

Chapter 12

Mapping Boundaries, Shifting Power: The Socio-Ethical dimensions of Participatory Mapping¹

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Introduction

The recent growth in the availability of modern spatial information technology (SIT) – geographic information systems (GIS), low-cost global positioning systems (GPS), remote sensing image analysis software – as well as the growth of participatory mapping techniques has enabled communities to make maps of their lands and resource uses, and to bolster the legitimacy of their customary claims to resources by appropriating the state's techniques and manner of representation (Peluso 1995). Since the publication of Hugh Brody's seminal work on mapping the lands of native Americans in the Canadian sub-Arctic (1981), participatory mapping has enabled the successful demarcation of land claims that led to: the signing of treaties (e.g. Nisga'a); compensations for land loss (Native American, Maori); and formation of indigenous territory and government (e.g. Nunavut).

But, the impacts of widespread adoption of SIT at the local level are not limited to the intended objectives. Among the unintended consequences of mapping have been increased conflict between and within communities (Sirait et al., 1994; Poole 1995; Sterritt et al., 1999); loss of indigenous conceptions of space and increased privatization of land (Fox 2002); and increased regulation and co-optation by the state (Urit 2001; Majid Cooke 2003). Consequently, mapping technology is viewed as simultaneously empowering and disadvantaging indigenous communities (Harris

1 An earlier and shorter version of this chapter was published as an introduction to *Mapping Communities: Ethics, Values, Practice* (East-West Center, 2005) that documents the collection of case studies covered by our project. Yet another shorter communication was published as 'Mapping power: ironic effects of spatial information technology', in *Participatory Learning and Action* 54: 98–105 (2006). This chapter is based upon work supported by the National Science Foundation under Grant No. SDEST-0221912, the Rockefeller Brothers Fund, and the Ford Foundation (through the Jakarta Office). We would like to thank all the participants to the workshops for sharing their ideas. Any opinions, findings and conclusions or recommendations expressed in this material are those of the authors and do not necessarily reflect the views of the National Science Foundation (NSF), the East-West Center, or the University of Hawaii.

and Weiner 1998). Researchers working under the umbrella of Research Initiative 19 of the National Centre for Geographic Information and Analysis (NCGIA) suggest that GIS technology privileges 'particular conceptions and forms of knowledge, knowing, and language' and that the historical development of the technology leads to 'differential levels of access to information' (Mark et al., no date). Rundstrom (1995) further suggests that GIS is incompatible with indigenous knowledge systems and separates the community that has knowledge from information (the 'product' of GIS application). Tensions thus exist between new patterns of empowerment yielded through SIT and broader social, political, economic, and ethical ramifications of the technology.

We submit that the tools, families of technologies, and practices associated with SIT use are value-laden and that deploying SIT will necessarily have ethical consequences. That is, the deployment of SIT will affect the constellations of values that distinctively shape any given society, its spatial practices, and its approach to reconciling conflicts or disharmony among competing goods or interests. We further submit that because the tools and technological families gathered under the rubric of SIT were not originally developed and produced in rural communities or among indigenous peoples in Asia, it will be in such settings that the tensions associated with SIT and its ironic effects are likely to be most apparent and potentially profound. To date, most research on the social and ethical implications of spatial information technology has been conducted in North America (Sieber 2000). Given the rapidity with which the use of SIT is becoming 'necessary,' there is an urgent need to examine the implications of this technology – especially in rural settings and in less developed countries, as well as among indigenous groups.

Unintended Consequences of Mapping

This chapter and the research project on which it is based emerged out of common and yet distinct concerns among the authors that spatial information technologies – at least in certain contexts and at certain scales – can lead to consequences that raise important ethical questions. We identified three inter-related dimensions in which these consequences have manifested: in conflicts correlated with changing patterns of spatial perceptions and values; in competition related to knowledge and claims of resources; and in relation to structural or organization stresses at the institutional level. Our observation began with discussions in relation to one author (Fox)'s experiences with participatory mapping activities in Southeast Asia, where he has been working since 1983.

Based on a series of interviews conducted with villagers in the Ratanakiri Province in northeastern Cambodia between 1995 and 1997, Fox observed that mapping village boundaries resulted in changes in local practices that governed access and territoriality (Fox 2002). Prior to this mapping, villagers had a clear sense of their respective rights to ancestral lands, but specific boundaries between hamlets were not required unless cultivation areas from two hamlets met one another. In such situation, village elders of both communities might meet to decide the boundaries. Villagers respected others' rights because they believed that crossing

another hamlet's swidden fields frequently would make the spirits unhappy and cause misfortune or death. In response to growing land pressures, however, a local leader convened village headmen together to map village boundaries. Subsequently, they began prohibiting people from other hamlets to use lands within the boundaries of the village – even in areas where they did not have to cross each other's fields (Fox 2002).

In another project, Fox observed that mapping raises critical questions on how map production, distribution, and ownership potentially consolidate control over spatial information. In 1997, a group of non-government organizations, community representatives and university researchers in Indonesia began to map land-use practices and boundaries of fourteen villages that lie in and around Wanggameti National Park in Sumba, Eastern Indonesia (Hardiono et al., 2005). Toward its completion in 2002, they brought the nearly completed maps back to villagers to assess their accuracy. At this time, villagers were also asked if they would grant permission to the project to distribute the maps. While villagers did not mind distributing the maps to the NGOs and university researchers, many objected to sharing the information that the maps contained with government agencies. Yet everyone realized that if maps were distributed to the NGOs, no one could guarantee that they would not fall into the hands of government officials. In order to retain some control of the information they provided, villagers decided to keep copies of the maps that they themselves could provide to organizations that sought them. Unfortunately, the villages' remote locations have limited practical utilizations of the maps for developing management plans for the park, leaving the multi-year mapping project largely futile (Hardiono et al., 2005). This controversy points to the important challenge of resolving the question of map ownership prior to initiating a participatory mapping activity.

Finally, working with two different NGO groups in Indonesia, Fox had experiences that raised questions about the impacts of participatory mapping activities on non-government organizations and their employees (Hardiono et al., 2005). In the early 1990s, a small NGO in Jakarta requested Fox to train one of their employees in GIS and related spatial information technologies, so that the NGO could integrate a spatial component into their work. A foundation grant was obtained to fund the training in the East-West Center's lab in Honolulu for several months, and to purchase equipment for a GIS lab in his NGO. Within several months of establishing the new lab, the director of the NGO fired the newly trained GIS specialist. Initially, Fox viewed the problem as a simple clash of personalities. The problem, however, was repeated several years later with another NGO, in which a newly trained GIS specialist and the leader of the NGO had a falling out, forcing the GIS specialist to leave the group.

We argue that adoption of SIT could alter the organizational hierarchy of an NGO, aligning staff members that are skilled with mapping technologies separately from the rest. Personnel skilled in spatial information analysis are still relatively scarce in many developing countries such as Indonesia. As participatory mapping approaches become popular, demand for such personnel increases. Organizations advocating environmental and community interests compete not only with each other but also with private mapping consultants, driving up not only the prestige, but also the salary structure of mapping and GIS technicians. Such a situation leads

to tensions within NGOs, as well as a relatively fast turnover of spatial information specialists (Hardiono et al., 2005).

This chapter evinces our efforts to critically broaden reflection on such experiences and their implications for technology transfer and evaluation. Our analysis of these phenomena is informed by studies in technology and society that examine the interplay between technological development and the social institutions that shape its further deployment. Furthermore, we examine these issues from a political ecology perspective that situates the proliferation of SITs in the context of economic and political liberalization in many countries in Asia, exemplified by the rise of decentralization policies and community-based approaches since the 1980s (Brosius et al., 1998; Ribot 2002). These reforms have brought an explosion of new property claims and protectionist strategies in forests and other environments changing the very terms by which resources and environments are defined.

Tools, Technologies, and Ironic Effects

Critically assessing the impacts of SIT requires us to clarify the relationships between tools and technologies. Tools are products of technological processes. They are used by individual persons, communities, corporations, and nation-states— and they are evaluated based on their task-specific utility. If tools do not work, they are exchanged, improved, cannibalized, or discarded. In contrast, technologies consist of widespread patterns of material and conceptual practices that embody and deploy particular strategic values and meanings (Hershock 1999). Technologies are complex systems promoting and institutionalizing relational patterns aimed at realizing particular ends. Technologies cannot be value neutral, and do not occur in isolation from one another but in families or lineages (Shrader-Frechette and Westra 1997; Hershock 1999).

A hand-held GPS unit, for example, is a tool associated with SIT. Individuals using GPS units assess them in terms of their reliability, ergonomic design, technical specifications, and features. By contrast, SIT as a whole consists of a complex system of material and conceptual practices. They include: the extraction of raw materials; their manufacture into tools like GPS units, notebook computers, and satellites; the storage of information in massive, internet mediated databases; advertising and marketing these tools, the services associated with them, and the ‘worlds’ to which they provide access; the crafting of industry-specific regulatory and legal institutions; new patterns of expert testimony in legal contests over land-use; and, a reframing of the politics of development. As technology, SIT transforms the discourse about land and resources, the meaning of geographic knowledge, the work practices of mapping and legal professionals, and, ultimately, the very meaning of space itself.

There are two major implications of the tool/technology distinction. First, while we can refuse to use a tool, there are no clear ‘exit rights’ from the effects of heavily deployed technologies, even if individuals elect not to use the tools produced as part of that deployment. The concept of exit rights in discussions of technology and ethics invokes rights not to be subject to the use or effects of particular technologies and their associated tools. Serious questions arise regarding the possibility of exit

rights with respect to technologies that are deployed at sufficient scale to make viable alternatives practically nonexistent. For example, although one can elect to not own or use a personal computer, computing technology is so widely deployed that it is not possible to avoid its effects. In practical terms, we have no exit rights from the computerized world.

Second, critical evaluation of a technology must go beyond assessing how well the tools specific to the technology perform, to examining the changes it brings about within and among societal systems and values. If viable exit rights do not exist for a technology, technologies can only be fully and effectively evaluated in terms of how they transform the quality of relationships constituting our situation as a whole. These relationships include those we have with our environment; with one another; with our own bodies; and with our personal, cultural, and social identities. In short, technologies must be evaluated in explicitly social and ethical terms.

Critical histories of technology deployment (see, for example Illich 1973; 1981) suggest that there are thresholds of utility for any given technology, beyond which conditions arise that make its broader and more intensive deployment practically necessary. That is, when a technology is deployed at sufficient intensity and scale, it effectively undermines the possibility of exercising exit rights with respect to the technology, generating problems of the type that only that technology or closely related ones can address. These distinctive patterns of ironic (or 'revenge') effects (Tenner 1996; Hershock 1999) have wide-ranging, systemic ramifications well outside the technology sector. For example, automotive transportation technologies were originally adopted to make transportation faster and easier, and to reduce urban pollution (from horse-drawn carriages). Their widespread adoption, however, transformed both environmental and social realities in ways that eventually generated problems – for example, inhospitable urban sprawl, traffic gridlock, and massive air pollution – that can only be addressed through more and better transportation (and transportation relevant) technology.

Ironic effects demonstrate the fallacy in assuming that what is good for each of us will be good for all. The individual user of tools is not, therefore, a suitable unit of analysis in critically assessing technologies. In addition, ironic effects argue for recognizing that the causality of technological impacts is fundamentally non-linear. Although new technologies are practically built from 'the ground up' by bringing together knowledge and materials in novel ways, once they are fully realized, the technology begins exerting 'downward causation' (Lemke 2000) on its component systems, bringing them into functional conformity with its own systemic needs.

Following this argument, once spatial information technologies cross the threshold of their utility, their use will become practically imperative and they will begin generating ironic or revenge effects that effectively command deploying these technologies at ever greater scales and intensities. While individual users may be benefited in anticipated fashions, the impacts at community level are less certain. More specifically, we submit that the widespread adoption of SIT will disadvantage small, local communities that – relative to other actors and stakeholders – have limited access to SIT as well as limited (material, conceptual, and professional) resources for making use of SIT in advocacy, legislative, and regulatory settings. Increased dependence on SIT will transform the relationships between human actors

and their spatial environments in ways that correlate with loss of the indigenous spatial practices that were originally to be conserved through their deployment.

Workshop on SIT and Society

In order to test and further refine our ideas about the socio-ethical implications of SIT deployment, we convened a workshop in Chiang Mai, Thailand in June 2003. In planning and hosting the workshop we sought groups that have used SIT extensively in their community-based work. Altogether twenty-three participants that included officials from non-governmental organizations (NGOs), project staff members, and university researchers attended the weeklong discussion. They represented eight groups in seven countries (Cambodia, China, Indonesia, Malaysia, the Philippines, Thailand, and the United States). Workshop participants were introduced to key concepts for evaluating SIT in terms of its socio-ethical effects, including the concepts of exit rights and ironic effects. Participants then worked in small groups to reflect on their own experiences in grassroots implementation and deployment of SIT. These results were shared in plenary sessions and further developed and refined through group discussions. Discussions were guided by three interlinked and overlapping sets of questions, summarized in Table 12.1.

We first sought to understand the *social and political dynamics* that result in communities choosing to engage in mapping, focusing on the ways maps and mapping shift patterns of resource control. The second set of questions addressed the *socio-ethical implications* of mapping technologies and activities. Spatial information technologies have embedded within them values such as ‘universality’, ‘objectivity’, ‘standardization’, ‘precision’, and ‘control’ that have emerged in systemic relationship within the context of a particular historical/cultural experience. The introduction of these technologies into societies where these values have been neither prominent nor systematically integrated may have unexpectedly disruptive effects. The last set of questions examined the impacts of SIT on the *organizational dynamics of the non-governmental organizations (NGOs)* that introduce SIT into rural communities. We began with a position that the adoption of spatial information technologies by NGOs is problematic because of their social context, the potential for co-optation, and a lack of resources.

Following the workshop, participants were invited to prepare research proposals. After consultation with the authors/project leaders, seven groups were funded by a grant from the Rockefeller Brothers Fund. These groups spent the next year conducting research at their respective organizations and field sites. The groups reconvened with the authors in Honolulu in October 2004 to write papers based on what they learned from their research. These papers were published in a volume edited by Fox, Suryanata and Hershock (2005), which this chapter summarizes.

Table 12.1 Questions to guide discussions in the Chiang Mai workshop

Why maps? Enrollment and empowerment	<ul style="list-style-type: none"> • Why do communities engage in mapping? Local and extra-local reasons for communities to adopt SIT • Who got empowered? Against whom? • What are the processes by which empowerment occurs? • Who controls the maps? How do various actors decide how maps can be utilized?
Socio-ethical implications	<ul style="list-style-type: none"> • Are there any changes in conceptions of space such as boundary and the sense of place? • Did maps and mapping resolve or cause boundary and land use disputes? • Are there any changes in the property institutions that regulate resource access and claims? • Did maps and mapping change intra-community relationships?
SIT and NGOs	<ul style="list-style-type: none"> • How does an NGO decide to invest in developing an SIT component to their work? How does it decide on the choice of technology? • How do they sustain operating costs beyond initial investments? • Does the adoption or rejection of the technology affect relationships with donors? • Does adoption of SIT change the intra-organizational dynamics of an NGO? • Does a focus on participatory mapping affect the expectations of community members vis-à-vis NGO partners?

Grassroots Realities: SIT in Local Contexts

Mapping Power

Maps have long served to facilitate accumulation strategies that consolidate state control and works against the rights of local people (Harley 1992; Thongchai 1994; Brealey 1995; Escobar 1997). By the same logic, participatory mapping is viewed as a tool of empowerment and mediation for local communities, to re-insert their territorial claims onto 'empty' state maps. Mapping becomes a critical tool for negotiation with other groups, including neighbouring communities and the state. These activities occurred in the context of increased local activism, coupled with the opening of political space that followed the introduction of a new decentralization policy in Indonesia and the recognition of indigenous rights in the Philippines.

In Sarawak, the 2000 legal victory of Rumah Nor, an Iban village's claim against a tree plantation corporation (Majid Cooke 2003) energized communities across the state to organize and mapped their respective native customary lands. In a move to curb this rights-through-mapping legal power, in 2001 the Sarawak legislature passed the Land Surveyors law, which was designed to regulate community mapping. Nonetheless, as of 2005 more than forty native customary land claims cases, based on community maps, have been filed in court – half of which were filed after the

enactment of the law (Bujang 2005). Yet it is not clear if community maps will be admissible in future court proceedings to defend land rights of the indigenous Dayaks. Participatory mapping thus must be accompanied by legislative efforts to de-criminalize the activity; otherwise the extent of empowerment that the maps confer will be very limited.

Spatial information is useful for a variety of purposes at the grassroots level. Communities can better plan the management of their resources, monitor the implementation of development projects, and resolve resource conflicts within their own communities. Maps can give community members more knowledge about their resources, so they can respond better to problems. This potential is most visible in many communities that adopted SIT in developed economies such as the United States. For example, GIS has been an important tool for the Agricultural Land Preservation Board of Adam County in Pennsylvania to help residents recognize the rapidity of land-use change and the extent of threats to their resources (Dayhoff 2003). In Trinity County, California, Everett and Towle (2005) found that GIS helped local people to be more aware of their resources, which has led to greater sophistication in public discussions among communities and with public and private resource management. In these cases, mapping and working with maps enhanced community capacity in negotiating access to local resources, and increased community involvement in policy processes.

Others have cautioned, however, that mapping also helps outsiders gain knowledge for furthering their own interests. While mapping has enhanced tenure security (in Indonesia, Thailand, Cambodia, and the Philippines), it also benefited local governments by providing them with free information. Fox (2002) argues that if local people do not have control of their maps, they may not be any better off than they were before their lands were mapped. SIT data could contain information on valuable common resources such as birds' nests and honey trees that, if known by outsiders, could result in increased resource competition.

We also observed competing local/village institutions that oversee access to the maps and spatial information ranging from formal village governments, to traditional or customary institutions, to functional village committees. NGOs that initiate or sponsor community-mapping projects play key roles in influencing which actors exercise authority with respect to spatial information, and thus benefit from the adoption of SIT. For example, two NGOs in Indonesia chose divergent strategies. PPSDAK, a Kalimantan-based NGO chose to revitalize traditional customary institutions (*adat*), entrusting them with control of the maps (Lorensius 2003), while Koppesda, a Sumba-based NGO chose to support a functional committee on forest conservation and to bypass traditional leaders (Hardiono et al., 2005). The implications of these decisions can be far-reaching in the restructuring of power relations and property institutions that govern resource access and utilization.

Even if the community can control the maps, it is important to understand the multiple interests and actors found within communities; and the political and economic relationships between communities and other social actors. Within the client communities, mapping affects these relationships, causing new social stratification to emerge. In Malaysia, Mark Bujang (2005) noted a case in which

entrusted community leaders colluded with a corporation, using community maps to support the corporation's plan to lease customary lands for an oil palm plantation.

Finally, we also need to be clear that not all maps and mapping activities are alike, with a spectrum of technological complexity that ranges from sketch maps to GIS. While paper maps are generally available to all at the local level, digital data presents a structural barrier that may prevent a large proportion of community members, as well as some NGO staff, from accessing the spatial data. In this case, determining who 'owns' the maps and the information they contain can be difficult. Reflecting on the case studies from Indonesia and from Cambodia, Hardiono et al. (2005) and Sarem, Ironside and van Rooijen (2005) noted that because the mapping facilitators and consultants that make community maps control the digital SIT databases, they effectively control access to the information they contain.

Impacts on communities' values

For many indigenous groups in Asia, the use of SIT in participatory mapping is primarily intended to 're-insert' their existence onto maps – to claim rights that had not been acknowledged by the state. Vandergeest and Peluso (1995) describe the process by which rights to resources are acknowledged by the state as territorialization. When resource rights have not previously been recognized and space has not yet been territorialized, mapping activities have greater impact on traditional ways of governing human environment interactions and seeing the world, than they do in communities where legal rights and territorialized space already exist.

We recognize, however, that changes in the sense of place and boundary conceptions are not exclusively caused by mapping activities, as they are also subject to changes in the political economic context, such as expansion of roads, markets, and state policies. For example, Setyowati (2006) documented shifting conceptions of rights and territoriality among the indigenous people of Siberut island, Indonesia through the eras of the timber industry in the 1970s; the national park/conservation movement in the 1980s and the early 1990s; and the decentralization since the fall of Suharto in 1998 (Setyowati 2006). Nonetheless, mapping accelerates these changes by facilitating direct influence of property institutions aligned with SIT. For example, if villagers engage in mapping in order to increase the security of their land claims, they need to follow through with land titling once they have mapped the land. But the land titling process is controlled by outside authorities, and has significant implications for their relations to the land, their neighbours, and their community. Mapping efforts initiated to recognize collective rights to land resources can lead to land privatization that is in the long run exclusive rather than inclusive.

We also recognize that mapping disadvantages nomadic groups that do not claim exclusive territories and therefore are generally not represented in the mapping process. In Malaysia, Indonesia, and Thailand, customary boundaries were traditionally flexible. These boundaries respond to changing needs within the community and extend across and overlap administrative boundaries, as well as the boundaries of neighbouring communities that may include nomadic groups. In communities who have mapped their territories, these boundaries have become less flexible and often cause disputes when they overlap with neighbouring boundaries.

Mapping can force communities to confront latent issues with regard to the management of natural resources. This can lead to new opportunities for consensus building, but it can also lead to conflict by making it harder to compromise positions, creating new disagreements within and between communities. One of the ironic effects of SIT observed in Cambodia is that mapping efforts initiated to resolve conflicts between local communities and government agencies resulted in increased conflict between and within villages (Prom and Ironside 2005). As long as boundaries remain fluid and flexible, defined only in a person's mental image of the landscape, conflicts between competing interests (within villages or between villages) can be minimized. Once boundaries are mapped, however, conflicting images of reality cannot be overlooked any longer and must be addressed.

Many participatory mapping proponents argue that they have no choice but to map. Today, maps' reach has extended to virtually every remote corner, leaving villagers with no 'exit option,' as they are already 'caught up in a mapping world'. They can refuse to map, but they cannot escape the implications of living in a world in which others will eventually map their lands. Mapping has become a precondition for protecting their territory and resources, as it is not possible to claim an unmapped area in contemporary politics. Even if you refuse to map within the boundaries of a protected territory, such as in a Native American reservation, the outer boundaries must be established and recognized. At the same time, villagers recognize that being included in official government maps can be as disadvantageous as being excluded from them (Majid Cooke 2001).

Furthermore, as SIT becomes a practical imperative, it ironically may disadvantage many small communities who do not have access to it. Likewise, resolving the conflicts caused by mapping draws attention to the importance of 'boundary' and 'territory' over other non-spatial aspects. This shift eventually makes SIT indispensable for asserting (and defending) communities' rights. In both Indonesia and Malaysia, many communities have realized 'the power of maps' and are anxious to have their resources mapped (Bujang 2005; Lorensius 2003). Yet the NGOs who assist in participatory mapping are unable to respond to all community requests for mapping. Communities that do not have maps become disadvantaged as 'rights' and 'power' are increasingly framed in spatial terms.

SIT and NGOs

We define non-government organizations (NGO) as organizations that work on a voluntary basis, rely on external funding, work with the poor and marginal members of society, have a small staff, and have a flexible, not-for-profit, independent and non-partisan nature (cf. Korten 1990). The urban and middle class nature of most NGOs as well as their dependence on funding from outside sources places their independence and performance in doubt.

Reflecting on their respective organizations' experience, participants of the workshop noted that decisions to incorporate SIT as an important component of NGOs' activities varied, but reasons external to the NGOs were at least as important as those from within. Donors, and how NGOs perceive donors' priorities, have a relatively large influence on many NGOs. Pramono (2005) describes how consultants

from other international organizations – e.g. the East-West Centre, the World Wildlife Fund, ICRAF, or the USAID-supported Biodiversity Support Program – proved to be instrumental for NGOs in Indonesia in their choice of mapping strategies. Similarly, Hardiono et al. (2005) describe how the shift from sketch mapping to GIS in Sumba, Indonesia was influenced by discussions with international actors. Donor's priorities, however, continue to evolve, and an NGO that received donor support to acquire SIT may not receive support to maintain the technology. It can also be difficult for an NGO to meet the timetables imposed by donors.

Success in using maps as tools for negotiating land rights in Indonesia and Malaysia has led to increased demand for mapping by neighbouring communities. This has created a shortage of technically trained people, and participants agreed that it is difficult to acquire and keep trained staff. There is also a gap in expectations and work culture between staff members trained in SIT sciences and those trained in social sciences that could lead to the separation of participatory mapping activities from the broader objective of NGOs (Hardiono et al., 2005).

Recognizing the potential socio-ethical impacts of SIT, there was a strong consensus among workshop participants that advocates of participatory mapping need a clear protocol to follow when introducing SIT into a village. This protocol should require outside actors to communicate clearly with each community prior to the mapping project. The NGO must clarify the purpose/objectives of collecting information, agree with villagers on what information can be mapped, and explain potential consequences of recording the community's spatial information on maps that can then be copied and distributed outside the community. Most importantly, outside facilitators must communicate that villagers can agree to accept or reject the mapping exercise.

Carrying out the protocol, however, is not sufficient in assuring that villagers would be aware of the full implications of mapping. In spite of the facilitators' efforts to organize meetings to discuss mapping issues, many villagers fail to attend the meetings (Bujang 2005). In some cases, the meeting schedules conflicted with the need of villagers to attend to their farms. In others, some villagers disagreed with the goals of participatory mapping and thus refused to participate in the conversation. Hardiono et al. (2005) and Sarem et al. (2005) highlight the problem of conceptual gaps between mapping facilitators or NGOs and villagers. In spite of the effort to consult with villagers and village leadership throughout the mapping process, the fact that many villagers had never seen or worked with maps made it difficult for them to fully comprehend the potential problems.

Unlike in North America, the use of SIT at the community level in Asia has largely been limited to producing one-time maps and neglecting the reality that working with spatial information is a process requiring revisions and changes. Thus far little attention has been given to building local capacity to revise and re-map as circumstances change. Meeting this challenge will require not only building technical skills, but also skills for looking critically at context and for identifying factors needing response. Finally it will require sufficiently broad and keen ethical sensibilities to think through how changing practices set different directions for the community, carefully weighing options and their effects.

Summary

Our goal is to understand the social and ethical implications of the use of spatial information technology in community-based management, so that those who chose to use it to meet social objectives can do so wisely and with an understanding of the unintended consequences that may accompany its use. We seek to enhance the knowledge of the scientific community regarding the ethical, organizational, and power implications of spatial information technology, as well as to provide social activists with criteria for deciding whether they want to use this technology in their fieldwork.

The case studies we reviewed in our project confirmed that mapping, and working with maps, enhance community capacity to negotiate access to local resources. It develops technical and analytical skills in understanding both the immediate locale as a familiar place and its complex relationships to surrounding locales and regions. This wider perspective affords greater insight into current and likely patterns of interdependence, enabling better responses by communities to their own problems. As such, SIT is a useful capacity building resource for supporting the broader goals of community-based management.

It is important to understand that SIT comes in a variety of forms, and its conceptual and technical accessibility to participating communities could be uneven. Sketch mapping and 3D maps are easier to understand and are effective in engaging even illiterate villagers in conversations regarding natural resource management. But these maps are often considered to have limited credibility – a perception that markedly reduces their effectiveness when negotiating territorial rights with outside interests. However, efforts to ‘formalize’ SIT – away from sketch mapping toward technical cartographic mapping and GIS – could backfire. Indeed, in remote villages in Asia, adoption of technologically complex SIT could marginalize many of the targeted communities. Participatory mapping proponents therefore must strike a balance between being able to produce maps and spatial information that meet the cartographic convention, but that remain relevant to villagers in solving their immediate problems.

Reflections by practitioners as represented in the Chiang Mai workshop and the case studies, however, also identified several ironic effects of mapping that could undermine the goals of community-based management. While mapping is useful for bounding and staking claims to ancestral or traditional territories, it also facilitates a shift toward exclusive property rights and provides outsiders a legal means to gain access to common property resources. Common property resources are managed through rules and practices that include the control of knowledge about the location of valuable resources. By making knowledge accessible to all, mapping weakens existing common property management systems. Mapping generally promotes practices that shift attention and concern away from qualities of human/environment relationship to quantifiable limits on that relationship implied by boundaries/borders. The newly acquired authority to define and exert control over the use of space thus has begun to compromise the customary uses and governance it is intended to protect.

The impacts of SIT must also be seen in the context of how the participating communities are positioned in adopting the technology. Communities in the United States utilize SIT as a tool for capacity building. It is not intended to reform the structure of rights and access, but to facilitate communities in claiming those rights. By contrast, for many indigenous groups in Asia, the use of SIT in participatory mapping is primarily intended to claim rights that had not been acknowledged by the state. These new spatial practices, however, also bring about new ways of conceiving space and new patterns of relationship centred on spatially determined resources. The adoption of SIT and participatory mapping thus serves to infuse new values into user and user-affected communities. In indigenous groups and in smaller rural communities these new values can dramatically affect an array of existing paradigms, acting as catalysts for change in social organizations and in local dynamics of power and prestige.

The adoption of SIT and participatory mapping in Asia has increased the capacity of indigenous groups and local communities to assert territorial rights and to promote decentralization of resource governance and management. But the adoption of this technology has also increased the need for the further adoption of SIT by other rural communities, practically eliminating exit options. As participatory mapping practitioners in the workshop concluded, the more we map, the more likely it is that we will have no choice but to map. Yet we submit that this need not be seen as a caution against mapping, but rather as an injunction to develop critical clarity with respect to mapping based on a comprehensive understanding of both intended and likely unintended consequences of our actions. Resource managers who engage in mapping must do so with clear protocols for explaining these consequences to rural communities prior to the mapping exercise. Meeting this challenge will require not only building technical skills, but also transferring skills for looking critically at context and for identifying factors needing response. They must also work to establish a sustainable trajectory of community capacity building – a trajectory that insures continued, sufficient resources for the community to participate in negotiating political and economic relations that are continuously being transformed, sometimes in response to the adoption of SIT itself.

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