which formed the basis of her PPGIS model. A similar strategy was envisioned for CAGIS through its application in Churchill, Northern Manitoba. The following section of the paper outlines the nature of tourism in Churchill and, suggests why CAGIS was thought to be a useful tool to capture resident attitudes of tourism in this community.

Case Study: Resident Attitudes towards Tourism in Churchill, Manitoba

Located on the western shore of Hudson Bay in northern Manitoba, the community of Churchill has a tourism industry that can be dated to the 1960s when visitors first arrived by train. (Figure 3). With the foresight of local entrepreneurs and exposure from media, Churchill’s polar bears quickly became a reason to visit the community. By the early to mid-1980s, substantial numbers of tourists visited Churchill to observe polar bears from the safety of specially designed tundra vehicles, leading Churchill to gain international status as the ‘polar bear viewing capital of the World’ (Churchill Tourism Planning Group 2006). It is estimated that up to 3,000 tourists visit in the fall season to view polar bears (Lemelin 2005) and, in 2003, the polar bear viewing industry alone was calculated to have added C$2 million to the Churchill economy (Lemelin 2004). In addition to polar bear viewing activities, much smaller numbers of tourists are attracted to Churchill for opportunities to watch birds, beluga whales in the Churchill River...
and Hudson Bay, and engage in other nature-based activities such as viewing the *aurora borealis* (northern lights) (Stewart and Draper 2007).

Given Churchill is likely one of the most-visited small communities in northern Canada, it is surprising that there are no records of resident perceptions towards tourism in Churchill. Lack of research on resident perceptions may mean, as observations from elsewhere indicate, that residents rarely have opportunities to comment on, and influence, the type of tourism activities and services being developed within their community (Wolfe-Keddie 1993). An assessment of resident attitudes towards tourism was both timely and critical, owing to the anticipated affects of climate change on the Western Hudson Bay polar bear population. A decline or loss of this polar bear population either through movement north or extinction likely will have far reaching implications for Churchill’s multimillion tourism economy (Stewart and Draper 2007).

CAGIS was thought by the researchers to be a useful tool to help capture resident attitudes towards current tourism activities and, in light of climate change, resident concerns about the longevity of tourism in Churchill. Since CAGIS is a relatively new approach to studying resident perceptions of tourism, this paper now critiques the research process adopted in Churchill. The critique begins with a description of the methodological approach underpinning CAGIS.

**Methodology**

The participatory nature of CAGIS demanded an iterative, multistage, multimethod approach be adopted in Churchill. Such an approach to research involves collecting data in stages with each stage informing subsequent periods of data collection (Hardy 2005). During four visits to Churchill between June 2005 and November 2006, the first author collected data over three main stages of research. The first stage of the research involved collecting preliminary background information from interested tourism stakeholders in Churchill. Resident attitudes
towards tourism were surveyed during stage two of the research, and feedback of results to the community comprised stage three of the research. Time between each stage of the research project allowed for synthesis and reflection. The research gained university ethics approval and no additional ethics approval was required for working with human subjects in northern Manitoba. The following section discusses findings from stage one, which sought to involve tourism stakeholders in the design and development of CAGIS, and to canvass their opinion of using CAGIS to capture resident perceptions of tourism (planned for stage two of the research).

A semistructured interview was designed with the dual aim of soliciting background information on tourism development and scoping out support for CAGIS. The fieldwork consisted of 25 stakeholder interviews with local tour operators, hotel owners, educators and representatives from the Town, the Chamber of Commerce, Parks Canada and Travel Manitoba. All of the questions were open ended so responses were later coded and analyzed using manual and computer-based searches for repeated themes and topics (Lofland and Lofland 1984). In the following section, a code containing letters (to denote the community, i.e., ‘CH' for Churchill) followed by

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1 In Nunavut research projects are assessed by the Nunavut Research Institute.
Results from stage one

This section reports on the key themes to emerge from the preliminary fieldwork and specifically examines the challenges, tensions and obstacles expressed by respondents about CAGIS during the interviews. Following Israel et al. (1998) the results are organized into three broad, but interrelated, categories: (1) issues related to developing community research partnerships; (2) methodological and technical issues involved in CAGIS; and (3) broader sociocultural, economic, political and institutional challenges.

(1) Developing community research partnerships

Overall, the preliminary fieldwork revealed a cautious level of support for the overarching aim and objectives of the research, acknowledging that...‘we can’t have one person saying that tourism should be like this, or that...someone has to come in and stand up and move forward, change is good. We need to tackle fears as we are a small place and everyone knows that too many people are stretched too thin’ [CH: 07]. There also was agreement that there was a genuine lack of research on tourism issues. ‘There is an abysmal lack of research on Churchill...Gauging it is very difficult’ [CH: 11]. Despite cautious approval of the research project, a number of issues related to developing community research partnerships emerged:

- **Lack of trust**

  A foundational component of participatory research is the development of trust (Harvey 2003). This was articulated clearly in many of the interviews, with some respondents doubting that such trust could be attained, thereby critically weakening CAGIS. ‘Respect and trust would make a big difference: but I don’t think you’ll find it here. In business, it’s dog eats dog...likely the dollars generated in a short time is something to do with it’ [CH: 09]. A number of respondents suggested that absolute researcher independence had to be ensured if trust was to be developed. ‘Ensure that you are not associated with any organization so that you can build that trust, because someone will have a negative feeling for at least one of the agencies’ [CH: 10].

- **Scepticism**

  Some scepticism among the participants was evident about whether it was worthwhile investing time and energy into CAGIS when participants ‘already know the answers you are going to get’ [field journal, June 2005]. ‘In terms of community [attitudes to tourism], there are different opinions: some see tourism as good for jobs but some get very annoyed’ [CH: 08]. For some respondents the issue of tourism development in Churchill was less than pressing, and this was of concern because one of the aims of PAR is to address questions of critical concern, as identified by the community (Van der Eb et al. 2004).

- **Prior community experience with researchers**

  In the past, Churchill has had negative publicity resulting from research projects, ‘and that reflects poorly on Churchill’ [CH: 10]. The backlash from these negative research relationships in Churchill was clearly unhelpful in developing a research project in partnership with the local community. Why should this research team be any different to the last! The advice from a number of respondents was to ensure that the research process was transparent and, that results should be fed back to the community first, before being published elsewhere.

(2) Methodological and technical issues involved in CAGIS

There was general agreement that GIS technological support and facilities existed in Churchill and that these resources were sufficient to facilitate an ongoing CAGIS process. This is important for CAGIS because without technological support and facilities in situ, the ongoing development of CAGIS would be severely limited. Also, Churchill residents previously had been exposed to mapping exercises; this is important for CAGIS because it was anticipated that these exercises would form the basis of stage two of the research. However, despite readily available support and facilities for CAGIS, a number of methodological and technical issues were highlighted:
Setting research questions

When stakeholders were asked to identify key research questions, often industry-specific questions were posed, such as ‘I’d like to know why we aren’t seeing more Japanese visitors here’ or ‘how can we attract more whale-watchers to Churchill’ [field journal, June 2005]. There did not appear to be consensus on a common problem, or on research questions to be tackled. This was of critical concern, because CAGIS, deeply embedded in PAR, requires community members to take ownership of the research, its questions and design. Without some level of consensus among community members, ownership of CAGIS was unlikely to be achieved.

Researcher appeasement

There were other warnings about conducting research in Churchill, ‘What we speak and what we practice are quite different things’ [CH: 10] and ‘[we are a] good community with good people but people tell researchers what they want to hear’ [CH: 10].

Research fatigue

Concerns that apathy levels in the community were sufficiently high lead some respondents to note that ‘people are afraid to think outside of the box, there is a lot of suspicion of anything new. The local people want everything but they are not willing to assist’ [CH: 06]. Given the assumption that only particular ‘types’ of people will be able to participate in these kinds of projects, community members who frequently participate ‘get tired as they are so heavily relied on’ [CH: 10].

(3) Sociocultural, economic, political and institutional challenges

As Israel et al. (1998) point out, the challenges of participatory approaches to research relate often to the broader sociocultural, economic, political and institutional dynamics of the community. These dynamics evident in Churchill are examined below:

Existing stakeholder conflicts and tensions

While some community members were encouraging, others were more sceptical that a participatory project could be managed in Churchill because of the difficulties of working with the main stakeholders, due to preexisting conflicts. This is reflected in field notes: ‘Interviews have been repeatedly focused on bully-boy tactics within the Churchill tourism industry, with hoteliers, operators, the “Town” and the “Chamber” pulling in different directions. The best word to articulate it is “fragmented”, to the extent that some believe that there is no future for tourism in Churchill at all. I suspect there is a great deal of history and “baggage” associated with this situation. Churchill is a community (not dissimilar to other small communities I suppose) where people wear many hats’ [field journal, June 2005].

Problems with seasonality

The short polar bear viewing season (generally six weeks in October and November) is the main income-generating period for tourism operators in Churchill. During this time, use of visitor facilities and services are maximized, but outside of the main tourist season, the community is left with an underutilized tourism infrastructure. There was identification that something ‘had to be done’ about the economic problems arising from seasonality but realization that this would not come from within the community: ‘Random energy needs to be harnessed, but it is hard due to the economies involved, we need to find a person we could trust who could keep it equal, but we don’t have the funds. We need more working together and trust’ [CH: 09].

Competing institutional demands on time and resources

Realizing a collaborative style is a challenge for a new researcher (or any researcher, however, well experienced), who, for example, may be inhibited from investing the necessary time often required in building a relationship with a community (Taylor et al. 2004). The first author is limited by the timeframe of a doctoral degree, and this situation does not lend itself well to conducting participatory research, and particularly in locations that are expensive to access. Equally, from the community perspective, competing demands on time and resources may make it difficult for individuals to devote the...
necessary time and energy to a participatory research project.

The importance of such comments to CAGIS is that without widespread community commitment to the research topic, the participatory process of CAGIS would be seriously undermined. When compounded by scepticism, mistrust, lack of time, existing community conflicts the use of CAGIS would appear impossible.

Discussion: Challenges of CAGIS Application in the Field

The challenges, tensions and obstacles encountered during stage one of CAGIS in Churchill illustrates the truism that participatory research rarely follows a smooth path in practice (Cornwall and Jewkes 1995; Turnbull et al. 1998; Schlossberg and Mattia 2003; Sieber 2003). The jump from theory to practice often is one of the biggest challenges facing researchers who aspire to follow participatory approaches to research. In order to make this move successful, some authors view participatory research as a series of interconnected phases. This is particularly useful in the context of this paper, because at each phase problems and/or challenges are identified. One of the most useful models (see Strauss 1999 in Schlossberg and Mattia 2003) identifies four phases to capture the chronological order of most participatory processes (see Table 3).

The first two phases, start-up and process-design, are of particular interest in this paper. The major challenges in implementing these phases include the need to agree on a common problem, the need for adequate resources and trained facilitators, and the need to establish collective responsibility for the outcome (Schlossberg and Mattia 2003). In the context of northern research, the authors would add other challenges such as the importance of stakeholder support, the need to develop trust and meaningful relationships and the appropriate incorporation of indigenous knowledge. Each of these challenges is discussed briefly.

- Need to agree on a common problem

While there was support for the broad overarching aims of the research in Churchill, there did not appear to be consensus on a common problem, on research goals or on research questions to be addressed. This lack of consensus echoes a warning made by Schlossberg and Mattia (2003, 2) that failure to agree on a common problem led their research into a ‘somewhat bitter, antagonistic state’. A connected problem is that GIS projects can flounder on poorly defined goals, or be exacerbated by using GIS (Robinson 1992; Landres et al. 2001). These problems might signal a faltering in the start-up and design-process phase of the research, but PPGIS projects might wish to treat research problems, goals and questions as somewhat fluid. However, there comes a time when consensus is required to progress the project.

- Need for adequate resources

While the provision of adequate resources was not at issue in the research reported in this paper, some authors suggest that access to resources has been one of the major barriers to the implementation of PPGIS projects (Dunn et al. 1997; Barndt 1998; Sieber 2003). These resources include sufficient funding for computing, training, upper-management commitment, a GIS champion capable of guiding the system to completion and access to data (Sieber 2003). Although many countries possess relatively easy access to these resources, there are stark differences in resource availability in marginalized communities such as indigenous reserves (Barndt 1998; Sieber 2003). These differences also may be the case in some remote northern communities.

Table 3
Phases of participatory processes

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<th>Phase</th>
<th>Description</th>
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<td><strong>Phase 1: Start-up</strong></td>
<td>people at the community level acknowledge that a problem exists beyond the power of a single person to solve</td>
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<tr>
<td><strong>Phase 2: Process-design</strong></td>
<td>determines if a consensus approach is appropriate, who should be involved and how the process initially should be structured</td>
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<tr>
<td><strong>Phase 3: Consensus-building</strong></td>
<td>is an iterative interaction where participants in the process agree on ground rules, engage in joint fact finding, come to a common definition of the problem, and possibly reach consensus about a course of action</td>
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<tr>
<td><strong>Phase 4: Implementation</strong></td>
<td>where the agreements reached in the consensus phase are put into action</td>
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Need to establish collective responsibility for the outcome

Without consensus on the goals of CAGIS, it is hard to imagine how joint ownership of the project can be attained and maintained. The need to establish collective responsibility implies that participants want the project to be successful, and for some researchers this is the most important characteristic in a participatory process (Schlossberg and Mattia 2003). Inextricably linked to attaining collective responsibility for the project’s outcome is the critical dimension of gaining stakeholder support.

Importance of stakeholder support

The effort required to ensure wide stakeholder participation should not be underestimated. Communities rarely are uniform, but sometimes are deeply divided by ‘differences in wealth, gender, age, religion, ethnicity, and by implication, power...’, so researchers need to be cautious of ‘coherent expressions of community needs or priorities’ (Cornwall and Jewkes 1995, 1673). Similarly, research questions devised (either wholly or in part) by a local community tend to carry their own biases, perpetuating the observation that PPGIS can simultaneously empower and marginalize (Elwood and Leitner 1998).

Need to develop trust and meaningful relationships

The requirement to develop trust between researcher and community is a key challenge in the early phases of PPGIS projects, but attaining trust is not straightforward. Working with local residents is rarely straightforward, particularly when there is a perceived imbalance between time and energy input and direct personal benefit. The researcher’s enthusiasm for a research project is unlikely to be shared (to the same degree) by the community, however well intentioned the aims of the research may be. There also may be a sense of research fatigue or overload where a community may be tired of answering questions to which they feel they already know the answers. Clearly, this is not the context within which to build meaningful relationships, or an effective CAGIS.

Appropriate incorporation of indigenous knowledge

Although the research reported here did not advance to this stage, a key challenge in the development of PPGIS in largely indigenous communities is the legitimate and appropriate use of indigenous knowledge. Debates surrounding this issue sometimes are bitter; on the one hand, some researchers claim that GIS tools complement indigenous knowledge systems where the relationships between individuals, places, cultural activities, experiences and indigenous knowledge can be explored (Tabor and Hutchinson 1994; Harmsworth 1998). On the other hand, some researchers caution that the use of indigenous knowledge in GIS projects is problematic because knowledge is taken out of its cultural and spiritual context, meaning is lost and knowledge becomes static and fixed. (Rundstrom 1995). This debate has many ethical and cultural implications and should be addressed openly in evolving indigenous-based PPGIS projects.

Stage one (preliminary fieldwork) of the research reported here revealed that the main components necessary for successful start-up and design-process phases were problematic and, given the limited research timeframe, it seemed untenable to persevere with a participatory process. As Dunn et al. (1997, 7) reminds us ‘a GIS should never be a quick fix strategy; rather its introduction should be slow, with long-term or medium-term training programmes, directed at real needs, and the design should be relevant to local conditions’. If full power sharing (as described by Arnstein 1969) is the aim of CAGIS then community fragmentation, clearly evident in Churchill would make a truly participatory approach to CAGIS difficult.

Research postscript

The results from stage one of the research required that the CAGIS framework be modified by the research team. The modification of CAGIS shifted the research approach from a PAR approach to a collaborative community-involved approach, utilizing a mix of methods, such as resident interviews and mapping exercises. A GIS component will be retained in the analysis, but CAGIS will not form the guiding framework for the research. However, it is hoped once
researcher trust has been established, future spin-off projects might emerge from the community itself, furnishing the elusive but fundamental requirement that research questions should come from within the community. Through discussion of stage two and three of the research, the following section briefly describes how the research has evolved to date.

■ **Stage two: Engagement with residents**

A total of 75 interviews were completed with local residents, representing approximately 11.6 percent of the 640 individuals over the age of 20 in Churchill (Statistics Canada 2007). Questions in the resident semistructured interview focused on how tourism has developed in the community, identification of positive and negative effects of tourism, their understanding of wider community perceptions of tourism, and future outlook in terms of tourism development. All questions were open ended, so that views emerged solely from the participants, rather than through prompting by predetermined answers. Statements were coded and grouped to form the basis of subsequent analysis.

The mapping exercise used a colour satellite image of the area, which was placed into a clean plastic sleeve. Respondents were asked to identify by writing with permanent markers locations that concerned them most about current tourism development, and places where they felt tourism development currently was acceptable. They also were asked to identify acceptable and unacceptable locations for future tourism development. A new plastic sleeve was provided for each respondent and retained for later data analysis. All the locations identified by the residents were later plotted onto the satellite image using ArcGIS-ArcMap software. The mapping exercise was useful for prompting discussion regarding the environmental effects of tourism; such effects were rarely mentioned in the semistructured interviews with residents.

■ **Stage three: Research feedback**

An integral part of the research process was to give residents the opportunity to view and comment on the raw data. This is an important principle for the conduct of research in general, and has been stated specifically in a document outlining ethical principles for research conducted in the north: ‘On-going explanations of research objectives, methods, findings and their interpretation should be made available to the community’ and ‘research summaries and reports should be made available to the communities involved’ (Association of Canadian Universities for Northern Studies 1998: 6). Feedback of results (including a series of recommendations) to the community took four forms: reporting back initial data (via a short written report) to as many stakeholders as possible (16 out of the original 25) who were interviewed at the start of the project; lodging reports of the initial data in public settings (library, town complex, school and study centre); setting up a poster in the community detailing the initial findings of the resident surveys; and developing a weblog to widen community access to the results (see http://tourism-in-churchill.blogspot.com/).

The adoption of a community-involved research strategy was useful to help engage local people in dialogue and identify issues that resonated locally. Despite warnings from individuals at the outset of the project, community cooperation was forthcoming and there was a genuine sense that this research was both timely and relevant. An iterative multistaged fieldwork strategy was critical to the success of this collaborative project. It was hoped that the repeat visits (four in total), in different seasons, would dispel community concerns that the researcher was not just another outsider ‘helicoptering’ in. The different iterations of the study allowed for feedback of research developments, the results of which also were integrated into later stages of the fieldwork. The process of reporting back findings to the community through various mechanisms was met with genuine surprise and interest (i.e., that someone had taken the time to come back). The weblog proved and continues to be a useful research tool to help facilitate communication between heterogeneous groups in Churchill. One of the outcomes arising from the research was the suggestion to integrate the findings into Churchill’s first community tourism plan. Community dialogue regarding tourism and identification of action from the research findings were initial objectives of CAGIS, so it is interesting that this outcome has been attained.
Conclusion

The initial faltering of CAGIS described in this paper is, we believe, representative of general broad-ranging issues facing PPGIS implementations. Some of the challenges were exaggerated by the unique nature of northern research, such as logistics, research culture and environment. But also, as is illustrated in this paper, participatory research presents a variety of practical, cultural and ethical challenges for researchers especially because ‘the visibility of the researcher and the transparency of their intentions are significantly greater than in conventional research’ (Cornwall and Jewkes 1995, 1672). This situation is magnified when researchers are working in small communities, such as those in northern Canada.

A key component of working with and within northern communities is the development of meaningful relationships, yet researchers rarely are provided with practical guidance on how to achieve this in an appropriate and effective manner (Laidler et al. 2004). This is problematic; with hindsight, the authors would stress to others who might be considering a similar course of research the importance of thorough preliminary investigation, where the researcher(s) visit the proposed case study site(s) to consider carefully and assess clearly the conditions necessary for successful PPGIS. And as noted above, there is a need: to agree on a common problem; for adequate resources; to establish collective responsibility for the outcome; to consider stakeholder support; to develop trust and meaningful relationships; and to consider appropriate incorporation of indigenous knowledge (after Schlossberg and Mattia 2003). Feedback of research results is an equally important aspect of collaborative research, and this project illustrated the usefulness of incorporating feedback throughout the research process.

These recommendations are made primarily for those researchers who are ‘cold-calling’ potential communities rather than for those researchers who have been invited to address a specific concern or research problem. Although the latter research condition will present its own challenges, it is the preferable scenario because the community has identified a concern or problem in the first instance. While a PAR approach to this research project has been modified to a community-involved approach, we believe PPGIS can yield positive outcomes for communities and academia that will enhance our understanding of human-environment interactions and provide a more integrated approach to planning (Harmsworth 1998). Because research strategies that emphasize participation are used increasingly in geographic research, we hope that by sharing some of our initial findings that these might be useful to others who are new to PPGIS research or for those new to working in northern Canada.

Acknowledgements

The authors acknowledge The Pierre Elliot Trudeau Foundation for funding Emma in her PhD research, as well as the staff at the Churchill Northern Research Centre for their support and funding. Thanks go to various agencies and individuals in Churchill who have so willingly given of their time to this project. Thanks also go to Heather Castleden, Roger Hayter and three anonymous reviewers for their useful comments on this paper. Finally, the authors thank Robin Poitras, cartographer in the University of Calgary, for map work and Typhenn Brichieri-Colombi, for translating the abstract.

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