EAST-WEST CENTER

MAPPING COMMUNITIES

ETHICS, VALUES, PRACTICE

Edited by Jefferson Fox, Krisnawati Suryanata, and Peter Hershock

ISBN # 0-86638-201-1

Published by the East-West Center
Honolulu, Hawaii

The East-West Center is an education and research organization established by the U.S. Congress in 1960 to strengthen relations and understanding among the nations of Asia, the Pacific, and the United States. The Center promotes the development of a stable, prosperous, and peaceful Asia Pacific community through cooperative study, training, dialogue, and research. Funding for the Center comes from the U.S. government, with additional support provided by private agencies, individuals, foundations, corporations, and Asia Pacific governments.

A PDF file and information about this publication can be found on the East-West Center website at www.EastWestCenter.org. For more information, please contact:

Publication Sales Office
East-West Center
1601 East-West Road
Honolulu, HI 96848-1601
USA

Telephone: (808) 944-7145
Facsimile: (808) 944-7376
Email: ewcbooks@EastWestCenter.org
Website: www.EastWestCenter.org

TABLE OF CONTENTS

CONTRIBUTORS

Mark BUJANG
Program Officer
Borneo Resources Institute, Malaysia (BRIMAS)
Miri, Sarawak, Malaysia
Email: bri@tm.net.my or snanet@tm.net.my

Yvonne EVERETT
Assistant Professor of Natural Resource Planning
Department of Environmental & Natural Resource Sciences
Humboldt State University
Arcata, CA 95521
Email: ye1@humboldt.edu

Jefferson FOX
Senior Fellow
Research Program
East-West Center
Honolulu, HI 96848
Email: foxj@eastwestcenter.org

Martin HARDIONO
Consultant
Jakarta, Indonesia
Email: hdmartin@indo.net.id

Peter HERSHOCK
Project Fellow
Education Program
East-West Center
Honolulu, HI 96848
Email: hershocp@eastwestcenter.org

Jeremy IRONSIDE
Agriculture and NRM Advisor
Non Timber Forest Products (NTFP) Project
Ban Lung, Ratanakiri Province
Cambodia
Email: jeremyi@camintel.com

KLOT Sarem
Ratanakiri GIS Unit Staff Member
Provincial Rural Development Committee
GIS Unit
Ban Lung, Ratanakiri Province
Cambodia
Email: saremklot@yahoo.com

Wutikorn KOJORNRUNGROT
Forester
Raks Thai Foundation, Thailand
Chiang Mai, Thailand
Email: caremc40@hotmail.com

Albertus Hadi PRAMONO
Degree Fellow
Education Program
East-West Center
Honolulu, HI 96848-1601
Email: albertus@hawaii.edu

PROM Meta
NRM Technical Facilitator
Non Timber Forest Products Project
Ban Lung, Ratanakiri Province
Cambodia
Email: ntfp@camintel.com

Huki RADANDIMA
Director
Tananua Foundation
Waingapu, Indonesia
Email: ytns@dps.centrin.net.id

Pornwilai SAIPOTHONG
Associate Research Officer
World Agroforestry Center (ICRAF)
Chiang Mai, Thailand
Email: PornwilaiS@icraf-cm.org or P.Saipothong@cgiar.org

Krisnawati SURYANATA
Associate Professor
Department of Geography
University of Hawaii at Manoa
Honolulu, HI 96822
Email: krisnawa@hawaii.edu

David THOMAS
Senior Policy Analyst
World Agroforestry Center (ICRAF)
Chiang Mai, Thailand
Email: D.Thomas@cgiar.org

Philip TOWLE, Jr.
Co-director
Trinity Community GIS Project
Watershed Research and Training Center
Hayfork, CA 96041
Email: pt@klamgis.cnc.net

Georgia VAN ROOIJEN
Non Timber Forest Products (NTFP) Project
Ban Lung, Ratanakiri Province
Cambodia

ZHENG Baohua
Director
Center for Community Development Studies
Kunming, Yunnan, China
Email: zhengbh@ynmail.com or cds@public.km.yn.cn

ACRONYMS

AMA: adaptive management area
BLM: Bureau of Land Management
BRIMAS: Borneo Resources Institute
BSP: Biodiversity Support Program
CBIK: Center for Biodiversity and Indigenous Knowledge
CBNRM: Community Based Natural Resource Management
CBO/CBOs: community-based organization(s)
CDC: Center for Community Development
CDS: Center for Community Development Studies
CPA: community protected areas
DNCP: Department of Nature Conservation and Protection [Cambodia]
ESRI: Environmental Systems Research Institute
EWC: East-West Center
FOMISS: Forest Management Information System Sarawak [Malaysia]
GIS: Global Information System
GMO: genetically modified organisms
GPS: global positioning system
GTZ: Deutsche Gesellschaft für Technische Zusammenarbeit [German Agency for Technical Cooperation]
ICRAF: World Agroforestry Centre
IDRC: International Development Research Center [Canada]
IDRD: Institute of Dayakology Research and Development
JKPP: Jaringan Kerja Pemetaan Partisipatif (Working group on participatory mapping)
KPMNT: Konsorsium Pengembangan Masyarakat Nusa Tenggara [Consortium on Community Development in Nusa Tenggara]
LLNP: Lore Lindu National Park
LMUPC: Land Management Urban Planning and Construction
LWMP: Laiwonggi Wanggameti National Park
MIGIS: Mobile Interactive Geographical Information System
MoE: Ministry of Environment [Cambodia]
NCGIA: National Center for Geographic Information and Analysis
NCR: native customary rights
NEPA: National Environmental Policy Act
NGO/NGOs: non-governmental organization(s)
NRM: natural resource management
NTFP: non-timber forest product(s)
PLUP: participatory land-use planning
PPSDAK: Pemberdayaan Pengelolaan Sumber Daya Alam Kerakyatan Pancur Kasih [Empowerment of People's Natural Resource Management]
PRA: participatory rural appraisal
PRCA: participatory rapid cadastral appraisal
PRDC: Provincial Rural Development Committee
PSW: Pacific Southwest Research Station
RCD: resource conservation district
RRA: rapid rural appraisal
SA: selective accuracy
SAM: Sahabat Alam Malaysia (Friends of the Earth Malaysia)
SCGIS: Society for Conservation GIS
SEGERAK: Sekretariat Gerakan Pemberdayaan Masyarakat Dayak [Secretariat of the Movement of Dayak Peoples' Empowerment]
SIT: spatial information technology
SPSS: Statistical package for social sciences
TAO: Tambon Administration Organization
TBRG: Trinity BioRegion Group
TCFSC: Trinity County Fire-Safe Council
TC GIS: Trinity Community GIS
TGHK: Tata Guna Hutan Kesepakatan (Agreement on forest land use)
TNC: The Nature Conservancy
TNET: "a local digital network" [California]
UBRA: Uma Bawang Residents Association [Malaysia]
UNDP: United Nations Development Programme
USFS: United States Forest Service
VNP: Virachey National Park
WRTC: Watershed Research and Training Center
WWF: Worldwide Fund for Nature
YTM: Yayasan Tanah Merdeka [Free Land Foundation]
YTNS: Yayasan Tananua Sumba [Tananua Foundation of Sumba]

ACKNOWLEDGEMENTS

The workshop on which this book is based was made possible by a grant from the U.S. National Science Foundation (Grant Number SDEST-0221912). The Chiang Mai workshop and the field research were funded by The Rockefeller Brothers Fund and the Ford Foundation (through the Jakarta office). We would like to thank Mr. Peter Riggs and Dr. Ujjwal Pradhan for their support of the project. We would also like to thank the Regional Community Forestry Training Center (RECOFTC) in Bangkok for organizing the Chiang Mai workshop, with special thanks to Ms. Ferngfa Panupitak for her invaluable assistance. At the East-West Center we are grateful for the administrative and fiscal assistance provided by Arlene Hamasaki, June Kuramoto, Margaret McGowan, and Karen Yamamoto. Finally we thank the East-West Center for hosting the workshop, general support, assistance, and cooperation on behalf of the workshop and book project. We are also indeted to Brian Niiya for his skillful and timely copyediting, Pam Funai for editorial assistance, and Jeff Nakama for the graphic design.

MAPPING POWER:
IRONIC EFFECTS OF SPATIAL INFORMATION TECHNOLOGY

Jefferson Fox, Krisnawati Suryanata, Peter Hershock, and Albertus Hadi Pramono

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). Over the last several decades participatory mapping has led to the successful demarcation of land claims that led to the signing of treaties (e.g., Nisga'a), compensations for land loss (e.g., Native American, Maori), and formation of indigenous territory and government (e.g., Nunavut). A community-made map was instrumental in the decision of the Sarawak High Court of Malaysia favoring an Iban village in a dispute against a tree plantation company (Borneo Wire 2001). Evidence of the perceived power of this technology to counterbalance the authority of government mapping agencies was vividly demonstrated in the Malaysian state of Sarawak where the 2001 Land Surveyor's Bill regulates the activities of land surveyors and declares community mapping initiatives illegal (Urit 2001, Thompson 2001, Majid Cooke 2003).

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 1994, Poole 1995, Sterrit et al. 1998), 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 and Wiener 1998). Researchers working under the umbrella of Research Initiative 19 of the National Center 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., n.d.). 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. 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. 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.

This book and the research project on which it is based emerged out of common and yet distinct concerns among the editors 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 interrelated 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. This book evinces the efforts of its editors 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 that has brought an explosion of new property claims and protectionist strategies to 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 relationship between tools and technologies. Tools are products of technological processes. They are used by individual persons, corporations, or nations, and are evaluated based on their task-specific utility. If tools do not work, we exchange them, improve them, cannibalize them, or discard them. 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; the advertising and marketing of 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. Second, critical evaluation of a technology must go beyond assessing how well the tools specific to it perform, to examining the changes that technology brings about within and among societal systems and values.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. Similarly, one may prefer not to consume genetically modified food, but if genetically modified organisms (GMO) related technologies became dominant, there would be few practical alternatives available to general consumers.

If viable exit rights do not exist for a technology, then we cannot evaluate the ethical implications of that technology or family of technologies in terms of how well the tools they provide serve individual users. Rather, 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 exists a threshold of utility for any given technology, beyond which conditions arise that make its broader and more intense 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 it, generating problems of the type that only that technology or closely related ones can address.

These distinctive patterns of ironic (or "revenge") effects (Hershock 1999; Tenner 1996) 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 could only be addressed through more and better transportation (and transportation relevant) technology. At present scales of deployment and social, economic, and cultural embedding, transportation technology and the tools associated with it are no longer truly elective.

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 nonlinear. 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. That is, the ironic effects generated by technologies deployed at sufficient scale are not incidental consequences, but are rather systematically conducive to the further deployment of that technology and/or affiliated technologies.

Following this argument, once spatial information technologies cross the threshold of their utility, they will become practically imperative and will begin generating ironic or revenge effects that require further deployment of the technologies. While this may benefit individual users in anticipated fashions, the impacts at the community level are less certain. More specifically, we submit that the widespread adoption of SIT will disadvantage small, local communities that have limited access to SIT relative to other actors and stakeholders, 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. We first sought to understand the social and political dynamics that resulted in communities choosing to engage in mapping. Political ecology scholars argue that local processes are interlinked across temporal, spatial, and institutional scales (Blaikie 1985, Blaikie and Brookfield 1987). From this point of view the decision of local actors to adopt or reject mapping technology and activities may be a conscious strategy, or it may be the result of larger political, economic, and social relationships. In order to explore this query we posed the following series of questions to guide discussion: Why did communities engage in mapping? Who was empowered by SIT adoption? Who was disadvantaged? Who controled the maps? How did various actors decide how maps can be utilized? What were the processes by which empowerment occurs?

The second set of questions addressed the impacts of mapping technologies and activities on communities' values. 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. We posed the following questions to start the discussion: Were there any changes in conceptions of space such as boundaries and the sense of place? Did maps cause boundary and land-use disputes? Were there any changes in inter-community

relationships? Many of these questions would require longitudinal studies on what happened after the introduction of SIT into the community, and the discussions at the workshop were intended to prod mapping proponents to begin interrogating these issues.

The last set of questions examined the impacts of SIT on the organizational dynamics of the non-governmental organizations (NGOs) that introduced 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. The discussions were guided by the following questions: How did an NGO decide to invest in developing an SIT component to their work? How did they sustain operating costs beyond initial investments? Did the adoption or rejection of the technology affect relationships with donors? Did it affect the expectations of community members vis-à-vis NGO partners?

After the workshop, participants were invited to prepare research proposals. After consultation with the editors, seven of the eight invited 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. Case study writers and the editors reassembled in Honolulu in October 2004 to write papers based on what they learned from their research. The papers in this book are the product of this work.

GRASSROOTS REALITIES:
SIT in Local Contexts

Why map?

Workshop participants and case study writers agreed that spatial information is useful for a variety of purposes. 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 (this volume) 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 their involvement in policy processes.

The opening of political space following shifts such as the introduction of a new decentralization policy in Indonesia and the recognition of indigenous rights in the Philippines provided a context in which mapping became a critical tool for negotiation with other groups, including neighboring communities and the state. Mapping re-inserted user communities' existences onto "empty" state maps and thus strengthened their claims to lands and other resources. These effects all occurred in the context of increased local activism as a reaction to disenchantment with the state. SIT is thus viewed as a tool of empowerment and mediation for local communities.

Participants also discussed the processes by which empowerment occurred and who was empowered. Mapping has enhanced tenure security in Indonesia, Thailand, Cambodia and the Philippines, yet it also benefited local governments by providing them with free information. In Sarawak, a community map was instrumental in the legal victory of an Iban village against a tree plantation corporation. But this rights-through-mapping legal power was quickly curbed as the 2001 Land Surveyors law was passed to regulate community mapping. Others have cautioned that mapping also helps outsiders

gain knowledge for furthering their own interests. It can be difficult to determine who "owns" the maps and the information they contain. 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. In the case study from Sumba, Indonesia in this volume, Hardiono et al. note that the NGOs and mapping facilitators that make the maps control the SIT databases and hence control access to the information they contain.

Even if the community can control the maps, it is important to understand the multiple interests and actors found within communities, the processes by which decisions are made within communities, and the political and economic relationships between communities and other social actors (cf. Agrawal and Gibson 2001; McDermott 2001). Workshop participants encountered competing local/village institutions that oversaw access to the maps and spatial information ranging from formal village governments, to traditional or customary institutions, to functional village committees. Bujang's piece for this volume provides an example 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.

NGOs who initiate or sponsor community mapping projects play key roles in influencing which actors benefit from the adoption of SIT. For example, the two case studies from Indonesia chose divergent strategies. PPSDAK, a Kalimantan-based NGO chose to revitalize traditional customary institutions (adat), entrusting them with control of the maps, while Koppesda, a Sumba-based NGO chose to support a functional committee on forest conservation, therefore bypassing traditional leaders. The implications of these decisions can be far reaching in the restructuring of power relations and property institutions that govern resource access and utilization.

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. 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 the villagers' relations to the land, their neighbors, and their community.

Mapping efforts initiated to recognize collective rights to land resources can lead to land privatization that is in practice exclusive rather than inclusive. One participant from Indonesia told a story of a woman who facilitated the mapping of her village and then sold the land to outsiders. Participants pointed out that mapping also disadvantaged nomadic groups that do not claim exclusive territories and therefore are generally not represented in the mapping process.

Workshop participants and case study writers from Malaysia, Indonesia and Thailand reported that customary boundaries were traditionally flexible. These boundaries responded to changing needs within the community and extended across and overlapped administrative boundaries as well as the boundaries of neighboring communities. Participants observed that these boundaries have become less flexible today and often cause disputes when they overlap with neighbors' boundaries. They noted, 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, decentralization policy, land tenure, and other factors.

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. Prom and Ironside report in their case study that 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. As long as boundaries remain fluid and flexible, defined only in each 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. For them, today's villagers are already "caught up in a mapping world" and do not have an "exit option." They can refuse to map, but they cannot escape the implications of living in a world in which others will eventually map their lands. Villagers recognize that being included in official government maps can be as disadvantageous as being excluded from them (Majid Cooke 2001). Mapping is a precondition for protecting their territory and resources, since it is not possible to claim an unmapped area in contemporary politics. Even if a community refuses to map within the boundaries of a protected territory, such as on a Native American reservation, the outer boundaries must be established and recognized.

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 nonspatial aspects. This shift eventually makes SIT indispensable for asserting and defending communities' rights. In Indonesia, Malaysia, and Cambodia (see the papers by Bujang and Pramono), many communities have realized "the power of maps" and are anxious to have their resources mapped. 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.

Participants in the workshop felt that their decisions to adopt SIT as an important component of their 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 describes how consultants from other international organizations—e.g., the East-West Center, 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. Furthermore, Hardiono et al describe how the shift from sketch mapping to GIS in Indonesia was influenced by discussions with these international actors. Donors' 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 neighboring communities. Both Pranomo and Bujang report that in their case studies, this has created a shortage of technically trained people, and 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., this volume).

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 to villagers that they 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. As Bujang explains in his case study, in spite of the facilitators' efforts to organize meetings to discuss mapping issues, many villagers failed to attend the meetings. 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. and Sarem et al. 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.

Finally, participants felt that 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 remap as circumstances change. Embedded within this context is the challenge of balancing the need for higher levels of technology against local capabilities. Some workshop participants speculated that the "non-professional" appearance of community maps gave government agencies reason to question the legitimacy of the maps. The papers by Saipothong et al., Zheng, Hardiono et al., Prom and Ironside, and Sarem et al. in this volume argue that as technology complexity increases, community access to the technology decreases. 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.

SUMMARY

The papers in this book do not seek to discredit the use of spatial information technology in community-based management. Rather we seek to understand the social and ethical implications of this technology 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.

Workshop participants and case study writers 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. The case studies revealed that 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 are "credible" 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 a fluid human/environment relationship to a relationship with quantifiable limits implied by boundaries/borders. The newly acquired authority to define and exert control over the use of space has thus begun to compromise the customary uses and governance it was intended to protect.

The impacts of SIT must also be seen in the broader 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 enhance their ability to manage resources. 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 centered 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 workshop participants 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 often quite complex 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.

REFERENCES

Agrawal, A., and C. C. Gibson. 2001. The role of community in natural resource conservation. In Communities and the environment: Ethnicity, gender and the state in community-based conservation, ed. A. Agrawal, C. C. Gibson, 1-31. New Brunswick: Rutgers University Press.

Beniger, J. 1986. The control revolution: Technological and economic origins of the information society. Cambridge: Harvard University Press.

Blaikie, P. 1985. The political economy of soil erosion in developing countries. London: Longman.

Blaikie, P., and H. Brookfield. 1987. Land degradation and society. London: Methuen.

Borneo Wire. 2001. Verdict secures native land rights. Summer. http://www.earthisland.org/borneo/news/wires/01sum03.html

Brealey, K.G. 1995. Mapping them "out": Euro-Canadian cartography and the appropriation of the Nuxalk and Ts'ilhqot'in First Nations' territories, 1793-1916. The Canadian Geographer 39: 140-156.

Escobar, M.1997. Exploration, cartography and the modernization of state power. International Social Science Journal 49: 55-75.

Fox, J. 2002. Siam Mapped and Mapping in Cambodia: Boundaries, sovereignty, and indigenous conceptions of space. Society and Natural Resources 15:65-78.

Harris, T., and D. Weiner. 1998. Empowerment, marginalization and "community-integrated" GIS. Cartography & GIS 25(2): 67-76.

Hershock, P.1999. Reinventing the wheel: A Buddhist response to the information age, Albany: State University of New York Press.

Illich, I. 1973. Tools for conviviality. New York: Harper & Row.

_____. 1981. Shadow work. Boston: M. Boyars.

Korten, D.C. 1990. Getting to the 21st Century: voluntary action and global agenda. West Hartfort: Kumarian Press.

Lemke, J.L., 2000. Material Sign Processes and Emergent Ecosocial Organization. In Downward causation: Minds, bodies, and matter, ed. P.B. Andersen et. al. Aarhus University Press.

Majid Cooke, F. 2003. Maps and counter-maps: Globalised imaginings and local realities of Sarawak's plantation agriculture," Journal of Southeast Asian Studies 34(2): 265-284.

Mark, D.M., N. Chrisman, A.U. Frank, P.H. McHaffie, and J. Pickles. n.d. The GIS history project. www.geog.buffalo.edu/ncgia/gishist/bar_harbor.html accessed Nov. 6, 2000

McDermott M. H. 2001. Invoking community: Indigenous people and ancestral domain in Palawan, the Philippines. In Communities and the environment: Ethnicity, gender and the state in community-based conservation, ed. A. Agrawal, C. C. Gibson, 32-62. New Brunswick: Rutgers University Press.

Peluso, N.L. 1995. Whose woods are these? Counter-mapping forest territories in Kalimantan, Indonesia. Antipode 27(4): 383-406.

Poole, P. 1995. Indigenous peoples, mapping and biodiversity conservation: an analysis of current activities and opportunities for applying geomatics technologies. Washington, D.C.: Biodiversity Support Program.

Rundstrom, R.A. 1995. GIS, indigenous peoples, and epistemological diversity. Cartography & GIS 22(1): 45-57.

Shrader-Frechette, and Westra, eds. 1997. Technology and Values. Lantham, M.D.: Rowman and Littlefield.

Sieber, R.E. 2000. GIS implementation in the grassroots. URISA Journal 12 (1):15-28.

Sirait, M., S. Prasodjo, N. Podger, A. Flavelle, and J. Fox. 1994. Mapping customary land in East Kalimantan, Indonesia: A tool for forest management. Ambio 23(7): 411-417.

Sterrit, N.J., S. Marsden, R. Galois, P.R. Grant, and R. Overstall. 1998. Tribal boundaries in the Nass Watershed. Vancouver: UBC Press.

Tenner, E. 1996. Why things bite back: Technology and the revenge of unintended consequences. New York: Knopf.

Thompson, H. 2001. New threats, opportunities to mapping program: Government criminalize community mapping in aftermath of legal victories. Borneo Wire. Winter. http://www.earthisland.org/borneo/news/wires/01win01.html

Urit, M. 2001. Land Surveyors bill goes against NCR lands. Rengah Sarawak. 10/31/01. (http://www.rengah.c2o.org/news/article.php?identifer=de0331t&subject=6).

Vandergeest, P, and N.L. Peluso. 1995. Territorialization and state power in Thailand. Theory and Society 24:385-426.

Winichakul, T. 1994. Siam mapped: A history of the geo-body of a nation. Honolulu: University of Hawaii Press.

COMPARATIVE STUDY OF PARTICIPATORY MAPPING PROCESSES IN NORTHERN THAILAND

By Pornwilai Saipothong, Wutikorn Kojornrungrot, and David Thomas

This paper explores the different mapping approaches of the Raks Thai Foundation and the World Agroforestry Centre (ICRAF) and how these differences affect resource management, boundaries, beliefs and culture practices, relationships within and among communities, and among communities and outside players. Since 1994 the Raks Thai Foundation has helped 167 sub-villages in Northern Thailand to build three-dimensional (3D) maps as tools for managing their natural resources. ICRAF has meanwhile built GIS databases for 55 villages and eight sub-watersheds. The paper suggests a number of similarities and differences between the two approaches. Villagers participate in the entire process of building a 3D map but their input into GIS mapping is restricted. 3D mapping is field intensive and requires much community time and participation, while GIS mapping involves time in lab and requires only one to two days of local participation primarily to serve as data sources, to produce sketch maps, and carry out field checks of data. 3D maps are good for using within villages but because of their limited spatial scope, they are less useful for planning resource management at sub-watershed or watershed levels. 3D models are difficult to retrieve and transport, are costly to produce, and are difficult to maintain and change. 3D maps are useful for intra and inter-village communication and planning. GIS maps can be easily produced at different scales and scopes, and data are easy to retrieve, maintain, change, and transport. But GIS maps are difficult for villagers to understand and GIS maps can only be produced by specially trained people and require new technology and special knowledge. Both types of map promote cross village comparisons, increase efforts by villagers to have their forests declared protected areas, and stimulate thinking among villagers about managing community forests.

The last twenty years has brought rapid change in northern Thailand. While most lowland areas now have some form of land title, land in the vast majority of mountain areas is classified as "slope complex" and reserved or protected forest. No legal basis for land-use zoning currently exists for areas within forest reserves.

A proposed community forest law is likely to provide a basis for official land agreements in many of these areas. But in order to establish such agreements, the information on which they are based must be in a form that can be officially recognized. Thus, there is now much interest in ways to translate land-use visions that have been locally negotiated among stakeholders into scale maps. This is a necessary part of the process of fairly constituting forest law.

In many upper watersheds, there is also growing conflict among villages and ethnic groups related to land use. Also, villagers in many areas are formulating local initiatives to zone and more effectively manage land and natural resources in their domain. Mapping activity has been an

important part of these initiatives, and boundaries of various types are being more clearly demarcated as part of this process.

Different kinds of mapping techniques have been introduced by different agencies and organizations to help people in various communities. The three-dimensional (3D) model map has been promoted in Thailand for more than fifteen years, while more technically sophisticated spatial information technology has been presented for use in rural areas only over the last five years. Both the Raks Thai Foundation and the World Agroforestry Centre (ICRAF) are working to address mapping needs in rural north Thailand. Because of their somewhat different approaches, it is useful to conduct a comparative study of their relative strengths and weaknesses under different conditions.

CASE STUDY BACKGROUND

Policy issues related to land use

As has been true in much of Southeast Asia, Thailand has a long and complex history related to land use and change in land-use patterns. The center of the Thai kingdom has typically been in lowland areas where agriculture is the major production activity, implying that the lowland people had more power than upland rural communities. This power differential manifests itself clearly in that the development of infrastructure and public services has been much more heavily carried out in lowland areas.

In combination, the realities of increasing population and export driven agricultural production have led to an expansion of land areas under agricultural cultivation. At the same time, influenced in part by the global environmental movement, people in the urban industrial lowland area have developed sharpening concerns about natural resource management practices in highland areas, especially with regard to water supply competition. Historically, the lowland peoples have come to cultivate in upper watershed regions, effectively forcing ethnic minority groups to migrate upward into mountain areas. In keeping with its forest protection policies and opium substitution program, the national government has instituted programs to reduce the spread of cultivation into upper watershed and mountain regions. Therefore, minority groups in mountain areas have had to transition from their traditional land-use system, based upon a shifting cultivation or swidden, to a land-use regime based on permanent upland crops grown within limited areas. This transition had led to great difficulty in meeting basic security needs for many upland peoples.

As stipulated in the new national constitution, the decentralization of governance systems in Thailand has been ongoing since 1997. Rural populations thus have had new opportunities to manage and use their lands at the subdistrict local level. The government provides funding, major infrastructure, and various other incentives to encourage greater local self-reliance, but also promulgates

restrictions with respect to local autonomy, as justified by the interests of the larger Thai society.

Mae Chaem Watershed

Mae Chaem Watershed is one of 255 officially zoned subbasins with an area of about 4,000 square kilometers. The elevation ranges from 400 to 2565 meters above mean sea level, and it is connected to Inthanon National Park and Ob Luang National Park in the eastern part of the watershed. More than 70 percent of the area is mountainous, and the amount of arable land is correspondingly relatively small.

There are five major groups of people settled at different altitude zones in Mae Chaem Watershed, each with a different language, culture, and agricultural practices.

The Lua

The Lua or Lawa people were the first inhabitants of this area, arriving around the middle of the eighth century, and numerous Lua temple ruins and cemeteries can be found in places close to Mae Chaem town. However, most of the Lua were assimilated by local Thai and Karen groups as these later groups migrated into the areas. Today, the remaining Lua live in remote areas and contact with them is extremely difficult, with only a few villages remaining along the ridge on the southwest of Mae Chaem Watershed. Traditional Lua agricultural practices centered on a shifting cultivation system that differs from that of the Karen people.

The Karen

The Karen entered the district in the mid-1800s from Burma. They have settled primarily in the middle altitude zone area (600–1000 meters a.m.s.l.) and practice their traditional rotational shifting cultivation system (ten to fifteen years forest fallow). This traditional system was geared to meeting only their subsistence needs. The Karen exchanged forest goods with the lowland Thai to supplement their agricultural production. With the expansion of upland field crops and government natural resource management policies, they have had to transition from their traditional system to a system based on permanent field crops and cash cropping. The Karen are the most populous group in Mae Chaem, numbering more than 40,000 people, making up over 60 percent of the area's total population.

The Hmong

The Hmong migrated from Mae Hong Son Province (west of Mae Chaem) after World War II. They live in the highland zone of the watershed. They used to grow opium in their pioneer shifting cultivation system. Under the nationally mandated opium substitution program, they now cultivate commercial highland cash crops including cabbage and tropical fruit trees.

A secondary group of Hmong people migrated from Hot District, south of Mae Chaem as part of a government

resettlement program and are now located in the lowland area. They also grow different kinds of vegetables as commercial cash crops.

The Lisu

The Lisu migrated to Mae Chaem after the Mae Chaem Watershed Development Project. There is only one Lisu village in this area.

Northern Thai

The local Thai live in lowland areas and use a wet rice cultivation system supplemented with vegetable and soybean crops in irrigated areas. They also engage in field crop cultivation in upland areas. Thai farmers have also tried to expand their cultivation activities into the forest. Especially in cases where the area of expansion has been forest fallow of the Karen people, this has led to conflict between those groups. Such conflicts have been most intense in relation to the corporate contract farming of potatoes and maize for seed production above Mae Cheam Valley.

Development programs in Mae Chaem

Many development programs have been conducted in the Mae Chaem Watershed, introducing new technologies and the participatory process to the region. This has affected the thinking of the people in significant ways.

- Missionary development has been ongoing in the area since the 1950s, particularly among Karen hill peoples throughout northern Thailand. About 20 percent of all Karen in Mae Chaem are Christian. The effects of missionary activity have been wide-ranging. In addition to changes in belief patterns centered on a shift from animist or spirit religion practices to Christian monotheism, the Karen have also undergone a change in overall lifestyle. Some significant changes can be observed in the Christian Karen attitudes towards spirit forest conservation and in their adoption of new crops and agricultural regimes.
- As a legacy of World War II, and the Cold War, Hmong began migrating into Thailand and the Mae Chaem area from the late 1970s and have often been involved in practicing opium production. The United Nations declared the highland area of Mae Chaem district to be the principal area of opium production in Thailand in 1980. Thereafter, the Royal Thai Government and the United Nations initiated the Thai/UN Crop Replacement and Community Development Project, which does not aim to directly suppress the cultivation of opium but rather to introduce alternative crops. This has led to the introduction of many kinds of vegetables and fruit trees to the highlands. Cabbage is currently the major production crop in the mountain area of Mae Chaem Watershed.
- The King's project or the Royal Project Foundation is another opium substitution program. This project is an integrated full-cycle approach that extends from research and cultivation, to processing and marketing new crops like temperate fruits, vegetables, and cut flowers. The end products have been sold under the "Doi Kham" brand name.
- The Queen Sirikit Reforestration Project (Suan Pah Sirikit) has tried to promote water conservation through bringing deforestation under better control in the north of Thailand. This project, operated by government officers from the Royal Forestry Department, has set up many forest conservation groups to help take care of forests in the village area.
- CARE-Thailand started in the Mae Chaem area in 1982 with the idea of "anti-poverty interventions." The project has covered eight of ten tambons (subdistricts) in Mae Chaem District. The project had the overall objective of improving community-based management of natural resources in watershed areas.

Local institutions in Mae Chaem

There are a number of institutions—particularly government organizations (GOs) and non-government organizations (NGOs)—that support natural resource management in Mae Chaem:

- The Tambon Administration Organization (TAO) is the local government institution at the subdistrict level created by the decentralization policy. TAO started with an initial series of elections in Mae Chaem in 1997. One of the eight major tasks of TAO and a key issue reported on in their yearly plan is the preservation of natural resources and the environment.
- The Watershed Network Committee was established with the initiative of the Raks Thai Foundation and Suan Pa Sirikit in 1996. The Watershed Network Committee consists of village conservation committee members within a given watershed. Its goal is to strengthen capabilities for natural resource management and to expand conservation efforts from the village level to that of watershed networks, ideally expanding management practices to cover watershed areas as natural wholes.
- Other local societies—Hug Muang Chaem, Kor Gor Nor, Chum Chon Rak Pa, Ruam Palang Rak Pa, etc.—consist of groups of local people with different backgrounds, each of whom wants to develop their area for some particular purpose. Outside donors support some groups, and most focus on natural resource management.

Maps as tools and/or sources of information

Maps have been used as sources of information for some time in the study area. Maps are good media for communication, are relatively easy to understand, and are more attractive than descriptive information. The maps are used to apply for and participate in negotiation processes, especially those related to natural resource management where spatial information is crucially important. Maps are also being used as devices for promoting and bringing about understanding of natural resources in target groups.

Spatial information technology goes beyond the simple production of maps. Because of its large and complex storage capacity and digital format, SIT allows spatial information to be readily used in other geographically focused research and analysis activities. SIT makes it relatively easy to change or update data and undertake remapping. It is thus particularly useful for analyses of dynamic systems over both space and time and is thus of great utility for planners and policy makers.

Raks Thai Foundation

From 1994–2002, community-based maps developed through 3D modeling came to be seen as effective tools that communities could use in natural resource management in the Mae Chaem Watershed area. Formal zoning maps were seen as helping to increase the responsibility and authority of local communities in ways compatible with seeking to minimize risks of negative effects associated with decentralized management.

World Agroforestry Centre (ICRAF) – Chiang Mai

has been working in the same area since 2001 as part of the project titled "Developing science-based tools for participatory watershed management in mountain mainland South-East Asia" funded by the Rockefeller Foundation. The spatial information and geographic information system (GIS) map outputs of this project have been used as tools to support local land-use planning, local and multi-level watershed management networks, intercommunity relationships, and associated functions by local institutions and agencies. The project goal was not just to produce maps, but also to help build local spatial information systems that were capable of producing various types of maps and displays suitable for various purposes. This is in line with other current efforts supported by the Thailand Research Fund to build TAO-level information systems for all tambons (subdistricts) in northern Thailand.

STUDY AREA

Mae Chaem Watershed, Chiang Mai Province, northern Thailand, where the benchmark site of the Raks Thai Foundation and the World Agroforestry Centre (ICRAF) is located. The study area is shown in Figure 1.

Figure 1. Village locations and subwatersheds that both ICRAF and the Raks Thai Foundation study in Mae Chaem Watershed

PROJECT METHODOLOGY

For this study, we selected areas in which both 3D modeling and GIS mapping have been introduced. Primary data gathering was carried out through formal interviews with key persons in the study areas. These included, for example the staffs of the Raks Thai Foundation, ICRAF, the Pang Aung Royal Project, and Heifer International as well as members of Hug Muang Chaem Group, the Northern Farmer Union (Sor Kor Nor), and TAO, along with others related to SIT and the GIS mapping process. We followed up on the questions in the formal interviews through discussions with groups of community members throughout Mae Chaem Watershed. The questionnaire consisted of four main questions with subquestions, totaling twenty-nine open-ended questions.

Mapping approaches

Mapping through use of 3D maps

The Raks Thai foundation introduced the 3D model in the Mae Chaem area from 1994–2002. The 3D model is made of paper with different colors displaying streambeds, roads, land-use areas, etc. The process of 3D mapping is diagrammed in Figure 2.

Mapping through the use of GIS

ICRAF has worked to help establish a spatial information network linking the local planning process with higher levels of planning and policy making activity. GIS maps from ICRAF-CM made of vinyl are colorful and denote different land-use types in the area and other landmark symbols. The process of participatory mapping undertaken by ICRAF is diagrammed in Figure 3.

Mapping experiences

Formal interviews were conducted with: key persons from GOs and NGOs in Mae Chaem Watershed that are using and developing community maps; relevant policy makers from government agencies; and key members of other agencies related to the study, including researchers, extension organizations, and other NGOs.

We also used key questions from the formal interview as points of discussion with representatives of different ethnic groups, with representatives of different groups within various watershed network committees, and with members of social organizations focusing on natural resource management.

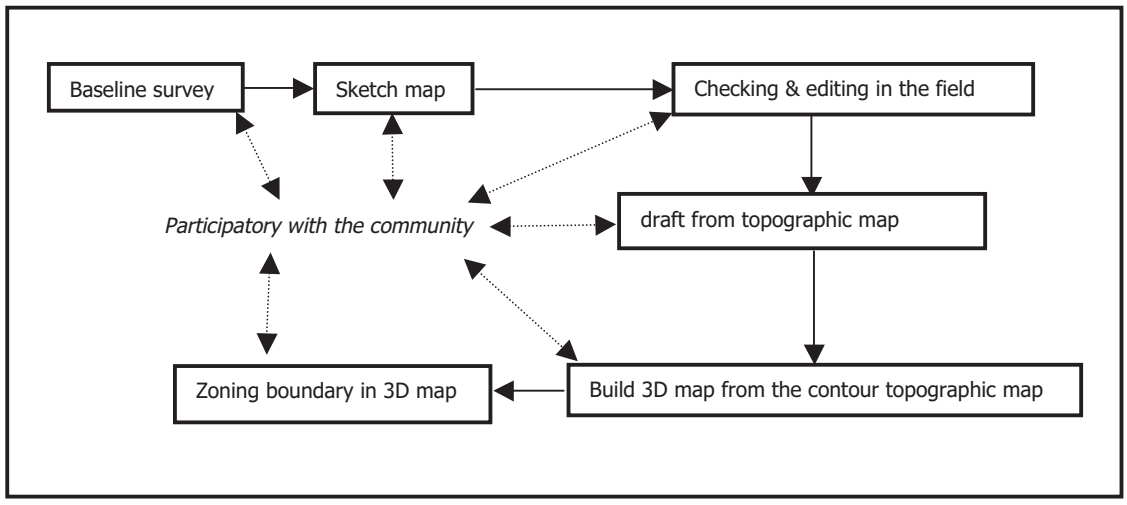


Figure 2. 3D mapping procedure in Mae Chaem area developed by the Raks Thai Foundation.

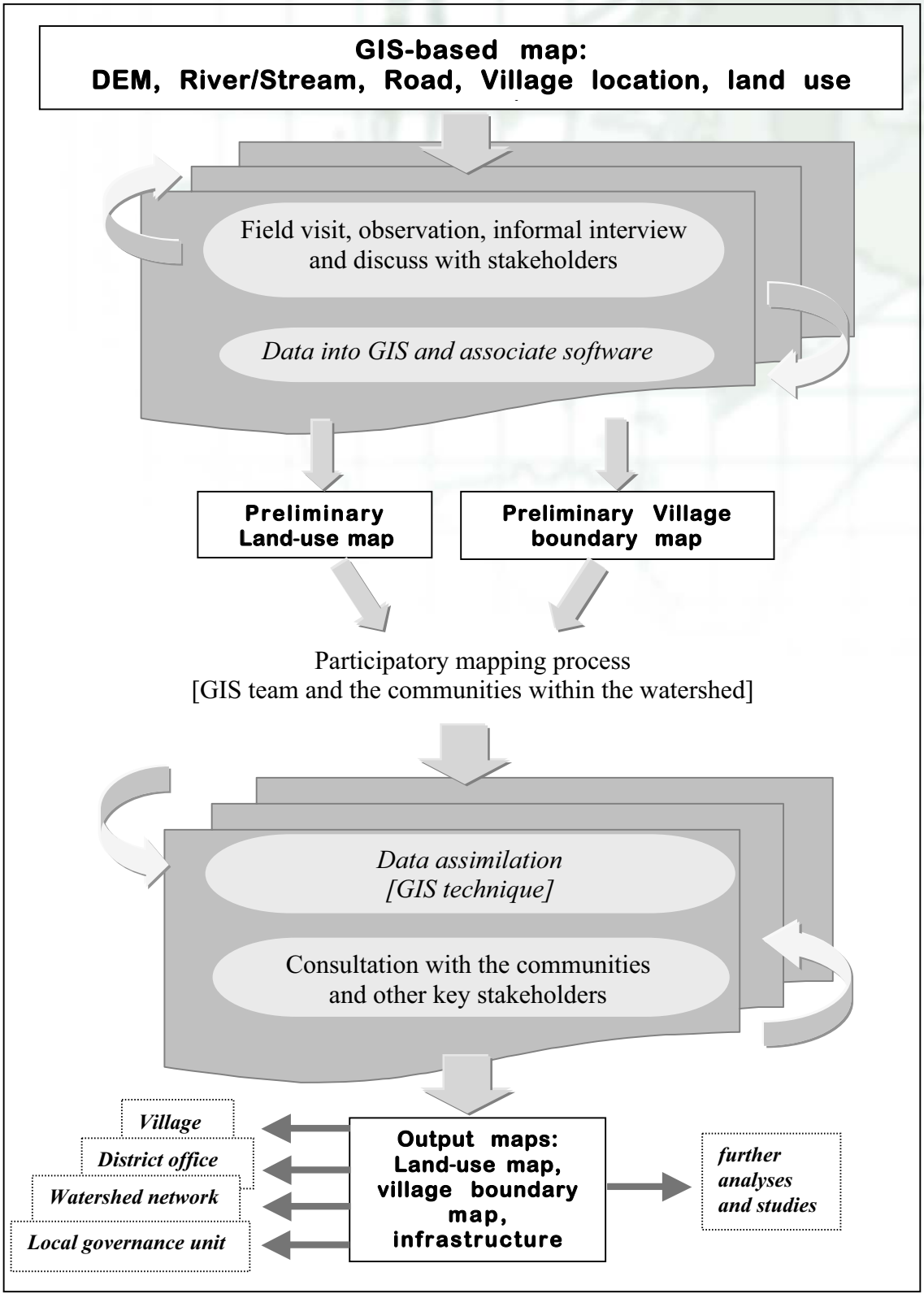


Figure 3. Methodology of participatory mapping to link local and expert knowledge

CASE STUDY RESULT

Mapping approaches

The following table shows the steps that are involved in 3D and GIS mapping processes.

3D MAPPING

1. **site selection**
2. **baseline survey**
3. **participatory rural appraisal**
4. **sketch maps**
5. **participatory mapping (field survey consulted by the community)**
6. **field checking and editing**
7. **maps of land use and land ownership**
8. **evaluate lessons learned**

GIS MAPPING

1. **site selection**
2. **base maps preparation**
3. **field survey**
4. **digitizing first draft map**
5. **print out the maps from the survey**
6. **field survey consulted by the community**
7. **digital map editing**
8. **participatory mapping**
9. **digital maps & paper maps of current land use of the village and watershed**

3D map production requires many volunteers from the village to participate in the process for a period of (typically) two weeks. The entire 3D mapping process is carried out with villager participation. The production of maps using SIT consists in large part of work carried out in a GIS laboratory, and requires only one to two days in the field for both the field visit and participatory process. The results of formal interviews and group discussions carried out in this study showed that people in the community got used to the 3D model and claimed it was easier to understand.

It became clear through the study that while any interested person can be trained to carry out the 3D modeling process, GIS enabled mapping requires access to both a computer and software, computer skills, and basic spatial data, all of which are difficult to bring together in rural Thai settings, especially those that are particularly remote.

The Raks Thai Foundation aimed to introduce 3D maps to the communities for use as a tool in their management of natural resources at the local level. Therefore, 3D maps were produced for 167 subvillages in the Mae Chaem area, and the output maps have been used at the village level in the area.

The GIS mapping process intends to establish a common store of spatial information for many levels of users. GIS maps had been created for fifty-five villages and eight subwatersheds in the Mae Chaem area. In contrast with 3D maps, GIS generated maps can be used at all levels from the village to the subwatershed and watershed systems as wholes.

Mapping experience

Mapping with 3D models has been introduced into Mae Chaem over the last ten years. During much of this period, 3D mapping was an appropriate technology for meeting community needs. Mapping with the use of GIS began being introduced in 2000 in response to increasingly sophisticated mapping needs, primarily at the initiative of NGOs operating in Mae Chaem. Over the

past four years, both mapping techniques have been employed in the area and some characteristic differences have emerged in how well they meet various needs and build community capacity.

Most apparent is the fact that while villagers can participate in the entire set of processes involved in 3D mapping, their input in GIS mapping is relatively restricted. 3D mapping is very field intensive and requires much in terms of community time and participation. By contrast, GIS mapping involves significant time in the computer laboratory and requires only one to two days of local participation, primarily to serve as data sources during the first GIS field visit, and then to produce sketch maps and carry out field checks of data. Although the total time to produce GIS maps may exceed that for 3D maps, considerably less local involvement is either required or possible. GIS mapping processes are also liable to include significant amounts of redundant work to produce an appropriate map.

3D models are good enough for use within a village, but not for use at higher levels, primarily because 3D maps have been used at the village and village boundary level. The small scope of 3D maps (most village areas are less than eight square kilometers) means that they are not suitable, for instance, for planning resource management at the subwatershed or watershed levels.

GIS maps were introduced in part to address the scope constraints of 3D models. With GIS data, it is possible to produce many types of maps, with different scales and scopes. The information contained in GIS developed maps are easily available afterwards for further analysis and research. The information contained in GIS maps is thus more easily transmitted. Among the most commonly cited weaknesses of 3D models is the difficulty of transporting them. In effect, they are restricted to use within villages, and not between villages or among groups of villages and government officials.

Yet, GIS maps also have notable weaknesses. Foremost among these is that GIS maps are difficult for villagers to understand. Some villagers state that they must be trained before they can use GIS maps. GIS maps can be produced only by specially trained persons and require introducing new technology and special knowledge of both software and hardware. By contrast, 3D models are easier to understand, and villagers feel comfortable and happy using 3D models to communicate with one another and with others who do not know much about the area.

In addition to the physical difficulty of transporting (and thus sharing) 3D models, they are both costly to produce and difficult to maintain or change in response to changing needs. They also provide less detail than GIS maps, which are easy to carry and can be used in precise correlation with other geo-reference maps. GIS maps are easily changed and updated, and have the aesthetic merit of being clear and colorful while providing many details. At present, GIS mapping has the disadvantage of being expensive, though this may change as computer technology and software become more widely used and available.

NATURAL RESOURCES MANAGEMENT/AWARENESS THROUGH THE INTRODUCTION OF BOUNDARY CONCEPTS IN RELATION TO PARTICULAR LAND-USE TYPES

Management

People in remote areas like the Mae Chaem watershed area—particularly the Karen and Lua peoples—have traditionally discussed land-use practices each season in order to have community consensus on the use of communal lands. In addition, discussions of land-use practices have traditionally occurred when conflicts have arisen about land use either within or between villages. After they got their 3D village maps, many villages started

discussing land use in their village areas more frequently and proactively, especially in relation to land-use zoning and forest management. But because of the difficulty of transporting 3D models and because their scope is limited to areas within individual village boundaries, GIS maps of watershed areas are coming into increasingly common use in discussions between communities and at the watershed network level.

This study has documented that both during participatory mapping processes and after looking at the GIS output maps of village areas and watershed areas, villagers from different areas have attempted to compare their land-use areas with those of their neighbors. We can notice that among some northern Thai, mapping has increased the likelihood that they will try to designate protected forest areas and begin thinking about how to manage the community forest in their own village area. There are cases where two neighboring villages that used to share a community forest now want to separate from each other and claim independent use.

Leaders of villages or watersheds (i.e. village heads, village committees, the TAO, and other conservation committees) are the dominant group who use 3D models and GIS maps for land-use management and in problem solving and decision making processes. Yet, even they insist that they still use their local beliefs/rules and formal discussions to solve problems, especially those occurring within the village.

Many people are willing to participate in the mapping process, often because they want to make sure that their lands are included on the maps. They are aware that not having their lands included might have undesirable future consequences. They also know that, unlike 3D models, GIS maps can include as much detail as they are able to provide about land-use areas, and that such maps are useful in claiming the right to use mountain areas for their own consumption even when they have no land title.

GIS maps have also generated changes in how villagers perceive lands that have not previously been claimed by any of the villages in a given area. Unlike 3D maps, GIS maps of watershed areas call attention to lands that have not had any classified use or that have been abandoned and that have simply been referred to as intervening "forest" areas. GIS maps make clear the gaps between the boundaries established by different villages in the watershed, and this has resulted in villages thinking about extending their own boundaries to include these intervening spaces.

Awareness

There are many examples of changes in boundary awareness associated with community mapping as a process and with the use of maps as information records. The most apparent of these changes are in how boundaries between communities are understood and located, and how the boundaries of new villages are established. For example, a number of new villages in the Lower Mae Yot Watershed area were not able to decide on their boundaries with neighboring villages without having access to GIS generated maps. The available 3D maps were seen as inadequate for deciding on boundaries for new villages because of their limited scope and the absence of references to the spaces between individual village boundaries.

A secondary effect of the participatory part of the mapping process is that villagers learned how to work with and contact government officers and other agencies related to land and land-use management. This has enabled villagers to exercise greater responsibility and initiative in resource management.

Beliefs and cultural practices in relation to land use

The ethnic minority groups in the study area–especially the Karen—traditionally used their close relationships with one another and their shared beliefs to manage their land, most often through formal discussion within the community. Today, these groups realize that their local rules cannot be used in negotiating with people from

outside the village because they do not know or do not share local beliefs and traditions. Maps have come to serve as material media for information sharing and as a common reference for solving problems.

For example, the Karen people traditionally practiced rotational shifting cultivation that had a ten to fifteen year cycle in which areas were left fallow for significant periods. According to their traditional agricultural system, they would allow cultivated areas in the Mae Tum area to lie fallow for five years and turn to using permanent field crop areas in the Mae Kong Kha area. As the fallow areas would fill in with local vegetation, the Karen would have conflicts with government officers about starting cultivation in areas that look like forest upon their return. The Karen found they needed maps to show the differences between forest areas and their own forest fallow areas. Both 3D models and GIS maps proved very useful in reducing conflicts related to this issue, with the 3D map being most helpful in understanding land-use patterns in the village area while GIS maps were most useful at the landscape level.

The Karen people also had the tradition of referring to their protected forests as "umbilical forests." Selected trees within this forest are hung with umbilical cords of community members. Because the Karen believe that the umbilical cord is the string of life for the newborn, trees encircled or hung with umbilical cords must be protected. Because most Karen now give birth in hospitals, this way of marking protected forests has become less and less common. Some villagers, especially older people, are committed to keeping these areas protected, so that when we worked with them on participatory mapping, they would draw in the boundary of the "umbilical forest" area but would rename it as a forest protected area. They did this primarily to protect that area from outsiders.

The change in religious practices of the communities also changes the behavior of people regarding their land-use practices. The spirit forest has its roots in Buddhist and animist belief systems, and areas once treated as spirit forest have been abandoned once Karen people changed their belief from animism to Christianity. At the same time, Christian missionaries help the villagers to continue treating the forest as a protected area. Thus, in the overall picture, villages that have undergone religious conversion still protect forest areas, but do so for different reasons.

Relationships within and among communities

The Karen and Hmong use their traditional village rules of resource use mostly within their communities. When they are faced with a problem like that of expanding agricultural activities and logging that infringes on their protected forest, they realize that the village rules are not binding and that they do not have enough information to broker agreements among conflicting parties. This is especially true when it is necessary to explain village rules to outsiders who may have no reference for such rules. Maps have been very useful in this regard, with both 3D and GIS models working best at different scales.

The expansion of field crops and intensive cash crops from lowland to upland areas by the lowland Thai, and from highland down to upland areas by Hmong groups, have caused problems for the Karen people because both groups end up using the Karen people's forest fallow area without permission. Thai and Hmong groups do not care because they believe the areas do not belong to anybody by law. GIS maps may help the Karen to work through such problems and, in some cases, may help them push encroaching agriculturalists out of their traditional use areas.

Maps are also useful when Hmong rent agricultural land from the Karen and then either do not pay or continue on the land after the payment period has expired. Here, the Karen feel that maps may help them reclaim their land.

Water use, both in terms of available quantities and quality, is becoming more and more of a problem all over Mae Chaem because of the expansion of agriculture areas. ICRAF has been asked for many types of GIS maps from the Mae Kong Kha watershed network committees for these committees to use in their negotiation processes regarding water management and water supply for agricultural activities in the watershed.

RELATIONSHIPS AMONG COMMUNITIES, NON-GOVERNMENT AND INTER-GOVERNMENTAL ORGANIZATIONS, AND THE STATE.

Led by local civil societies, a few villages that are located in a new national park asked ICRAF for different types of maps for their negotiations with government officers, because they realized that the GIS map may be officially recognized.

At the same time, explanations of village areas by use of sketch maps is not as powerful and clear as when conducted using 3D models, especially when there is a need to refer to the topography of the area. The 3D model is a very powerful explanatory tool in village relations with government officers or other outsiders who come to visit their area.

Because they were longtime producers of opium, the Hmong make particular use of community maps in their encounters with government drug enforcement officers.

CONCLUSION

The practice of distinguishing between different land uses is not new to the peoples of the Mae Chaem region. The use of boundaries to distinguish between different land-use areas is also not new. Distinctions among different land uses were traditionally developed on the basis of local knowledge and its gradual evolution and were institutionalized in village rules. There were not many land-use conflicts in the area in the past, largely because the population density was much lower, and villages were not closely packed. When conflicts did arise among groups of people in the area, they were able to resolve these conflicts easily because the various groups saw themselves in a relationship with one another that resembled that of being in the same family. Some groups or villages had their own maps, but the maps were used only to show important locations in an area, not to establish the boundary of a particular land use.

Outsiders from GOs and NGOs entered the area to initiate various development programs, including the introduction of mapping processes to local communities, making use of a range of mapping techniques. Some changes in land-use distinctions and the use of boundaries have ensured for example the new agreement of village boundaries and the land-use zoning area. Often, the key person involved with these development activities is the head of the community—the village head, local governance members, village committee members, etc. Especially in remote areas it is difficult for other villagers, especially women and youth, to participate in this process, in part because of differences in cultures and languages.

The 3D model mapping process required many volunteers and extensive fieldwork, while GIS mostly consists of work in the computer laboratory. In both kinds of mappings, villagers and their representatives are the sources of data, while others are involved in the creation of maps based on this information. Villagers are willing and interested in engaging in mapping processes because they would like to have maps produced with accurate and fair information. They are increasingly aware that inaccurate maps may adversely affect them as individuals and communities.

Even after the acquisition of maps, many communities continue using their close relationships and formal discussions to solve their land-use problems. However, they all agreed that maps are useful because they make it easier to generate mutual understanding. This is apparently because villagers throughout the area consider maps as a common and authoritative source of relevant information. The communities in the study area would like to have the local maps be of the type and quality acceptable to GOs. They believed that such officially acceptable maps would be more useful than sketch maps for settling disputes. At the same time, they believe that maps made by experts would have more precise and complete spatial information and would be recognized by neighboring villages and outsiders.

From the study, it is evident that both 3D models and GIS mapping are useful to rural communities as new tools for their negotiation support system, especially when coordination must be achieved among different communities, GOs, NGOs, and outsiders. It is also evident that the introduction of boundary concepts in relation to particular land-use types and village borders changed the ways in which community members think about land use and land-use management within and among communities.

APPENDIX I: FORMAL INTERVIEWS AND GROUP DISCUSSIONS

Formal interviews

Key persons in the study area

- Raks Thai Foundation
- World Agroforestry Centre (ICRAF)
- Pang Aung Royal Project
- Heifer International, Thailand
- Hug Muang Chaem Group
- Northern Farmer Union (Sor Kor Nor)
- TAO - Pang Hin Fon
- TAO - Mae Na Jon
- TAO - Tha Pha

Relevant policy makers

- Land Development Dept., Region 6
- Geo-Informatic for Natural Resource Management
- Forest Area Management Unit
- Suan Pa Sirikit (Queen's Initiative Project)
- Huay Sai Luang Head Watershed Management Unit
- Pang Hin Fon Head Water Management Unit
- Mae Suk Head Water Management Unit
- Mae Yot Head Watershed Management Unit

Other agencies related to the study

- Geography Department, Faculty of Social Science, Chiang Mai University
- SLUSE Program (Sustainable Land Use and Natural Resource Management), Chaing Mai University
- PhD. Student, Upland Program, Hohenheim University
- Chiangmai-Lumphun Promotion of Local Administration Headquarters
- The Committee for Protection of Ping River Basin and Environment
- Institute for Community Rights
- Northern Enterprise Co., Ltd.

Group discussion and stakeholders workshop of the local community members by:

Watershed network committee

- Mae Kong Kha
- Upper Mae Yot
- Lower Mae Yot
  - Mae Satop Nua-Tai, Huay Sai luang
  - Mae Ning-Mae Nai
    - Ban Mae Jum Sai Nua-Tai, Tor Yae Nor
    - Ban Khun Mae Nai
- Mae Ao
  - Ban Mae Ao Nua-Klang-Tai, Huay Ma Da
  - Ban Mae Hae Nua, Huay Kamin
  - Ban Mae Jae
- Mae Tum
  - Ban Mae Pi Kli, Mae Hae Nai, Molotu, Pador Pa, Koh Tha
  - Ban Kong, Hoh Kao-Mai, Kok Noi, Pae, Din Kao

Civil society

- Northern Farmer Network 1 (Kor Gor Nor, Mae Hae Tai, Se Do Sa, Blo De)
- Northern Farmer Network 2 (Kor Gor Nor, Ban Mae Tum Nua-Klang-Tai)
- Northern Farmer Network 3(Kor Gor Nor, Ban Mae Ma Lor, Tok Ka)
- Thammanat Foundation (Ban Sop Wak, Mae Wak)
- Forest Protection Community (Huay Nam Kiew, Huay Pha)
- Power to Forest Protection group (Ban Na Klang Nua-Tai, Huay Bong, Huay Pak Kude)

Ethnicity

- Hmong 1 (Ban Khun mae Wak)
- Hmong 2 (Ban Na Hong Tai)
- Hmong 3 (Ban Pui Nua-Tai, Tung Ya, Pang Hin Fon, Pang Ma O)
- Karen 1 (Ban Pong Ka Nun, Mae Ning Nok-Klang-Nai)
- Karen 2 (Ban Mae Ngan Luang-Noi, Mae Kom Nua-Tai, Kong Bod Luang-Tai-Bon, San Pu Lei, Pui Karen)
- Northern Thai 1 (Ban Mae Suk, Pae, Kong Kan)
- Northern Thai 2 (Ban Na Hong)

APPENDIX II: RESEARCH QUESTIONS AND ASSOCIATED SUB QUESTIONS

1. Does community mapping help stakeholders to translate local land-use visions into forms that can be officially recognized? If so, how? Are there other effects on community resource management?

Working questions	Tangible/measurable variables
What is community mapping?	
• What does it mean?	Individual/group perceptions
• Who formulated the maps?	Individual motivations
• How was it done?	Number/type of participants
• Who uses the maps?	Recruitment methods
• Who is the "owner" of the maps?	Characteristics of key persons
• Who will be responsible for and able to revise and remap as circumstances change?	Activities using maps
How are maps useful for the community?	
• Why do you want to use GIS maps?	Individual/group motivations
• How does mapping increase boundary awareness? In what ways?	Perceptions/Activities
• Does mapping allow community members to have more knowledge of resources and their management? How?	Activities
• Have maps helped create new agreements about resource use? How?	Activities
• Do maps help create new opportunities for consensus? How?	Perceptions/Activities
How important are the stakeholders?	
• Who are the stakeholders?	Types of stakeholder
• How do they participate?	Activities
• In what ways do they participate?	Activities
• At what level do they participate?	Venues
• What are the reasons they participate (or not)?	Motivations/Events
• How can different opinions, ideas, and approaches among stakeholders be compromised and who facilitates the process to solve the differences?	
What kinds of maps can be officially recognized?	
• Why do maps need to be officially recognized?	Protocols, standards, rationale
• What are the criteria to assess acceptability of so-called "official maps"?	Criteria
• How can the owners of the maps or affected communities gain sanction from the relevant authority for their maps?	

APPENDIX II: RESEARCH QUESTIONS AND ASSOCIATED SUB QUESTIONS

2. How have community maps been used as a tool in negotiations and planning to resolve/manage conflicts among communities and/or between communities and the state or other outside interests?

Working questions	Tangible/measurable variables
What other tools in negotiation and planning exist in the community?	
• What are other tools?	Types of tools
• Who uses them?	Groups/individuals
• How are they used?	Activities
• What are the advantages and disadvantages of these tools compared to maps?	
Have the tools (including maps) helped to resolve/manage conflict?	
• Among community	Events/Activities: Conflict and negotiation process
• Between communities	
• Communities and state	Land-use rule/tenure changes
• Community and other outside interests	

3. How does an NGO decide whether or not to make the investment in developing a GIS component to their work?

Working questions	Tangible/measurable variables
How does an NGO decide to make the investment in developing a GIS component?	List of agencies
• Who invests in developing a GIS?	Activities
• How do they decide to use it?	Reasons
Does a focus on participatory mapping at the grassroots level distort the expectations of community members vis-à-vis NGO partners?	
• What are the expectations of community members about the NGO partner?	Perceptions Events:
• Has mapping distorted expectations of community members vis-à-vis NGO partners?	Activities Event:
• What are the expectations of NGOs about participatory mapping?	

EFFECTIVE MAPS FOR PLANNING SUSTAINABLE LAND USE AND LIVELIHOODS

By Prom Meta and Jeremy Ironside

This paper seeks to document the impacts of mapping activities conducted by the Non-Timber Forest Products Project (NTFP) in three communities in Ratanakiri, Cambodia. The paper compares sketch maps and GIS maps with regard to their effectiveness in assisting villagers and the NTFP to achieve their goals. Many villagers perceived that maps help them to establish their territorial claims against outsiders. Sketch maps are easily understood and can help resolve land conflicts among villagers as well as between villages. However, more formal maps such as GIS are needed for interacting with outside parties such as government agencies or corporations. The participation rate in mapping activities was relatively low due to schedule conflicts and language barriers between mapping facilitators and villagers. Within the NTFP organization, only one staff member knew anything about mapping. The NTFP must balance between the two approaches in mapping. GIS technologies are seen as necessary to protect villagers' lands from outside interests. But the GIS initiative is plagued by problems that include shortages in personnel computer equipment, working space, and organized data. Given these constraints, sketch mapping fits best into the organization. But more training for staff members in facilitating village discussions on land management is still needed.

The Cambodian province of Ratanakiri lies about six hundred kilometers northeast of Phnom Penh, to the immediate west of Vietnam, and to the south of Laos. Ratanakiri is an ethnically diverse province with eight ethnic groups—Kreung, Tumpoun, Charay, Kachok, Kavet, Lun, Prov and Phnong—constituting approximately 68 percent of the population according to the 1998 census. Traditionally these groups practiced swidden agriculture and forest based livelihood activities. Since 1993, when Cambodia opened up for international investment, over a dozen concessions of 100 to 20,000 hectares have been granted for estate crops such as coffee, rubber, and cashews. In addition, a significant number of people from the dominant Khmer ethnic group have migrated into the province from lowland areas of the country to acquire land for cash cropping. Local people are unhappy about this "land grab" by commercial companies as well as government agencies. Problems caused by this influx of migrants on local peoples' livelihoods include increased land conflicts, illegal logging, and land selling. These problems are becoming critical.

The Non-Timber Forest Products Project (NTFP) was founded in August 1996 by a group of donors interested in establishing a long-term project to address issues of land tenure and management of natural resources by indigenous communities in Ratanakiri. Activities undertaken by the NTFP include natural resource management (NRM), land-use planning, informal education, community health, agriculture, gender training, and advocacy. The NTFP has facilitated the formation of six forest management associations and two community land-use plans with other

land-use plans in various stages of completion. The provincial government has recognized two of these forest management associations and one of the community land-use plans.

Since 2001 the NTFP has initiated many activities to build the capacity of indigenous people to advocate for their own interests and concerns. These activities have included providing education on land and forest laws, assisting with the preparation of letters of complaint, maintaining meeting minutes and reports, and providing training in how to use Global Positioning Systems (GPS) as well as how to prepare sketch maps. However, the capacity of community members is still limited and communities face many barriers to gaining recognition and acceptance from the provincial and national governments for their proposals. The NTFP recently implemented a policy of hiring local indigenous people as staff members. Many of these staff members are not conversant with maps and mapping technologies, even though they may be required to facilitate mapping activities taking place in their target areas.

The NTFP uses both sketch and geographic information system (GIS) maps for fulfilling objectives that range from advocating for land rights to resolving boundary disputes and designing community forestry agreements. The NTFP's advocacy and tenure security work requires GIS maps at a known scale in order to receive government recognition. But for fulfilling other objectives such as soliciting community participation in designing community forestry agreements or resolving boundary disputes, we have achieved greater success using sketch-mapping methods.

This paper seeks to document the impacts of mapping activities conducted by the NTFP in three communities. A key question facing participatory mapping is whether village based participatory rural assessment (PRA) style sketch maps or more technically complicated GIS maps best assist villagers and the NTFP to achieve their goals. In order to gain further understanding of this issue we conducted interviews with natural resources management (NRM) committees and villagers in three villages and with NTFP staff members who work in these communities. This paper also seeks to document how well NTFP staff members both understand and facilitate mapping activities.

BACKGROUND

Krola Village, Poey Commune

In 1998 Krola became the first village in the province to prepare a sketch map of its traditional lands. This sketch map was used to develop a land-use plan to aid the villagers in managing and protecting their land. This map has also been used as an advocacy tool when dealing with provincial and national governments. For example, the map was featured in a booklet about land-use planning activities in Krola that was sent to the king as well as to members of parliament and to some of the highest government officials in the country.

The people that prepared the map followed a system known as participatory rapid cadastral appraisal (PRCA), developed by the German Development Agency (GTZ) for use in lowland areas of the country. Professionals working for the GTZ hypothesized that Cambodia was not yet able to offer an accurate and efficient cadastral and mapping system to record land ownership. In response they developed a rapid system utilizing sketch maps whereby land ownership is officially recognized if all neighboring landowners agree with the boundaries of the land in question. While this system was relatively easy to implement in lowland areas, a technician from GTZ was asked to come to Ratanakiri to adapt the method to the forested, upland, and communally owned systems of the area. The result was the 1998 sketch map of Krola's village area. A GIS map of Krola was completed in 2003.

Kachon Village, Kachon Commune

Kachon Commune is located in Veunsai District along the Sesan River. Kachon Commune has six villages, all of which depend on forest products for their livelihoods. In 1999 a logging concession that included the forests of Kachon Commune, was granted to the HERO Company. The company initiated logging activities in 2001, and villagers were constrained from gathering vegetables or hunting in the forest. Seeking assistance with these problems, villagers came to the NTFP. We began by inviting villagers to discuss the problem in workshops and then conducted a mapping training for Kachon community forestry committee members. Although the HERO Company had ceased operation due to financial difficulties by the end of 2001, the NTFP has continued to organize community forestry activities in the six villages to prevent further illegal logging, land selling, and land conflicts and to ensure that the natural resources are managed and used sustainably.

Villagers and NTFP staff members have conducted various types of mapping activities. For example, members of the NRM committee in collaboration with village elders prepared a sketch map of traditional village boundaries. A workshop was conducted with neighboring villages and communes to reach agreement on commune boundaries. Community members received training in community mapping and in using GPS technology for collecting information on areas used and protected, forest boundaries, and other spatial features. Land and forest use regulations for the commune were also developed during these trainings. The NTFP recently finished a scaled GIS map of commune boundaries and community forest areas. The district forest office has recognized these maps and the regulations for governing the use of these forests.

Rok Village, Kok Lak Commune

Kok Lak Commune, with a population of approximately 2,000 people, is located in the far northeastern corner of the country near the borders with Laos and Vietnam and on land protected by Virachey National Park (VNP), the largest national park in the country. The park was established over a large part of Kok Lak's traditional territory and park and government officials have pressured Kok Lak residents to take up paddy farming near the Sesan River and its tributaries and to stop swidden farming in upland areas near and inside the park. NTFP staff members held mapping and map reading training for Kok Lak representatives in 2001 and in 2002, and mapping activities have followed these trainings. After the second training, members of the NRM committee traced the rivers and hills from a topographic map of the area. On this scale base map they placed numbers beside each of the streams and hills and developed a database of local place names that linked corresponding numbers on the map to a local name in the database. This map and database was used in discussions with VNP staff members to delineate areas villagers would like to use in the park. As a result of this activity, park staff members designated more than 20,000 ha in the park as community protected areas (CPA). This area was included in the park management plan and map, approved by the Ministry of Environment (MoE), which has overall responsibility for protected areas. The plan allocated 17 percent of the park to four community protected areas. However, despite this early success, the Department of Nature Conservation and Protection (DNCP) within the MoE

began to argue that these areas were too big and that communities cannot manage such large areas. They asked that the size of the CPAs be reduced.

The GIS Unit in the MoE (in Phnom Penh) subsequently produced maps showing the size of the new CPAs. One CPA was reduced from approximately 20,000 ha to about 600 ha. Another proposed CPA disappeared off the map altogether. The DNCP was now saying that these reduced areas are what villagers themselves asked for in meetings with government officials. In meetings with the Kok Lak commune members, however, VNP staff members pressured the community to reduce the size of its CPAs. The commune leaders were extremely reluctant to reduce their CPAs since this was their traditional homeland and since they had already surrendered much of their homeland to the park. These CPAs were also seen as an important resource for community livelihoods as villagers faced food shortages since being pressured to move to lowland areas and to take up lowland rice farming. As a result of more discussions with VNP staff members another agreement was signed that allocated approximately 10–15 percent less land to the Kok Lak CPAs. A VNP ranger and Kok Lak community members then jointly walked the new boundaries for the CPAs with both the ranger and the community members collecting their own GPS coordinates. The maps produced by the MoE and by the NTFP using the different sets of GPS data are vastly different. These differences have created further conflict between villagers and government authorities.

The NTFP and participatory mapping

The NTFP encourages villagers to participate in mapping as one step in the land-use planning and community forestry processes. Villagers from Kok Lak and Kachon have participated in many workshops to develop regulations and by-laws and to map village boundaries. Villagers from both communes also met with NTFP staff members to review the maps, to add new information, to edit the maps, and to agree on their accuracy. Sketch and GIS maps are produced in a two step process. In the first step, the field staff (team leader and assistants) introduces and conducts sketch mapping in a village. If the field staff has no experience with mapping they can ask for help from the NTFP technical staff member. In the second step, the NTFP technical staff member goes to the village with NTFP field staff members to organize a training course on using GPS and on methods of collecting data. After the two steps are completed, the two groups (field staff and technical staff) meet to discuss transferring the information collected in the sketch maps to topographic maps. Women staff members with less knowledge of mapping participate in this process by facilitating and translating between the local and Khmer languages.

The NTFP seeks to produce GIS maps that demarcate areas villagers have zoned for use (forests and agriculture) and protection. The NTFP hopes to use these maps to gain ratification of these community protected areas from the provincial government. For example, the Executive Committee of the Provincial Rural Development Committee ratified the map of Yaka Ol Forest in Poey Commune. Kachon and Kok Lak Communes land-use maps and regulations have been recognized by Veunsai District. The NTFP feels it is important to produce GIS maps, even if villagers do not understand them, because the government is not interested in sketch maps, especially those produced by villagers. In Kok Lak and Krola, for example, provincial authorities would not accept the sketch maps villagers had produced to show present day land-use practices. Consequently, NTFP team leaders are currently conducting numerous training workshops and meetings on making and using sketch maps for members of the NRM committees in each of the target villages. In Kachon and Poey Communes, sketch mapping workshops have been organized in four villages in each commune.

One problem the NTFP has faced is that village women are generally not interested in mapping because they consider it to be "men's" work. Moreover, women are busy feeding their babies, husking rice, and carrying out other chores. Women are also shy to speak in public and defer to the

men to take action and make decisions. In order to overcome women's resistance to participation, the NTFP recently began to hold workshops specifically for men, women, and youth groups. In Kachon commune, villagers drew sketch maps with the assistance of village elders, the village chief, and NRM committee members. Women participated in a separate group by drawing sketch maps on the ground using items such as bamboo, stones, leaves, and branches as symbols for village boundaries and resources. People interested in this activity stopped to add their information. After the sketch maps were finished on the ground they were copied to a flipchart. The NTFP continued to divide the group by gender for discussions on sketch mapping processes. The women's group focused on areas near the village where women collect vegetables, firewood, and other resources. The men's group discussed areas further away from the village and marked traditional boundaries, spirit forests, and other areas. Finally, the NTFP organized a workshop where both sketch maps were presented to all villagers and invited them to agree on village boundaries. NTFP staff members also conducted a three-day training in using GPS for approximately twelve people from Kachon and Kok Lak Communes including the commune chiefs, village chiefs, and NRM committee members. NTFP staff members conducted this training after the sketch mapping exercise. The attendees used GPS to verify the village boundaries they had delineated in the sketch mapping activity.

METHODS

This project sought to understand the impact of NTFP sketch and GIS mapping activities on target communities, and to assess how well mapping activities are meeting overall NTFP goals. Methods used to meet these objectives included interviewing NTFP team leaders and mapping facilitators; presenting the objectives of this research to the communities, including the commune chiefs, village chiefs, and community NRM committee members; interviewing village chiefs and community NRM committee members; and conducting focus group sessions with villagers.

Interviews conducted at the study sites asked villagers questions such as: What do villagers expect the NTFP to do for them? And why do villagers want maps? Interviews conducted with staff members asked questions such as: What do NTFP staff members hope/think they can do for villagers? And how well do NTFP staff members understand maps and facilitate mapping? The research was conducted from January 2004 to March 2004 in three study villages. We interviewed nineteen members of the three NRM committees including three women members, six villagers including four women, and three NTFP team leaders including one woman.

RESULTS

What do villagers want?

When respondents were asked what they wanted from the NTFP, twenty percent replied that they wanted NTFP staff members to help mediate conflicts over village boundaries. The large number of people who have migrated to Ratanakiri from other provinces to buy land has caused rampant land selling in nearly all districts in the province. As people sell land to outsiders, the amount of land remaining for their own purposes is reduced, and villagers are forced to cross the boundaries of neighboring villages in order to clear new land for farming. Conflicts have begun to arise between neighboring villages, and villagers are beginning to look to outside organizations like the NTFP for methods to help them resolve these problems.

In addition, villagers look to the NTFP for assistance with village development activities such as land-use planning and the management of community forests. NTFP staff members help villagers develop regulations and by-laws for managing common property, and they facilitate village meetings to gain acceptance and recognition of these regulations. For example, with the NTFP's assistance Krola Village developed land-use regulations and by-laws to manage their lands and forests. As a result, villagers in Krola rarely have problems such as illegal logging and land

conflicts. The NTFP also assists villagers in developing networks for exchanging and sharing experiences with each other for finding solutions to similar problems. To facilitate networking and other community development activities, the NTFP has built small community centers in each target commune where community members can meet and interact.

Twenty-five percent of the respondents said they do not know what they can expect from the NTFP, because they do not attend meetings where NTFP activities are discussed. These people tend to work in their swidden fields located two to four kilometers from the village and only come to the village at night. However every one knows the NTFP by its nickname the "squirrel organization," and most villagers have some idea of the NTFP's activities. It is possible that some villagers did not understand the questions and/or did not understand the Khmer language used by the interviewers well enough to know how to answer the question.

Case Study

Mr. Phet Kanhem, Natural Resource Management committee member from Kok Lak Commune, and his group recorded the names of rivers, hills, and important sites of their area onto a map which they traced directly off a topographic map. This map was later used in discussions with Virachey National Park to resolve conflicts between the community and park staff members.

When respondents were asked why villagers wanted maps, approximately 80 percent replied in order to display them in their village. People feel that maps help them to stop illegal logging and other activities. They use maps as documents that establish their territorial claims with outsiders such as government authorities and company representatives. Previously villages did not have clearly demarcated boundaries, and villagers would frequently cross each other's territories to make new swidden fields and to gather non-timber forest products. During that time they also had disputes over benefits but these were solved following accepted traditional procedures.

In Kachon Commune, for example, conflict existed with villagers from Pong Commune who frequently crossed Kachon territory to gather non-timber forest products, hunt, and cut timber. Pong is a Lao village, and while the Lao and Kachon communities have lived near each other and even intermarried for a long time, the Lao do not have the same respect for traditional management mechanisms or for traditional territorial boundaries as do Kachon villagers. In this case the problem was resolved when the Kachon NRM committee reported the problem to the village and commune chiefs. This was followed by an invitation to the chiefs of both villages to meet and negotiate boundaries using a map. Since then, Kachon Commune has conducted three workshops where people were invited to discuss and agree on the village boundaries and to jointly walk these boundaries. Veunsai District authorities now recognize Kachon Commune boundaries.

All the NRM committee members interviewed felt that they needed access to both GIS and sketch maps. Sketch maps are understood more easily by villagers and provide a generalized understanding of the village situation, its land-use practices, its borders, its relationship to neighboring villages, and its access to resources. Sketch maps can be used within the village to identify, negotiate, and resolve land conflicts among villagers and sometimes between villages. GIS maps are necessary for interactions with government agencies and other outsiders such as forest concessions and such

"If we have no map then all that land is not ours."

Mr. Oum Mean community member, of Kachon Commune

commercial enterprises as mining and agricultural firms. GIS maps are necessary because they can be legally recognized as an accurate representation of the village and its resources.

Villagers acknowledged that not many people outside of the NRM committees and the few people who have joined NTFP training sessions understand maps or mapping. Women do not understand mapping because it is outside their sphere of knowledge and hence they are not able to make effective contributions. Few villagers have had any schooling and this makes technical training difficult. In addition, the NTFP did not conduct many training sessions, and the time between trainings was quite long. In Krola Village, for example, the NTFP last conducted a mapping training in 2000–2001. When we returned to the village to interview members of the NRM committee in early 2004, we found only a few people who still remembered their training and who could explain the symbols used in the sketch map for demarcating features and many who could not. In Kachon Commune, twelve members of the NRM committee received GPS training from NTFP mapping trainers. Three of these people later taught the NRM committee members in Koh Peak community how to use GPS.

All the villagers we interviewed who were not members of NRM committees stated they did not understand maps or mapping activities. We feel this is because they were not able to join meetings and mapping training courses. One respondent acknowledged the need to display a sketch map in the village, but could not understand the map himself. This suggests that people who have to spend most of their time in their swidden fields and who are not able to attend meetings are disadvantaged in terms of learning how to read and use maps.

Case Study

Mr. Oum Mean, NRM committee member from Kachon Commune, trained seventeen members of the Koh Peak NRM committee to use GPS. At least three of these people can use GPS to collect information (including one woman) and five of these people understand how to use GPS but did not feel comfortable operating it by themselves.

Another problem the NTFP has faced is that most villagers only speak their local language—Kreung, Tumpoun, or Kavet. This makes it difficult for the facilitators or trainers, who only speak Khmer, to conduct training. The NTFP uses local people who can speak Khmer as translators but some things are lost in translation, especially the meaning of technical words for which there are no translation in the local languages.

Study results also suggest that younger people find it relatively easy to understand sketch maps. During the sketch mapping process in Kachon Commune, for example, the young people were divided into a separate group. This group quickly became familiar with their map. Younger people have also generally had more education and can read Khmer. Even young people who did not join the mapping activities still understand sketch maps because of their better Khmer language literacy. Other villagers, however, had difficulty understanding these maps. In particular many villagers had difficulties with the concept of scale and the difference between the sketch and GIS topographic maps. All the villagers interviewed cited the need to display both sketch and GIS maps in their villages even though some villagers could not understand either of them.

When respondents were asked how maps help villagers, many responded that they found maps useful for decreasing land disputes and land conflicts with outsiders and for stopping forest concession companies from using their lands. In Krola Village, for example, the Taiwanese HERO Company had a forest concession agreement with the Cambodian government but did not follow the forest law. The company illegally cut down many kinds of trees. Villagers did not agree with the activities of the company and some villagers used GPS and sketch maps to map the locations of the

illegal logging activities and to show them to the district and provincial authorities. Since then the company has ceased its illegal activities. In another example, Cham people from Pok Village came to the forests of Toeun Commune to clear forest for swidden farms causing conflict between the two villages. In 2003 villagers from Toeun mapped these lands and took the maps to Pok Village for discussion. Since then these conflicts have been resolved.

Both maps are very good, and I need to display both of them in my village. I can remember the sketch map in my brain and the GIS map has many signs, colors, and marks on it and no one can understand it completely except clever people.

Ya Kouk, tribal chief of Krola Village

What do NTFP staff members want?

When we asked what NTFP staff members sought to achieve we received various answers. NTFP team leaders hope to facilitate the smooth implementation of village development activities. They seek to assist villagers in drawing sketch maps, with special attention to zoning use areas, protected areas, burial areas, and boundaries between villages. They expect to conduct workshops assisting villagers with boundary definition, demarcating their territories as well as to gain recognition for these boundaries from commune, district, and provincial level authorities. They also seek to help villagers develop regulations and by-laws for managing land within the areas demarcated on the sketch map. Their major hope is to assist villagers in building capacity as quickly as possible to protect their lands and to assist villagers in communicating their regulations outlining management of areas for use and protection to all villagers and neighboring villages.

"If we have no map, land disputes will increase."

Mr. Oum Mean community member, of Kachon Commune

Another objective of the NTFP mapping technician is to facilitate a better understanding of maps among other members of the NTFP staff. NTFP staff members do not yet have sufficient capacity to assist with anything other than sketch map training in target villages. The survey showed that two out of three team leaders can read and understand maps and map information and approximately three or four NTFP staff members can understand and read maps. They have gained this knowledge through participation in the meetings facilitated by the NTFP technical staff member. Staff members and NTFP team leaders have also received "on the job" training in reading maps and using GPS receivers. One team leader and one assistant do not understand maps even though they too have participated in these trainings. Some NTFP staff members do not speak the Khmer language fluently. But at present all NTFP field staff work very hard on sketch mapping and those who are not as good ask for help from the technical staff member.

According to NTFP staff members the first benefit of mapping has been to empower local communities to manage their natural resources better. In Kok Lak Commune, for example, NRM committee members used the map they produced from a topographic map showing the names of rivers, hills, and important sites to negotiate with Virachey National Park officials on land and forest management. In Kachon Village, another NRM committee member was able to teach NRM committee members from Koh Peak Commune how to map. These people were then able to collect GPS data by themselves.

The second major benefit of mapping has been to decrease land conflicts. In Kameng Village, Poey Commune, for example, villagers had problems with an influx of lowland Khmer settlers (twenty-one families from Svay Reang District, Stung Treng Province). In this case, villagers used sketch maps in discussions about their boundaries with other villagers and the new settlers. In the end all of the new settlers left the village.

The third benefit of mapping has been to help resolve problems such as illegal logging, land sales, and other issues. In Kachon Commune a few people from outside the community entered the forest to cut timber illegally. In this case the NRM committee and a women's group caught the illegal loggers and sent them to the office of the Forest Administration for prosecution. Finally, maps can be used to document boundaries between villages and between communes. These maps can be kept as a document that is protected by law, after they have been recognized at the provincial level. In these cases, maps provide local people with legal protection for their land. On the other hand, none of the team leaders understand how maps help to maintain culture. But maps are absolutely essential for resolving problems of land conflicts and illegal logging.

Overall, however, the survey results suggest that the NTFP is an organization where GIS technologies do not fit comfortably. Staff members are busy with a number of tasks; there is a shortage of office space; high demands are already being placed on available computers and printers; and files for maps and other documents are not well organized. Only one staff member is capable of processing map data and producing a computerized GIS map, even though other staff members have been trained. Consequently the sustainability of these activities is questionable if this staff member decides to move to another job.

CONCLUSIONS

Survey results suggest numerous reasons why villagers feel they need maps. These include displaying maps to make other people, both within the village and on the outside, more aware of the village, its land-use practices, and its borders. Maps increase the knowledge of villagers regarding their resources, their relationship to their land, and their relationships with each other. Maps are particularly important for establishing legal claims to land in relationship to logging, resolving land conflicts, clarifying fallow land claims of other community members, and for managing border conflicts. Maps are useful for resolving both traditional and non-traditional conflicts over land and claims to other natural resources. The rights of indigenous communities to manage their community and immovable

property is defined according to their maps, regulations, and by-laws. The village elders and traditional village chief are recognized in their own communities as the authorities with the power to enforce these regulations and laws. Once properly defined, provincial and national level authorities can recognize the rights of villagers to manage their land.

There are, however, several problems associated with the use of maps. The survey shows that the major disadvantages of sketch maps are that outsiders from government and private enterprises do not recognize the boundaries delineated on sketch maps. Villagers are under strong pressure from outside authorities to simply give up or sell their lands. GIS maps of their village territories provide some protection from these pressures. Even with GIS maps however, villagers still need a better understanding of the nation's land and forest laws in order to be clear about their rights. They also need confidence and support to enforce their regulations and decisions.

All villagers should receive some training in using and understanding maps, but from the results of our interviews, we see that only three to four members of the NRM committees can train others in the use of both sketch and GIS maps. This is because they have received GPS training and have worked directly with NTFP staff members on the topographic map. Other NRM committee members can only explain how to make and use sketch maps. Committee members need more training in GIS mapping and GPS. Along with this training people also need increased knowledge of land and forest laws and their rights, and to be able to increase their basic incomes in order to be able to advocate for their interests. Centralized control over rights to access resources is still strong at all levels of government authority.

From the NTFP's perspective the key question is do maps assist the NTFP to achieve the goal of making a measurable difference in its partner communities' ability to defend and manage their lands and forests? Maps clearly increase local communities' ability to defend their lands and forests. The focus on mapping traditional use and boundaries is helping to define these traditional rights in the eyes of government and outsiders who may not otherwise recognize these rights without visual delineation.

It can be argued, however, that delineation of traditional territories and of subsistence patterns of use is not enough, even in the near future, to help people hold onto their lands and forests. In a world where outside pressure on these resources and these communities is increasing, often drastically, efficient planning and concrete implementation of these plans is the only thing that will assist communities in holding on to their resources. In this sense, maps are tools for achieving good management. But how well do maps fulfill this objective?

This study started with the question of whether village based participatory rural assessment (PRA) style sketch maps or more technically complicated GIS maps best assist villagers and the NTFP to achieve land protection and management goals. Survey results suggest that scale and GIS maps provide different kinds of advantages and disadvantages. GIS maps can be recognized by provincial and national level authorities and by the law. On the other hand sketch maps are useful to local people for understanding and protecting village resources. All the NTFP team leaders interviewed understood that both sketch and GIS maps are important for facilitating village development activities. However, it would be fair to say that the potential use of maps for planning and management is not well appreciated within the NTFP as a whole.

This research did not assess whether communities are using maps to plan for activities such as planting cashew trees, but it was instructive that most of the discussion focused on preventing conflict with outsiders rather than on internal management and land-use planning. The potential use of maps for internal management is weakened by there being no consideration of appropriate land uses for different areas of the villages' lands. The fact that much of the planting of cashews is being done on the best rice and food growing

soils is an indication of this lack of land-use management. Krola Village's land-use plan contains zones and detailed rules for development of agroforestry or other agricultural activities, but for several years now this detailed planning has not been implemented.

GIS technologies hold a precarious place within the NTFP. Staff members reluctantly accept that these kinds of maps are necessary for communities to negotiate with outsiders and government. The ethos and capacity of the NTFP, however, is more towards strengthening communities and sketch mapping rather than developing the technical foundation necessary to produce GIS type maps and to carry out legalistic negotiations. As a result GIS technologies are an afterthought within the organization that has to compete with many other demands on the one staff member/technician and the many other uses of available computers, etc. GIS technologies are seen as necessary to react to a situation/constraint that is out of everyone's control (the government will not accept anything else), but the strategic potential to proactively use these technologies to dictate the terms of the negotiation process with outsiders and government is not considered. This could be seen as a possible mistake for several reasons: the government's general acceptance of community/GIS mapping by NGOs, the legal acceptance of traditional land uses such as swidden agriculture in Cambodia, the lack of mapping and management capacity within the government, and possible synergies with other Ratanakiri GIS technicians/initiatives, etc. Many problems plague the GIS initiative including (1) the presence of only one staff member capable of processing field information to produce simple GIS maps (and that person is also required to serve several other tasks); (2) the lack of computers; (3) poor data management; (4) the lack of attention to training; and (5) the general low priority given to this activity.

This focus on sketch maps could actually be the most logical choice for the NTFP given the other constraints the organization faces. The NTFP has hired local staff members who have lower educational levels but who also speak local languages. An interesting question that grew out of the research is whether the capacity of these new employees in local languages improves the ability of villagers to understand the mapping classes. Interactive sketch mapping activities using local materials and drawing maps on the ground may explain the ability of villagers to understand mapping as much as careful explanations in local languages. The Ratanakiri GIS Unit has had some success with training community mappers capable of explaining maps and GPS use to villagers in local languages. Does this suggest that the NTFP is not fully exploiting what it considers one of its greatest strengths—local staff members who speak local languages?

The other question that remains is an assessment of the overall impact of the NTFP's mapping activities since 1996. If impact is measured in securing village resources in the face of outside pressures, these activities have achieved at least some of the NTFP's goals. Villagers in Krola have maintained the integrity of their village lands; however it must also be noted that because of its location Krola has not experienced the same outside pressures as other more exposed villages. Villagers in Kachon have managed to negotiate and secure their boundaries with neighboring villages. Their success in holding off the HERO Logging Company is due as much to the poor management of HERO as it is to villager resistance. Ongoing illegal logging, however, continues to be problematic in the Kachon forests. Villagers in Kok Lak have used maps to define community management areas that they want the VNP to recognize. But subsequent mapping activities have been to slow to maintain the negotiating initiative and offensive in the face of changing ideas about the size and desirability of community management areas within the MoE. As a result Kok Lak risks having to accept what the MoE feels like giving them rather than being in a position to dictate some of the terms of the discussion. The same could be said for the mapping and planning activities for areas of Kok Lak Commune outside the VNP that are now included in a forestry concession. It can be argued for Kok Lak and perhaps for some of the other areas discussed above that

the real outside pressure has not yet begun in earnest, and that the NTFP's impact in empowering communities to defend their resources has not yet been tested.

In conclusion the NTFP is an organization that is reasonably comfortable with sketch mapping activities, although the resulting maps have perhaps not yet been used to their fullest potential for internally raising village awareness and improving land management. NTFP staff members use GIS technologies more out of necessity than anything else, and this form of map making is given a low priority. Consequently, achieving government recognition of villager plans and maps is progressing slowly. The NTFP needs to think carefully about what their villager partners will require in a fast changing environment where their fertile lands will be in high demand. Perhaps the overall conclusion is that both sketch and GIS maps can be effectively used to empower communities, but their uses differ. The NTFP needs to decide on its priority activities and objectives. If sketch maps are considered more appropriate for the core task of strengthening internal management, then staff members need considerably more training in how to facilitate the design and implementation of village land-use plans. If gaining recognition of village lands from government authorities is prioritized, then a much stronger commitment is required to allocating funding for GIS equipment, workspace and staff time, training technicians and community mapping trainers, and in raising the understanding of all staff members.

APPENDIX

Key questions asked in the research

Questionnaire

1. What do villagers expect that the NTFP can do for them?
2. Why do villagers want a map?
   - Why and how do villagers think that maps are important and useful?
   - What do they hope a map will do for them? How will a map do this?
3. Are men and women participating in mapping? How and who?
   - Did you participate in any way in the mapping activities that were conducted in your village?
   - Have you ever been to a meeting where your village map was explained?
4. How well are maps and mapping understood?
   - Can you understand your village map (can the person understand the map when given some place names on the map)?
   - Has anyone ever explained the map of your village to you?
   - Have you ever had any mapping training?
   - If so what do you remember from this training?
   - Do you think it is important that you understand your village map?
   - What language did the NTFP use when they mapped in the village and how well did you understand when Khmer was used and when the local language was used?
   - Do you think using local languages improves understanding of mapping concepts?
   - How many types of maps do you know?
   - Do villages understand GIS maps?
   - Do the villagers understand sketch maps?
   - What do men and women elders and young people think about GIS and sketch maps?
   - What is the easiest map to understand?
5. Does the map help the villagers? How?
   - How does mapping help to build the capacity of the community to protect their rights?
   - How does mapping help to maintain culture, gain land security, and resolve conflicts?
   - What do villagers think is the best kind of map to do this?
   - What examples are there where maps have assisted villagers?
6. What do NTFP staff members hope/think they can do for villagers?
   - What does the NTFP hope a map will do for villagers?
   - How are NTFP staff members using maps in the village, with government, etc?

7. How well do NTFP staff members understand maps and facilitate mapping?
    - Can NTFP staff members understand maps (can the person understand the map when you give them some place names)?
    - Has anyone ever explained or trained NTFP staff members in community mapping?
    - Has the mapping training helped NTFP staff members to build their capacity to facilitate mapping, use maps in the community to protect rights, and use maps in the community to resolve conflicts?
    - Do maps help you in your work?
    - Do you think it is important that you understand maps when working in the village? Why?
    - Who from the NTFP does the sketch mapping and who does the GIS mapping?
    - Are NTFP women staff members involved in mapping activities? How?
    - Who do NTFP staff members work with when they are mapping in the village?
    - What do NTFP staff members think is the best kind of map?
    - How do NTFP staff members think that maps help the villagers? Why?
    - How do NTFP staff members think mapping helps to build the capacity of the community to protect their rights?
    - Do NTFP staff members think that mapping helps to maintain culture, gain land security, resolve conflicts, etc?
    - What examples are there where maps have assisted villagers?
    - What do NTFP staff members think is the most effective and most easily understood kind of map? Why?

UNDERSTANDING AND USING COMMUNITY MAPS AMONG INDIGENOUS COMMUNITIES IN RATANAKIRI PROVINCE, CAMBODIA

By Klot Sarem, Jeremy Ironside, and Georgia Van Rooijen

This paper seeks to describe results of research to assess villager understanding and use of community maps in four villages where the Ratanakiri Provincial Government GIS and CBNRM project have been working. Villagers have difficulties reading map legends and understanding misspelled or misplaced names. Training is time consuming. Most villagers cannot read Khmer script; lessons were forgotten if not practiced; GPS receivers in English could not be understood. Maps and regulations can be used to control the activities of outsiders, but the project documented several cases where maps were not enough to control land alienation. The project also documented increased instances of conflicts between villages after mapping. Villagers feel there is tradeoff between community understanding of maps and the speed in which areas are mapped. Villagers felt that a 3D map would be easier to understand.

This paper describes the results of research carried out in 2004 to assess the effectiveness and villager understanding of community mapping activities carried out in four villages by the Ratanakiri Provincial Government GIS Unit and Community Based Natural Resource Management (CBNRM) project. The research was based on individual and group interviews with villagers and with members of the CBNRM core team, who facilitated the mapping and training activities in the villages. This has identified specific areas that could be improved in the mapping and training process.

Overview of Ratanakiri province

Ratanakiri Province is located in northeastern Cambodia. The province has historically been inhabited by eight groups of indigenous people whose livelihoods have been based on swidden agriculture and the collection of natural resources around their village. There are many problems facing traditional land management practices in Ratanakiri Province that will only worsen in the future. The national government has designated the area as part of a "triangular development zone" designed to link neighbouring areas of Vietnam and Laos for "ecotourism" development, commercial/export agriculture, and other uses. At present an international airport is being constructed, and the main road from the Vietnamese border to Strung Treng in Cambodia (on the Mekong River) will be closed off as a trade route between the two countries. These developments portend a large increase in access to an area that has traditionally been isolated from the rest of Cambodia and neighboring countries due to its difficult climate and terrain.

Because of these and other changes, people from other provinces in lowland parts of Cambodia are increasingly coming to Ratanakiri in search of land for cash cropping and other business opportunities. In addition, concessions for timber and plantation crops have been granted to national and international companies over large portions of the province. As a result of increasing competition for natural resources, indigenous people are being pushed

further and further away from areas of development and struggle to maintain their traditional methods of food production and livelihoods. These people face growing problems with forest and community land encroachment by outsiders, land and forest concessions, illegal logging and forest exploitation, and changes in their traditional rotational system of farming to more intensive input dependent agriculture.

Ratanakiri Province GIS Unit

Small scale land-use mapping activities began in Ratanakiri in 1996-97 as part of resource management projects initiated by the International Development Research Center (IDRC-Canada) and the Non-Timber Forest Product (NTFP) Project. In 1998 the Cambodian government's Seila Programme followed these projects by setting up a community-based natural resource management subproject within the Provincial Department of Environment.

In meetings in 1999, donors and government officials decided that mapping needed to be done more quickly in order to slow down the loss of traditional indigenous lands. This resulted in the establishment in 2000 of the GIS Unit dedicated to supporting communities in mapping and mapping related technical matters. The GIS Unit's role is to assist and support the CBNRM core team field staff to promote participatory land-use planning that responds to the needs of the community.

The GIS Unit works with the field team to help villagers draw a sketch map of the current land use of their village. The field team consists of members of the CBNRM core team. The villagers involved in the mapping activities are usually members of the NRM committee. This committee, which consists of both women and men, is elected by the village during land-use planning and regulation development activities.

This sketch map information is then digitized on an enlarged topographic map or aerial photograph to make a "scale sketch map." The GIS Unit then translates these maps into digital form using the land-use boundaries drawn by villagers in conjunction with aerial photographs, satellite images, and GPS points gathered in the field. The digitized land-use information is presented back to the village on a large map (120 cm by 86 cm), incorporating local place names, streams, administrative boundaries, and road information, to be corrected if necessary and approved by the villagers. There is also consultation with neighboring villages and relevant government departments regarding boundaries.

After villagers approve the map, it is included in a finished document along with rules and regulations for land use within the village area that have been created by the villages in a separate step of the process. This is then approved by provincial authorities and recognized as proof of community use and management of that area. However,

this document is not currently recognized at the national level. This interim form of land tenure and the villager capacity building exercises are intended to slow the rate of land alienation caused by competition for land and resources with outside interests.

The mapped village land-use boundaries become part of a provincial data set, which contains land-use information for communes (each containing an average of five villages) across the province. Mapping activities are targeted currently at areas of high land insecurity mainly along Highway 78, which runs through the center of the province to the Vietnamese border. The GIS Unit has completed mapping twenty-three (out of forty-nine) communes and is currently working in four additional communes. The original intention was to map the entire province in this way by 2005.

Some areas have been mapped using a "slow step mapping process" that can take up to three years to complete for one village and involves more consultation and mapping training with the villagers than the "quick step mapping process" that has been used more recently. This quick step process has now been abandoned, since its impact in preventing land alienation has been limited. Additionally, the government is now requiring the implementation of a standardized participatory land-use planning (PLUP) process. In the slow step process, villagers involved in mapping receive training in how to read topographic maps and aerial photographs and how to use GPS. The PLUP process is similar to the slow step process. All previously completed land-use maps will be reviewed under the new PLUP process.

GIS Unit staff members have conducted a series of training sessions to introduce villagers to mapping. These have included training in reading topographic maps, aerial photographs, sketch maps, and using GPS. Despite these training activities many villagers find it difficult to understand the maps of their areas. Particular problems have included villagers and elders not being able read map legends and place name information being misspelled or misplaced. To increase villager understanding, the GIS Unit experimented with various ways of presenting mapping information. Table 1 summarizes these activities and their results.

CASE STUDIES

The villages selected for this research, including background information and a description of mapping processes undertaken, are as follows:

Tuy Village, Ting Chak Commune, Bokeo District.
The CBNRM project utilized a "slow" land-use planning/mapping process in this village, taking three years to complete the mapping and documentation exercise. Provincial authorities have recognized the maps and regulations developed by the village with the help of the CBNRM project. The village is situated along the main road that runs through the province and has experienced and will likely continue to experience intense land pressures. Private landowners have purchased a significant amount of village land along the road on which they practice cash cropping (mainly cashew nuts and soy beans). This trend of cashew nut planting can be found across the province, but is most advanced along the main road.

A participatory mapping training exercise for representatives of several communes and villages conducted in Tuy Village in 2000 highlighted problems with the mapping process within the CBNRM and eventually led to the formation of the GIS Unit. A report about intimidation practices used in Tuy Village by private buyers and government officials also came out of this mapping training. This report was thumbprinted by all the villagers and sent to government authorities. A follow up government investigation found that the land had been purchased "legally."

Tong Kro Pou Village, Ou Chum Commune, Ou Chum District.
Tong Kro Pou, located approximately fifteen kilometers from Ban Lung, the provincial capital, is situated on a secondary road. In 1996, villagers successfully defended

Methods	Problems and issues encountered
Projecting aerial photographs onto the village meeting house walls at night	• Requires a lot of logistical work transporting generators, projector etc. to remote villages • Elders have difficulty seeing the projected aerial photographs
Printing large (120 cm by 86 cm) plots of aerial photographs	• Useful for mapping village land-use practices. Some villagers could immediately orient themselves and identify features of the landscape and their swidden fields • Aerial photographs (2001) are becoming outdated rapidly decreasing their effectiveness due to the rapidly changing landscape in Ratanakiri and as a result of the shifting nature of swidden agriculture • Easier for field staff to carry to the village
Printing large (120 cm by 86 cm) size topographic maps	• Found to be just as efficient in displaying geographic information to villagers as aerial photographs • Topographic maps can help communities see hills, slopes, and rivers • Communities cannot see their swidden fields due to the age of the maps (1967)
Formal training in topographic map reading	• Time consuming: not understood by some participants
Basic map reading taught to villagers during the mapping exercise with the facilitator "guiding" villagers through the map and reading it for them	• Most of the trainees have difficulty reading Khmer writing • Often lessons are forgotten if villagers do not get ongoing practice
Using community GPS users/mappers to train villagers how to use GPS	• Beneficial to have trainers who are able to speak the local language • GPS receivers with displays in English are difficult for communities to understand • Villagers do not get enough practice and review of the training they receive
Sketch mapping	• Villagers have difficulty remembering the colors and signs assigned to the different zones and features. • The map is not always oriented to the north (sometimes the north arrow is actually pointing to the west which makes it difficult to interpret) • Sometimes the names of nearby villages are not included

Table 1. List of activities carried out by the GIS Unit to introduce villagers to maps

their land against a private outside company wanting to plant soybeans. Today the village is experiencing internal land pressure due to several families recently moving into it and external pressure from neighboring villages seeking to use village land. This village provides a good example of the meeting of traditional and outside influences. Ou Chum Commune is also undergoing "slow" land-use planning/mapping, which has taken two years.

Samout Krom Village, Seda Commune, Lumphat District.
This village is located far from markets and other provincial towns. But a new road to nearby Lumkot Lake has created easy access for tourism and recreation. Seda Commune underwent a "quick" step CBNRM that took one year to complete. The commune boundary was delineated, and only some internal zoning was carried out.

La En Kren Village, Ou Chum Commune,
Ou Chum District.
This village was one of the first to complete the CBNRM "slow" process in 2000. It has since been a model for community land-use planning in Ratanakiri and was selected to be a pilot communal land titling site in 2003. La En Kren borders the main road (Highway 78) and in 1998-99 saw sixty ha of its land sold by a neighboring commune. When the villagers complained, they found that the new landowner had already planted kapok trees; the villagers felt they could not get the land back because of this. Reluctantly the villagers accepted compensation from the new owner. The 900 ha that remain of La En Kren Village is a remnant of a large village area that had been encroached on by the expansion of Ban Lung Town and the flooding of lowland areas for a hydroelectric scheme for Ban Lung Town.

METHODS

Village interviews took place between December 2003 and August 2004. A structured interview questionnaire was prepared as well as a list of topics for semi-structured interviews. To begin with, project staff members introduced the objectives of the research to commune council members and later to villagers in a village meeting.

Interviews were conducted with council members, individuals, and families. Questions were asked about sketch maps, topographic maps, aerial photographs, and GPS equipment. A group discussion was also conducted with CBNRM and GIS Unit staff members to look further into specific problems they have experienced including language barriers and differences between villager and field staff perceptions that could be preventing proper communication of mapping concepts. Table 2 summarizes the research process.

A workshop was also conducted after the completion of the interviews. At this workshop, the results of the mapping research conducted by the NTFP Project (See Prom and Ironside, NTFP Project Mapping Research Report) and the GIS Unit were reported to representatives of all villagers involved in the research, mapping facilitators, and other government staff. The objective of the meeting was to have a frank discussion of mapping activities in the province. Nearly half the province had now been mapped and covered by some sort of community land-use map. Since several changes had taken place it was a good time to reflect on mapping progress and on directions for the future. Most of the participants (mainly village leaders and NRM committee members) would have received at least two basic training sessions on mapping per year. Issues discussed at the workshop included:

- What has been achieved? Have expectations been met or not?
- How are maps being used?
- How well are maps understood in the villages?
- What problems/difficulties have been encountered in these mapping activities?
- How well are NGO and government staff facilitating mapping and training in the village?
- How well does the staff understand maps and mapping themselves?
- What suggestions for improvement do people have?

RESEARCH QUESTIONS

The underlying question we explored was how do hill tribe people in four villages in three different communes in Ratanakiri Province use and understand maps after the Ratanakiri GIS unit and the CBNRM Project have conducted training and completed mapping in their village?

Key Questions

1. Are maps important for local villagers?

a. What are the changes in land and natural resource use in your village?
b. How does the community protect their natural resources?
c. Who in the village is consulted about the traditional use boundary?
d. Why do villagers need a map?
e. Do villagers/CBNRM staff think that maps can help to preserve local traditions, culture, and religion? If so how?
f. What problems have been caused due to mapping activities in your village?

2. How well do villagers understand maps?

a. What do women, men, elders and young people understand about sketch and scale maps?
b. What do they remember about the map training?
c. In what ways do villagers think that mapping training has helped the community?
d. Who do they think owns the maps?

3. How can the GIS Unit better support villagers' mapping needs?

a. What further mapping and map training do villagers want and need?
b. Can community members use a GPS?
c. What does the community need to help them link with the GIS Unit or IO/NGOs to help them use and make maps?
d. How could the CBNRM project and the provincial GIS Unit better support villagers' mapping needs?

4. Are there any other forms of mapping that will better meet communities' needs and priorities?

RESULTS

Representatives in the workshop summarized the key uses of maps as:

- a tool and proof of management to assist in the prevention of illegal natural resource activities and to reduce the intrusion of companies and agricultural and forest concessions;
- an aid to managing the village area better through zoning land use;
- helping to defend village boundaries; and
- making it easier to present village lands to NGO/IOs and other visitors for community development.

While there are cases of villages using their maps and regulations to control the activities of outsiders, there are just as many cases of villages not being able to control land alienation despite having an approved map and regulations.

Some villagers said that maps can be used to communicate where illegal activities are taking place. One villager said that without a map, not much can be done about people coming and cutting trees or cutting an area for a swidden field in their village. They felt that using a map adds authority; as a participant said, "If there is no map people don't believe." In one case villagers had used their map to show police where to go to look for some buffalo thieves.

In some villages however, the map and regulations have been unable to protect the village land. This was the case with Galang Village where there is now a gem (zircon) mining town of around 1,000 people. The village chief said that Galang had lost some land, but he hoped with the regulations and the map that they could protect the remaining land.

In another case, Kamang Village, the map and regulations have also been of little use. This village is situated along

the main road to Vietnam. A fast growing market town (Bokeo) has grown up in the past few years right next to Kamang Village. This village has seen influxes of cash cropping farmers from lowland areas buying land. A large map of Kamang Village's land-use plan was posted on the main road, but has had little impact. Villagers have been unable to resist the intense land selling pressure. Some land remains in villagers' hands.

Survey results suggest that villagers felt that **it is important for maps to show the places villagers use for supporting their livelihoods. Community people in the village know the areas they use such as bamboo forests, swidden lands, streams, spirit forests, cemetery forests, protected forests, etc.**

From the interview results, villagers in general claimed that before the CBNRM project began in their village, natural resources were being destroyed. This included activities such as logging, wildlife hunting/trapping, land encroachment, and other illegal activities. The CBNRM project has mapped village lands and prepared rules and regulations controlling land use that have been recognized by provincial government departments and the governor. However part of the reason for the reduction in wildlife hunting has been a government program over the last few years to confiscate weapons from the general public, and a ban on "legal" logging activities for the past three to four years. The establishment of village level rules and regulations and land-use maps has perhaps reinforced these activities and has given villagers a sense that they have the right to control and maintain the natural resources around their villages. The combination of more control of illegal activities and officially recognized internal village control has led to villagers' perceptions that wildlife is now recovering, including wild pigs, wild chicken, civet, and deer and that logging is also reduced from the blitzes of late 1990s.

However, even with provincial recognition problems in villages have continued. With a decrease in the assault on forest resources, there is now an assault on land resources owned by indigenous communities. This is evident in Tuy Village where the community rules and regulations and map were used to prevent outsiders who had settled along the main road from clearing and planting within their village spirit forest. When they showed their map, the people clearing the forest did not believe them and continued clearing. The villagers took their case to the environment department of the CBNRM Project, and the people were forced to stop clearing. Alternative land in the commune was found for the new settlers. The villagers in Tuy also used the regulations and maps to stop new settlers, who were relatives of those who have already settled along the road. In another incident Tuy villagers found some people who were illegally cutting timber near the village boundary; they were able to fine them and confiscate the timber.

According to the assistant village chief and a female Ting Chak Commune councilor, who lives in Tuy, outsider settlers have resorted to buying land from villagers. Land is being sold cheaply. The commune councilor said that those that know how to bargain well are getting $300 for two to three hectares. Those that do not know how to bargain are selling for $50 per hectare. Around twenty village families are selling land. The village authorities are unable to stop this; this comes on top of serious intimidation and deceit being used in the past to "buy" land in Tuy Village. Some people are still not aware of the consequences of land selling even after other villagers had tried to explain the problem to them.

In Tong Kro Pou Village, four families from a nearby village came and used a piece of village land. They said they were only going to plant rice, but they planted cashew nut trees and did not go back to their own village land. They now want to sell this land to others. In another incident, the Ou Chum district governor wanted to clear an area close to a protected forest for a farm, but the villagers did not agree. The district governor then ruled that the community would also not be able to use this piece of land.

In Samout Krom Village, villagers have used the map to show the police where thieves had taken stolen cows and buffaloes. They said that before the map they could not stop illegal activities because they had no recognized right to prevent them and to manage their village land. In the past, they received no support from provincial government departments and authorities who often did not recognize their village user areas.

Participants in the workshop replied that in the past there were no boundary conflicts because there were fewer villagers and people from the outside. Because there are now more people from outside and a larger number of villagers, there are conflicts over land and natural resource use. Even with the CBNRM project making land-use maps and plans, delineating boundaries, and gaining recognition from the provincial government, there are still conflicts.

As part of the mapping process a boundary negotiation workshop is held with representatives from neighboring villages. Before the village representatives attend the boundary discussion workshop they have a meeting with village members to agree on their village boundary. After the provincial authorities recognize the rules and the map, the NRM committee and key people inform the people in the village about the map and the rules and regulations. Relatives outside of the village are also informed through informal networks.

However, conflicts with historical roots exist with some villages now situated on another village's land. Some of these conflicts are the result of disruptions to traditional territories during the long years of war of the Khmer Rouge era, when villages were moved onto lowland areas of other villages where they remain. In some cases, villagers want to claim their traditional lands back, sometimes so they can sell them. New land pressures by outsiders are also a source of conflict between villages. Mapping has brought out these conflicts. Often villages do not feel they can negotiate their boundary with a neighboring village, being afraid of opening up old conflicts. This has meant that villagers have relied on CBNRM staff to invite neighboring villages to attend the boundary negotiation workshop.

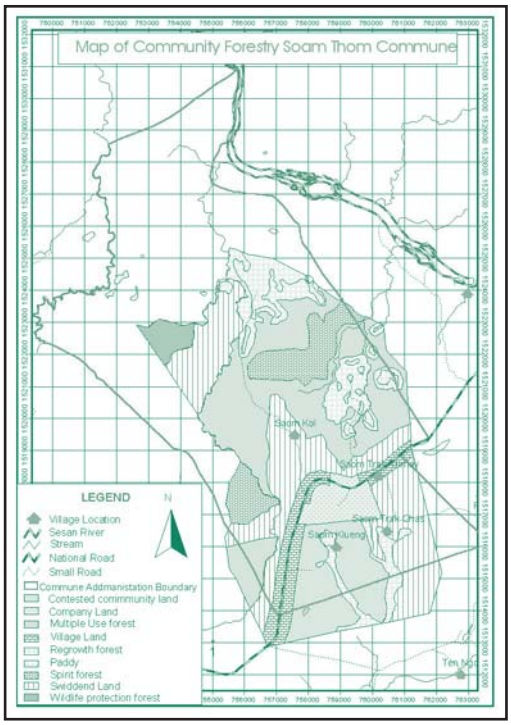
Such disputes in the boundary delineation workshop have generally required facilitation by district authorities and CBNRM/GIS staff to get agreement on the boundaries of current user areas. Conflicts have also arisen after an agreement has been reached, and a document explaining the agreed upon boundaries has been thumbprinted. The village that negotiated its boundaries has been hesitant to disseminate this information in neighboring villages, in fear of fanning inter- and intravillage conflicts. When representatives return to their villages and report the results to their communities, some villagers who did not attend the workshop often refuse to accept the results of the discussion.

Boundary problems have arisen after land-use planning activities in:

- La En Kren and Pa Chun Villages in AekKpeap Commune, Ou Chum District;
- PaTat, New and Samot Krom Villages in Seda Commune with Kaleng Village in Kaleng Commune; and
- SamotLer Village in Seda Commune with TaKokPnorng Village in BorKam Commune.

Some communes/villages whose boundaries have already been recognized by provincial authorities have changed their mind and do not accept the agreement. In one case, La En Kren Village conducted boundary negotiations with neighboring villages and completed their land-use plan well before the neighboring village of Pa Chun. When Pa Chun began their mapping activities, La En Kren indicated a desire to change the originally agreed upon boundary. This conflict has added significance because La En Kren had been selected as a pilot village for communal land titling. Given the small size of the village it is likely that all the land inside the La En Kren Village boundary will become the communal property of La En Kren Village, and the boundary will be permanent.

Pa Chun Village was also involved in a dispute with a neighboring commune that wished to establish a joint community forestry area with them on either side of a prominent hill. Pa Chun refused to agree to this joint area and then cut the forest on their side of the hill. There are several contributing factors behind the problems in Pa Chun. The commune chief has not been supportive of land-use planning activities, as he has been involved in land selling. Villagers were told not to participate in these activities, and this took some time to resolve. The problems have been compounded by distrust of the Christian organization facilitating the land-use planning. In any case, this confirms what some participants in the workshop have reported about villages that do not understand the process and that create conflicts.



Problems have also occurred with central level ministries who with donor support are increasingly extending their management reach. For instance, after the CBNRM project completed land-use planning activities in the villages of Seda Commune, the Ministry of Environment began management activities in a designated wildlife sanctuary in the area. Because of this the CBNRM project cannot facilitate discussion with nearby communes and villages about their common boundaries because much of the area "belongs" to the Ministry of Environment, and they are responsible for this work.

Some disputes have also been very difficult to resolve. For example, a disagreement occurred during the boundary discussion workshop between Paler Village in KeChung Commune and KaTe Village in MaLic Commune. During the workshop they could not agree on the village boundary. Because of this the CBNRM staff wrote a report and requested the governor or his officials to intervene and conduct the boundary discussion again. When the deputy provincial governor intervened again, there was still no result. The deputy provincial governor ordered the district governor to arrange a time to conduct the boundary discussion again, and the result was still the same. After this discussion the district governor and line departments had a discussion and agreed to use the administration boundary– which is invariably different from the existing use and the traditional boundaries. The KaTe Villagers were not happy with this decision.

Regarding participation in mapping and understanding of the maps, few community members understand maps, and not all members of the community participate in mapping activities. The NRM committee members are more conversant with them as they have received more training. One comment in the workshop was that several maps only show the big streams. Some participants felt that the small streams should be included in the map with their names. This they said would make it easier for people to find their bearing on the map.

Another participant in the workshop said that around 50 percent of villagers know how to look at maps, most of whom are young people. Problems mentioned included:

- problems of communication in training and mapping processes;
- people cannot read Khmer; and
- people do not yet understand the reasons for mapping and they are not sure of its usefulness.

The sketch maps drawn by the Natural Resource Management committees and key people are easily understood by the participants, but the community people

who have not attended the sketch mapping activities do not understand. People said that the maps appear distorted, the streams are not drawn as they actually are, things are in the wrong place, and the writing is not all oriented in the same way. Many people cannot read, and those that can read often cannot read the poor writing on the map. The writing is also often in the wrong place.

The scale map is easy for people who can read text because it has a legend. But most community people cannot read text, so they cannot understand. The topographic map is difficult to read because it has contour lines, which are confusing to look at. People trying to read them often mistake a mountain for a flat area and vice versa. Additionally the topographic maps are old (1967) so the village areas have changed since that time, and villagers have trouble orienting themselves in their own village area. They have trouble finding swidden areas, collection forests, spirit forests, protected forests, and other areas.

Participants in the workshop however felt that both sketch and scale maps are required. Having seen an example of a 3D map in the workshop, participants felt that 3D maps could be useful but no one in the meeting could say whether their village would agree to spend the time required to make one of these. A couple of participants said they would ask in their villages. NGO staff said that villagers had to clearly understand how these maps would be useful for them before agreeing to build one. Another suggestion to make maps easier to understand was to change the fill types of the land-use areas on the scale map. Currently land-use codes are colored/patterned polygons that are unrelated to land type. Villagers suggested that it would be easier to understand if the codes were more realistic. For example, a picture of trees where there is a forest, or bamboo where there is a bamboo forest. They also wanted large maps with large writing so that those with poor eyesight can still read the maps.

In general community people cannot use GPS because they have only received a short amount of training and have had no time to review. Thus, only some of the NRM committee members have had experience and training in using GPS. One request from the workshop was that people want to learn how to use GPS. Another comment from the La En Kren Village chief was that NGO and government staff members came to his village and told him that if they take some points with a GPS they can tell him how big the area is. He said he really wondered how this can be done. La En Kren was mapped using the slow step process, and over a period of three years, the village chief would have received approximately four training sessions on mapping including GPS use.

The feeling was that the training was satisfactory but too infrequent for villagers to remember and fully understand. Training sessions need to be more regular and perhaps incorporated into a program of village land and forest management. Community people also say it is difficult to read the topographic and scale maps and use the GPS receiver because the training course they had was a long time ago, and they have had no time to review these lessons. Participants in the workshop suggested that training sessions should be shorter and more frequent because the concepts are difficult to understand, and they also have limited time to attend training sessions. The facilitators sometimes try to use village translators to explain the ideas in the local language. Also the GPS equipment is in English and the capacity of CBNRM staff is limited, because they receive only two short training courses per year. It is not possible for them to remember and to be able to train the NRM committees. There is also a high turnover of CBNRM staff, so as a result only some of the NRM committees and a few community people can read maps and use a GPS.

Regarding the question of who should be involved in mapping activities, participants in the workshop answered that elders, NRM committee members, younger members of the village, and all communities in the village should take part. Comments were that generally both women and men participated in the mapping activities. In some cases

villagers had been divided into female and male groups to encourage women to give their ideas.

Often the map is kept at either the village chief's or at one of the NRM committee members' homes. There was a problem when the map was kept at the commune chief's house, and villagers could not go and get it if they needed it. In another case the village did not receive the map at all. The government staff responsible said they thought they had already distributed it. Sometimes the village only received a copy of the scale map and not the sketch map, when it would be useful for them to have a copy of both. Participants in both the workshop and the interviews suggested that the map should be displayed somewhere accessible for all villagers such as the meeting house. However, some meeting houses are not suitable due to roof leaks or inadequate security.

DISCUSSION AND RECOMMENDATIONS

All participants in this research responded that both sketch maps and scale maps are important since they serve different purposes and are both required for understanding. However, the maps are not solving all of their problems. Land is still being sold, encroachment and logging are still occurring and national level priorities can override the maps and plans. Some of these issues will hopefully be solved with the new standardized process, since this will mean that the maps will be recognized at the national level.

There appears to be a trade off between community understanding of maps and the speed in which areas are mapped. The region needs mapping to occur urgently and quickly to ensure land security benefits for all villages; however it is also important for communities to understand the maps so they can use them and explain their boundaries to outsiders. A balance needs to be found so that there is maximum benefit for all stakeholders.

From the research it is clear that amongst the villagers there is limited understanding of maps and mapping processes. Even those who have received training forget what they have learned, as there is no review of the training. This is not surprising as maps contain complex concepts that are difficult to grasp. Those involved in the sketch mapping process tend to understand the sketch map better than the scale map. Those with more education and those who can read find the scale map easier to read as they can understand the legend and labels on the map.

One option is to raise the level of education and understanding of maps in the community. The capacity of the trainers could be built upon, the frequency of training sessions could be increased, and map reading and GIS could be introduced into the school curriculum. This is a long-term solution and also difficult given the expertise, money, and time required. One solution could be to develop more community level mapping trainers and local experts. Villagers should be used to train other villagers. Community mapping trainers were tried but government bureaucracy did not allow it in the CBNRM project, and it was stopped.

One of the problems with map understanding is that literacy levels amongst villagers are extremely low. The national literacy average for Cambodia is 62.8 percent, and for Ratanakiri it is 23.5 percent (National Census 1998). Maps generally require some text for labels and in the legend.

Map concepts are also complex and abstract. Villagers know their land extremely well, but they are not used to viewing this information in scale map form. To local people, place names are very important and one suggestion from participants was to include all the small streams as the scale maps only show the large ones. This would make it easier for the villagers to orient themselves. Mountains are not shown on the final maps because adding contours makes the map appear crowded and difficult to read; however they are also important for orientation on the map. Experience has shown that people from poor, isolated areas with low levels of education understand

concrete sensorial experiences much more easily than abstract concepts.

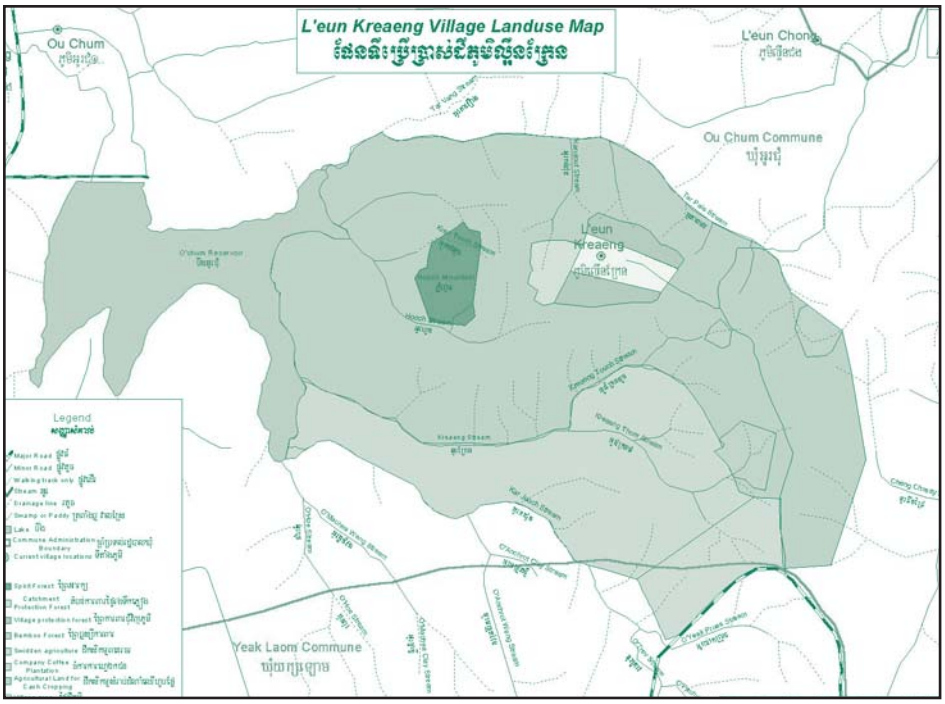
Another problem in the understanding of maps lies in a gap in the participation of villagers in the mapping process. When the mapping team takes away the digitized sketch map and turns it into a scale map using GIS, there is no village participation. This was not perceived by any of the participants as a problem. However, it may be that they did not think involvement in this process was a possibility. GIS would be too complex for them to use or understand, especially since it is in English. In other countries in this region (Philippines, Thailand, Vietnam, Indonesia) 3D mapping has proven to be an extremely useful tool for both participation and understanding in village areas (Rambaldi and Callosa-Tarr 2003). Complex mapping concepts are more understandable, and mapping is made a more tactile participatory experience. 3D maps and the information produced can then be used in conjunction with GIS. The problems with 3D maps are that they cannot be moved easily and that they require secure storage.

The participants in the workshop agreed that a 3D map would be easier for them to comprehend. "Participatory 3-Dimensional Modelling (P3DM) has been conceived as a method for ... bridging the gap existing between geographic information technologies and capacities found among marginalized, isolated and frequently natural resource-dependent communities" (Rambaldi and Callosa-Tarr 2003). There is an opportunity for Cambodia to learn from other countries' experiences and 3D mapping will be tried in one to two pilot land titling villages in 2005.

In most villages the map is located in the house of the village chief or NRM committee member. However there have been some access problems identified in this and research participants all suggested that it should be in an easily accessible and visible place such as a meeting hall. They should have a copy of the sketch map, rules and regulations, and a large scale map covered in plastic in a prominent position such as the commune resource center or community information notice board.

One of the problems of these CBNRM planning activities has been that they are not yet recognized at the national level, and therefore decisions made at the national level override provincially approved land-use plans. Companies have been awarded land concessions near the Vietnamese border, for example, and gem mining concessions from the central level, over areas that had already been mapped and management handed over to communities. A part of a gem mining concession that had already been mapped as a community forest area did get cut out of the concession after the provincial authorities used a map to argue that the area had already been designated a community forest. Other areas that were not already mapped remained part of the concession however. The Ratanakiri provincial government made the decision to begin community NRM planning before policies and processes had been developed at the national level. To comply with national standards, existing maps and plans will now have to be reviewed.

With the development of national standards and other developments at the national level there have been



considerable changes in the GIS Unit and it is not clear how this will play out in the coming years. The first major change has been the moving of the unit from the management of the Provincial Department of Environment (within the Provincial Rural Development Committee offices) to the Provincial Department of Land Management Urban Planning and Construction and Cadastre (DLMUPCC). This is because of the adoption of a standardized participatory land-use planning (PLUP) process as a national strategy to be implemented under the management of the Ministry of Land Management.

Up until now, the GIS unit has mapped what the village tells them about their traditional use areas. Changes resulting from the standardized PLUP process will see more input from line departments and could also see a change in focus with implications for land titling. This process is much more focused on delineation of land ownership and management authority, especially of state land, which is largely unmapped and unmanaged in Cambodia at present. PLUP activities are currently focusing on four communes, and this activity is a considerably slower process than the rapid delineation of community management boundaries and zones that the GIS Unit has been focused on previously (quick step process). Both PLUP itself and the delineation of state land have political implications for community management and indigenous communities, and it is not clear how these political aspects will affect the mapping process especially with regard to access by communities to mapping facilities, data, and mapping facilitation services.

The other major change has been the decision of the Ministry of Land Management Urban Planning and Construction and Cadastre (MLMUPC) to begin implementing the provisions in the 2001 Land Law that allow for indigenous communities to apply for a communal land title of their residential and agricultural lands (including fallow areas). To begin with, the ministry has agreed to begin this process in three pilot villages–two in Ratanakiri Province and one in Mondol Kiri Province. This communal land titling work is also being managed by the DLMUPCC, under a Seila/UNDP land and conflict resolution (LCRT) project with technical assistance with land surveying and so forth from the ministry and from an expatriate GIS technician within the GIS Unit. This work will also have implications for the future direction of the GIS Unit. What seems clear however is that the mapping work will become more detailed and technical, and more dictated by the priorities of the DLMUPCC and national standards. This also means that coverage of villages will be slower with implications for tenure security for many villages and communes not yet mapped in an environment of rapid change and land alienation.

CONCLUSION

Based on mapping research conducted in Tuy, Tong Kro Pou, Samout Krom, and La En Kren villages, maps are very important for communities in order to present their traditional user areas and village/commune lands to authorities and IO/NGOs for any activities pertaining to these lands. Maps also make it easier to control illegal activities. However, most of the community people cannot read the scale GIS maps that are kept at their villages. There is a range of understanding of maps due to literacy levels, education, and villager participation in the mapping process, but even those who are involved soon forget since there are no reviews of the training. The location of the finished map is also an issue since it is currently stored in the house of the village chief or NRM committee member where it is not accessible to all villagers.

Map understanding requires the grasping of complex concepts and therefore requires substantial training. However, ways of making it easier for villagers should be explored including using more realistic colors and codes on the map and also investigating 3D mapping. We should learn from countries in the region that have had similar issues and experience with 3D mapping to decide on the best option for the villages in Ratanakiri.

Interview results suggest that before the CBNRM project began, natural resources were being destroyed due to logging, hunting, catching wildlife, encroachment, and other illegal activities. The CBNRM project mapped village lands and prepared rules and regulations controlling land use that have been recognized by various government departments and the provincial governor. These actions have provided villagers with a sense that they have the right to control and maintain the natural resources around their villages and at the same time made it possible for the government to begin enforcing forest and land laws. This has reduced the amount of illegal activities occurring on village lands and increased the availability of renewable resources. Villages, however, are still experiencing problems with illegal land sales and the granting of land and forest concessions.

On behalf of indigenous communities that rely on natural resources, we would like to suggest that all levels of authority and IO and NGOs should obey the village maps and rules and regulations that have been recognized by the governor and/or other authorities to more fully empower the villagers to protect their rights and natural resources.

REFERENCES

Rambaldi, G. and Callosa-Tarr, J. July 2002, 'Participatory 3D Modeling: Guiding Principles and Applications', ASEAN Regional Centre for Biodiversity Conservation.

Prom, M. and Ironside, J. Nov 2004, 'NTFP Project Mapping Research Report: What are the most effective kinds of maps for villagers and NTFP Project for planning sustainable land use and livelihoods?", NTFP Project, Ban Lung, Ratanakiri Province, Cambodia.

EMPOWERING COMMUNITIES THROUGH MAPPING:

EVALUATION OF PARTICIPATORY MAPPING IN TWO HANI VILLAGES, YUNNAN PROVINCE, P. R. CHINA[1]

By Zheng Baohua

This paper seeks to evaluate the products of a mobile-interactive GIS (MIGIS) activity conducted in 1999 to determine whether the activity had any long-term impact on the community. The paper suggests that participation in the mapping process helped villagers to read and interpret simple maps and charts. With some assistance from the evaluation team members, they could even interpret more complicated maps and charts. Sketch mapping was an effective tool for communities to collectively analyze their own situations. MIGIS mapping activity provided a catalyst in raising villagers' awareness of environmental degradation caused by deforestation. It might also have catalyzed villagers' actions to build their infrastructure. The maps also helped local communities to communicate with government bureaus.

Many development workers in China, especially in the southwest provinces of Yunnan, Guizhou, and Sichuan, have adopted participatory rural appraisal (PRA) and rapid rural appraisal (RRA) tools for soliciting community participation in action research. However, many government officials and some scholars view the products of PRA and RRA exercises as rough and unscientific. Meanwhile community participation practitioners are beginning to realize that the design and implementation of PRA and RRA exercises need to be tailored to the particularities of local situations. These developments are pushing development workers to look for new ways to utilize PRA and RRA methods and tools.

In 1999, a joint group of scientists and development specialists, with financial support from the New Zealand Foreign Affairs and Trade Ministry, conducted an action research project in Shang Shapu and Xia Shangpu Hamlets, Luchun County, Yunnan Province.[2] The participants collected data and information by using different PRA and RRA tools and methods, including mapping. The data they collected were later transcribed into a geographic information system (GIS). The participants later returned their results back to the villagers for sharing and correction. After at least two rounds of this process they finalized the maps and charts. They named this activity "mobile interactive geographical information system" (MIGIS).

Five years later a group from the Center for Community Development (CDC) revisited these communities to assess whether this GIS-oriented participatory mapping process had any long-term impact on these communities. The evaluation group conducted two field trips to these villages in 2003 and discussed its findings with other CDC staff members who provided many good suggestions and recommendations.[3] This paper seeks to evaluate the mapping processes undertaken by the MIGIS group and to assess whether MIGIS had any notable impacts on these communities. We sought to learn whether participatory mapping affected natural resource management by asking questions about the local community's perceptions of the mapping process and results and about how mapping affected natural resource management.

BACKGROUND

According to the MIGIS proposal, the overall goal of this initiative was to place PRA results within a spatial context by entering them into a GIS. This would serve the duel purpose of allowing development workers and other interested groups to access research findings more easily, as well as to place PRA results within a spatial context. MIGIS also expected that linking PRA and GIS might assist grassroots communities, local government officials, and development workers to develop more efficient communication, to build a common understanding of local situations, and to improve their working efficiency.

The specific objectives of the MIGIS initiative were to facilitate villagers, who generally had little or no formal school education to understand their living conditions better; analyze the opportunities and threats related to their living conditions; evaluate and analyze the priority of potential development areas; and formulate feasible development action plans.

The MIGIS group stayed in villages for more than four weeks. They conducted many exercises with villagers by using PRA methods and tools such as community mapping, community resource mapping, transect mapping, historic mapping, seasonal calendars, big events, and venn diagrams. During this processes they facilitated villagers to record most of this information on big sheets of paper.

In order to interpret the information collected from the PRA exercise fully and to make these data more visual, they scanned the information sheets into a computer and then transcribed them into GIS maps. The MIGIS group then engaged in a participatory mapping process showing the maps to villagers and making many rounds of consultation and changes based upon villagers' recommendations and suggestions.

Using both the PRA and GIS toolboxes made it easier for the MIGIS group to discuss different topics with villagers; these topics included for example, grain crop production and food security, land-use patterns and historic changes, human resources and labor divisions, farming and non-farming activities, seasonal constraints, development opportunities and difficulties, and social relationships among villagers and between villages. The MIGIS group also helped villagers to formulate ten action plans (five for each village).

The MIGIS group concluded from this action research that it was necessary and feasible to undertake community development work in Shang Shapu and Xia Shapu Villages. The group thought the villagers possessed abundant and practical indigenous knowledge of farming and forestry even though they were poor in terms of material assets and had not received much formal school education. The MIGIS group expected villagers would receive financial help, information, and technical support from outsiders, especially the local government. Villagers, however, recognized how

difficult it might be to acquire this support and wished to receive more support in the form of technology, applied tools, and equipment. Villagers were willing to contribute labor and other resources, providing great potential for development work.

Village profiles

The target of this initiative was two Hani minority villages.[4] The Hani are one of many unique tribes in southern Yunnan Province located in areas bordering Laos and Myanmar. The total Hani population is more than 1.5 million distributed mainly over the mountain areas between the Yuanjiang (Red) and the Lancang (Mekong) rivers.

According to historical records, the Hani used to be a nomadic tribe living in the Qinghai (Tibet) Plateau. Later one branch moved south, and by the early third century BC, they inhabited the Ailao and Wuliang Mountains. The Hani minority comprises over twenty subgroups. With the founding of the People's Republic of China in 1949, the official name of the group was designated to be the "Hani Nationality."

Generally speaking, Hani people engage in agriculture. Situated in the subtropical climate zone, the area inhabited by the Hani is blessed with a mild climate, abundant rainfall, and fertile soil, providing ideal conditions for agriculture. Their main crops include rice, corn, and peanuts. The Hani are also good at planting tea–the tea they grow accounts for one-third of the total tea produced in Yunnan Province.

The area where the Hani people live also abounds in natural resources, including animals and herbal medicinal plants. Growing on the rolling Ailao mountains are pine, cypress, palm, tung oil, and camphor trees. The area also provides a, habitat for many wild animals, including tigers, leopards, bears, monkeys, peacocks, parrots, and pheasants.[5]

Shang Shapu and Xia Shapu are located in Luchun County, Honghe Prefecture, Yunnan Province. In 2003 there were 37 households with 191 persons in Shang Shapu hamlet. Most of the adults had not received formal school education. For school-age children, two-fifths (14 of 35) cannot attend school for reasons that include poor family economic situations, long distances to the school, and language constraints. Villagers in Shang Shapu are quite different from other Hani people. They have very limited arable land, about 0.25 mu of paddy rice fields, 1 mu of dry land and 2 mu of tea gardens per capita.[6] About one-third of the households do not have enough food grain from their own production, another two-thirds have only a seven to eight month supply, while only one or two households have a ten to twelve month supply. Usually they must buy food from markets or borrow food from relatives and friends. The major reasons most households cannot grow enough food grain have to do with different natural disasters such as floods, winds, heavy rain, and insects, as well as lower agricultural inputs, especially due to hybrid seeds and chemical fertilizers. Most households' cash income depends on tea, palm, and lemon grass plantations (especially before 1998), as well as animal husbandry.

Xia Shapu Village consisted of 33 households with 168 persons in 2003. Most of the adults have not received formal school education, and almost half of the school age children cannot attend school (17 out of 38). They have almost the same livelihood coping strategies and cash income sources as Shang Sahpu Village. However their food grain situation is much better than that in Shang Shapu Village. Two-thirds of households have about ten months of grain supply from their own production, one-fifth of the households produce enough food by themselves, while only four or five households lack food grain more than three months each year. The major reason for this is that their farmland is located in a lower valley, resulting in much better irrigation and soil fertility conditions than in Shang Shapu Village.

Prior to 2001, there was a nearby school that served both villages, so that children had easy access to school and families did not need to pay for boarding costs. A national policy focusing on improving education quality consolidated

many schools, resulting in the closure of the school serving these two villages. Children must now go to another school that requires a walk of one to two hours each way. There was a road connecting these two villages to the main road running to Luchun County Seat before 1998, but it was cut off because of floods. They have tried two times to construct new roads, but all were destroyed again. There has thus been no connection to the main road from the villages. Villagers must carry their own products to and from the market by themselves or with animal power. It takes about one hour to climb down to Shang Shapu Village, and two hours to climb down to Xia Shapu Village; however it takes twice as long when climbing up since the paths are very steep and curved. Villagers also need more time when they carry something.

EVALUATION METHODOLOGY

The evaluation group conducted two field studies during September 2003 (six days) and November 2003 (eight days). The first field trip focused on evaluating the mapping processes taken by the MIGIS group. We organized two group meetings and interviewed about ten key informants from each village. The second field trip evaluated the impacts of the MIGIS initiative. We organized three group meetings and interviewed the same villagers we interviewed during the first trip. The evaluation employed different methods, in particular semi-structured group meetings and key informants' interviewing.

Secondary data gathering and analysis

The evaluation group visited different organizations based in Kunming that have used PRA for indicator formulation and data collection for many SIT mapping activities. These included the Center for Biodiversity and Indigenous Knowledge (CBIK), the Yunnan Institute of Geography, Southwest Forestry College, the ICRAF Kunming Office, and the Great Nature Conservancy (TNC). We collected information on major activities regarding SIT mapping for each organization and discussed procedures taken by each working group, gaining much from the discussions. We also consulted with these organizations about our evaluation. We also gathered many relevant documents and papers from these organizations.

The evaluation group spent almost two days learning from the MIGIS that group members, especially Dr. Cai Kui and Dr. Ma Huangcheng. We discussed the objectives and methodologies as well as the major findings for and from this initiative. We also collected their maps and listened to their interesting stories from the mapping period.

The evaluation group then spent almost one week reviewing these documents and papers. This was a learning process for the evaluation group helped us in several ways: (1) let us understand better both the advantages and disadvantages of linking PRA with conventional GIS technology and involving local communities in the mapping processes actively; (2) helped us prepare more appropriate and relevant questions for the field studies; and (3) allowed us to enlarge some of the maps made by the MIGIS group which were very helpful in discussing and sharing information with villagers.

Map reading and information verification

The evaluation group enlarged twenty-two maps and charts that were made by the MIGIS group in 1999, including community maps, resource maps, venn diagrams, a land-use map for 1990, a land-use map for 1999, a historic transect map, food grain shortage charts, and seasonal calendar charts for farming, animal husbandry, and household economic security.

The group showed these maps and charts either at the beginning or during the process of group meetings or individual interviews and asked villagers to provide what information they could, for instance, the location of their own homestead or where the well is located. The results indicate that, for the simple maps and charts such as community maps and food grain shortage charts, villagers who participated in the mapping process could very easily read and interpret the major information on the maps. Villagers who did not participate in the mapping process might also be able to read and interpret the maps with help

from other villagers and/or evaluation group members. However for more complicated maps and charts such as land-use maps and seasonal calendar charts, the villagers who participated in the mapping process could only interpret them with some explanation from the evaluation group members. Villagers who did not participate in the mapping process had difficulty even after detailed explanation from evaluation group members.

The evaluation group paid more attention to selected maps and charts such as community maps and seasonal calendar charts for farming and household economic security. We felt that the villagers may be more concerned with these maps and charts because they were more relevant to their daily lives.

During the evaluation period some households also showed us the report prepared by the MIGIS group that contained all colored maps. When asked who had the report, they answered that every household did. Some households had read the report and could tell us about the major contents and stories behind the maps; some households told us they just looked at maps there since they could not read the text. Some households had put the report in very safe places such as in a cabinet or under a pillow. In some cases the report was new and seemed to have never been looked at it. Most households had no clear answer to the question of who might change the map. Some people thought only the MIGIS group could change them, and some others said they did not know.

The map reading sessions were helpful in several ways: (1) Introducing the maps allowed us to learn from the villagers very easily. When we showed them the maps and charts many villagers looked very happy and excited, and some villagers even told us "this is what we made, it is our product." They felt comfortable with sharing the information they had learned. (2) The maps served as a very good entry point to learn about the changes in the villages and people's lives there. Villagers could easily recall what happened after 1999 in the villages. For instance, an old man from Xia Shapu, more than sixty years old and who had not attended school at all, told us clearly from the community map which households moved to places near the main road from the village. (3) The map reading also allowed us to ask more appropriate questions during the group meetings and individual interviews.

Participatory evaluation methods and tools

During the field studies, we exercised several participatory evaluation methods and tools. The basic approach we employed for this evaluation included the following:

Semi-Structured interview. We used semi-structured interviews for both group meetings and individual interviews. We held two group meetings for each village. One was for those villagers who participated in the MIGIS mapping process. The key issues explored were how they were selected, what they did during the process, what they learned from the mapping exercise, and what happened after the mapping and who had benefited. The second meeting was for those villagers who did not participate in the MIGIS mapping process. The key issues here were why they did not participate, what they heard about the MIGIS initiative, and what their opinions were about it.

We conducted individual interviews with village heads, the women's association head from Shang Shapu, the village property keeper, village supervisors, older Communist Party

members, the Beima, and villagers' representatives who participated in the MIGIS mapping process.[7] The questions for individual interviews focused on personal perceptions of the impacts of the MIGIS activities for both the village as a whole and individual families. During the semi-structured interviewing process, we always kept in mind "the six helpers"–what, who, when, where, how and how much–in probing for answers. For example, one woman from Xia Shapu mentioned that "they cannot make a living if they do not work, however this is also true if they do work very hard." We probed further and learned that the constraints are related to natural conditions such as bad weather and poor soil.

Narrative. We also employed narrative tools to collect some interesting stories that occurred during and after the MIGIS mapping activities. In one example, the women's association head from Shang Shapu told us why she drew adult men, boys, plowing buffalos, and chickens on the resource map–it is because as a woman, these things were most important in her life. From the narratives we found out the villagers' levels of interest in taking part in the mapping and their participation levels. We also learned how the MIGIS group lived with the villagers and how they tried different PRA methods and tools to motivate villagers' participation.

Participatory mapping. During the map reading, group meeting, and individual interview processes, we also asked participants to either draw new maps or add updated information to the copies of maps made by the MIGIS group. During this process we observed that villagers who participated in the MIGIS mapping were active. However those who did not participate in the MIGIS mapping worried about making mistakes, so that they always said "I cannot draw, you please draw what I tell" or "please let them (people surrounding him or her) do it." Through participatory mapping we got clearer information on the changes that occurred after the MIGIS initiative–for instance, the location of newly constructed public toilets and the drinking water scheme. We also further experienced how skillfully local people can draw the maps.

Community participation problem trees. We used community participation problem trees to help us understand some critical issues posed by the villagers, like for instance, why the survival rate for Chinese fir was very low (see diagram on page 64), or why village roads always were collapsed by floods.

FINDINGS AND ANALYSIS

Major natural resources management activities taken after mapping

Many things happened in these two villages after 1999. We compiled the major events during the second field trip (see Appendix). Here I list the major ones that are relevant to natural resources management.

Road construction. We learned from villagers that the first road for both villages was constructed in 1991. Most of the road passed through areas belonging to Xia Shapu Village. The road slope was not too steep and the road bed was hard so it was maintained until 1998. However it was destroyed by a big flood resulting from a long-term heavy rain in 1998. During the MIGIS mapping period, an Australian expert, Dr. Mark did a detailed survey and comprehensive computer analysis and shared this information with villagers. He felt that the old road could not be repaired and that it would collapse if it were. The MIGIS group thus suggested that a new one be constructed.

At the end of 1999, villagers from Xia Shapu Village visited Shang Shapu Village four or five times and discussed the suggestion made by the MIGIS group. However, after they held several villagers' meetings, most villagers from Shang Shapu did not agree to construct a new road because they thought it would occupy more dry land and tea garden land belonging to Shang Shapu Village, and because many villagers also thought that the road construction would make the hill unstable. This hill was dominated by a tea garden that comprised one-fifteenth of the territory of Shang Shapu Village. Given this situation Xia Shapu Village held meetings

for several days continuously, and finally most villagers agreed to construct a new road by themselves. They also decided that villagers from Shang Shapu Village could not access the new road after it was built. The road was about four kilometers from the main road to Xia Shapu Village and took more than two months to build. Unfortunately the road was cut off again in some sections because of several days' heavy rain only one month after it was opened. Ultimately, neither Shang Shapu nor Xia Shapu Villages ended up using it.

In September 2002, the township government organized the two villages to construct a third road. It was developed in November 2002. However, it was destroyed again in June 2003.

Villagers from both villages felt very sad when we discussed the road issue. They complained that it was not acceptable without a road because they must truck in materials to build a house; they also preferred decreasing the labor burden to improve living conditions. However, most people who took part in the meeting agreed that a new road could not be constructed since it already occupied many areas and had brought so many soil erosions and hill collapses. They agreed to repair the first road with higher quality construction material.

The above discussion invites the question of how local governments may provide concrete support to local communities based upon this kind of study. It seems to us that the villagers themselves cannot deal with some technical issues, such as for instance, the design of the road. They really need help from others, including NGOs. Another question the above discussion raises is how action research can really help local communities accomplish something. Do we leave local communities with only suggestions or with some practical and detailed design? It could make problems worse if we just told them what they should do rather than offered detailed guidance on how to do it; otherwise we may create new problems and conflicts for the community.

Tree plantation. Villagers told us that they planted trees before 1999. However these were "tasks" allocated by the township government. They also mentioned that there were big changes after the MIGIS mapping activities. In the past, there were only six or seven households that planted trees on their contracting hills, under individual titles.[8] We were told about 80 percent of the forest was owned and managed by collectives, and only 20 percent was allocated to individual households as contracting hills. However, after the MIGIS mapping activities, two villages decided to close the hills for forest generation and to plant trees on bare places.

There were two major reasons for this according to villagers who participated in the group meetings. The first was that some households earned an economic return from their private forest land[9]; the second was that they recognized the problems of environment degradation from the MIGIS mapping process.

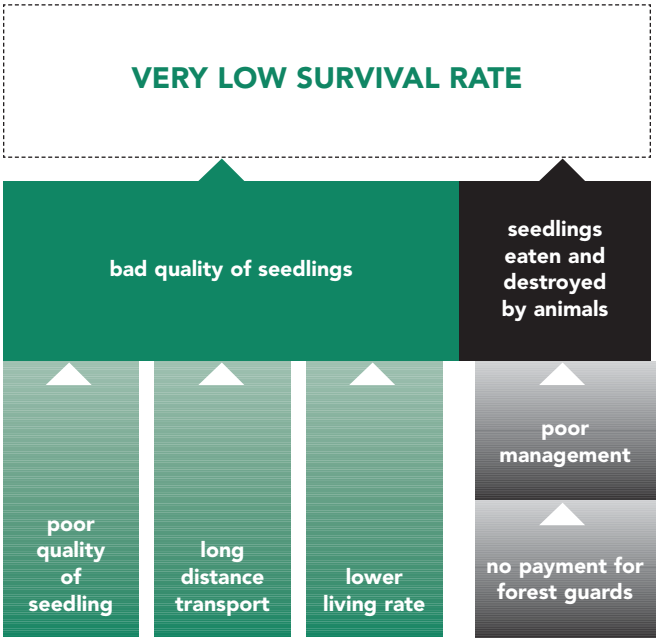
Villagers said that during the mapping process a group of people compared the different situations in 1990 and 1999. They finally agreed that about half of the forests disappeared in the ten years. They mentioned that the MIGIS group expert show them the land-use patterns for both 1990 and 1999 on a computer and said that more than 60 percent rather than 50 percent of the forests disappeared in the ten years. The MIGIS group also discussed with them what would happen if the forests could not be protected effectively. Some villagers thought that they would have more soil erosion. The village headman from Shang Shapu said that "because of the MIGIS mapping activities, we may now see that many trees were destroyed and disappeared on the collective forestry land. We did not know how serious the situation we were facing was. We know now we should plant more trees after we saw so many maps during and after the mapping activities."

Villagers told us that both villages had several meetings to discuss the environment issue and decided to close hills for forest generation and to plant trees, as well to revise and implement villagers' regulations and rules. This means mapping gave them very strong reasons to decide to stop

tree cutting and animal grazing in the forests.

The two villages' headmen told us that in October 1999, these two villages asked the county forestry bureau to provide them with seedlings. However the county forestry bureau told them that they could not do it in 1999 since the tree plantation season was over, but they agreed to provide them with seedlings in year 2000. In June 2000, Shang Shapu Village received 5,000 seedlings of Chinese fir from the county forestry bureau. The village cadres organized to plant trees on the collective forest land. The reason they planted trees on collective forest land together was that the seedlings could be planted on individual households' private forest land only if they allocated seedlings to each household.

We then probed the current situation for the seedlings planted. Villagers told us that the survival rate was around 50 percent, which was very low compared with the provincial standard which is over 85 percent. The villagers cited the major reasons as (1) the poor quality of seedlings and (2) that seedlings were eaten and destroyed by animals. See the following diagram the villagers analyzed for us:
We may understand from the tree plantation in Shang Shapu that the MIGIS mapping activity catalyzed villagers' awareness of environmental degradation caused mainly by



deforestation. They realized the importance of forest protection and tree plantations and also started to put them into action. Moreover, this was a collective decision making process through villagers' meetings so that we may say that the mapping process was empowering local communities.

However, from a long-term perspective, most villagers also thought that management was a key issue. The core of the issue was the management mechanism. Some villagers noted that the village had different professional administrators from long before such as forest guards, irrigation water source takers, and even an animal herder. They made no cash payments, and only the beneficiaries shared some grains with the administrators. It is difficult to ask households to pay them in cash, since most households are very poor. The government also cannot make payments for the villagers.

Formulation and implementation of villagers' regulations and rules. A long time ago, there were no regulations and rules on paper in these two villages and only some customary oral agreement among villagers. In 1991, the villagers' committee sent people to these two villages and helped them formulate some rules on paper. However they were not implemented very seriously since the regulations and rules came from village cadres rather than the majority in the villages, who saw little need for these kinds of rules. In Shang Shapu Village, we asked all the eleven villagers who participated in one group meeting if there were villagers' regulations and rules, and only the two village cadres said there were. They also said that the papers had disappeared. The other nine ordinary villagers had no idea of the rules. We then asked these two village cadres details about the regulations. They could only cite the following two: households must pay all the cost if their animals ate or destroyed any other household's crops, in addition to paying a fine of 20 RMB Yuan per head of animal per incident; villagers would also be punished 300 RMB Yuan per incident if they stole any other household's animal.[10] In Xia Shapu the village headman told us that it was difficult to organize villagers' meetings and wondered how we might

formulate these kinds of rules before the mapping activity.

However, after the MIGIS mapping activities these two villages had several discussions in 2000 regarding villagers' regulations and rules. At present, they have developed some rules for administrating village affairs as well as for managing natural resources. These include, for instance, that: (1) households can not cut down trees and then plant crops, including lemon grass; (2) each village will hire one forest guard to take care of all forests, including collective forests and individual households' forest. Each household will pay 2 RMB Yuan per year to subsidize the forest guards; (3) villagers stealing trees will be fined in cash[11]; (4) owners of domestic animals loose in the young forests and closed hills will be fined 5 RMB Yuan per head per incident; and (5) tree harvests must be approved by village cadres, and three trees must be planted for every one tree cut down.

A key issue is how to enforce these kinds of regulations and rules. Animals, especially cattle, still contribute a great deal to households' cash income and engage in labor such as plowing fields, carrying products, and so forth. In many cases households must graze animals in forests. It is thus necessary to find a compromise in dealing with this issue.

A question we asked the villagers was why they needed villagers' regulations and rules after the MIGIS activities. One young man about twenty-five years old told us that it meant it was necessary for them to have villagers' regulations and rules, but no one was willing to take the responsibility for organizing villagers to discuss and formulate them. The MIGIS mapping exercises showed that all the villagers were facing the same problems resulting from deforestation so they needed some regulations and rules to protect their forests. Before, not all people had the same understanding as to how important the forests are for everyone.

One point we argue here is that the empowerment should come from the community inside. However these does need to be an external spark lit. This can be a way of facilitation. In other words, the community may not be empowered by outsiders; however the outsiders may take roles of starting and speeding up the process. The community participation mapping activity more or less took this kind of role in these two villages.

Construction of bio-gas systems. In order to decrease firewood consumption, the two villages organized households to construct bio-gas systems. Initially, the village cadres faced much opposition because most households thought that a bio-gas system with three cubic meters would cost about 1500 RMB Yuan. This was not affordable for almost every household. At that time they visited Mr. Heng Chunqing and reported this issue to him. Mr. Heng then made a phone call to the county forest bureau. Later the village cadres visited the county forest bureau three times and finally they got a subsidy for materials, including cement, steel and plastic pipes, gas stoves, and gas pulp. The forest bureau also sent technicians to design the bio-gas tank for every household and provided training for households on how to maintain the system and how to use the bio-gas equipment. With the subsidy from government, each household only needed to contribute labor and stones that they may prepare themselves.

Villagers explained the many advantages of the bio-gas systems: (1) it is not necessary to pay for electricity for lighting since they use bio-gas; (2) smaller households (three to four family members) could save on firewood consumption since they could also use bio-gas for cooking; (3) it decreases the labor burden for firewood gathering and carrying, especially for women and children; and (4) forests can be more effectively protected.

We asked Mr. Heng Chunqing a question about the linkage between the construction of bio-gas systems and MIGIS activity. He said he could not give us a clear answer. However he mentioned one point we thought was important. He said that during the mapping process villagers not only analyzed the reasons for deforestation, they also analyzed how to resolve the problem. One woman presented what she saw at her parents' village concerning

the bio-gas project that was implemented there. She said we could decrease consumption of firewood if we could have that. He said this could be one link between bio-gas construction and MIGIS mapping activity.

Construction of drinking water scheme. With financial and technical support from the Luchun County Environment Protection Bureau, these two villages implemented a drinking water scheme in April and May 2003. We asked villagers and village cadres whether this project came about because of MIGIS mapping activities. They said it might be part of the reason. The Shang Shapu Village headman explained to us that there actually was an agreement to implement a drinking water scheme in 1997 when the bureau rented a place from Shang Shapu for storing waste materials and rubbish. However before the MIGIS mapping activities, the villages made two inquiries to the bureau and did not receive a positive answer. After the MIGIS mapping activities village cadres asked the bureau again and got a clear answer that the drinking water scheme would be implemented in 2003. From this discussion we might say that the involvement of Heng Chunqing from the bureau took an important role. According to him, villagers in these two villages really needed help. Furthermore, he told us that it was the first time he recognized how poor the villagers were and how anxious the villagers were to get help from outsiders.

Moreover, according to Mr. Heng's explanation and our observations in other places, the designing responsibility basically was taken by technicians without any consultation from beneficiaries. The MIGIS mapping activities provided many good suggestions from villagers. He cited the water source sites' selection as an example. The technicians took the draft design to the villages and tried to get village cadres' feedback. The village cadres held meetings and reported back to them that this kind of thing must be decided by villagers themselves collectively. They then held villagers' meetings to discuss the design, and most villagers proposed different designs that were finally approved by the technicians and the bureau. The suggested design by the villagers themselves not only gave more households convenient access to water tanks, but also linked the pipes with farming fields adding to the water supply for rice fields.

This is a very good example of how the mapping approach may help local communities exchange information with government bureaus. Moreover it once again demonstrates how knowledgeable the local villagers are. They are not only the learners, but also the experts. They not only find ways to resolve practical problems but can also contribute their knowledge to government officials as well as scientists. We can thus say that community participation mapping is not only a way to empower local communities but also an approach where government officials were empowered as well.

Impacts of participatory mapping activities

The evaluation group summarized the following general impacts of the MIGIS participatory mapping initiative:

The visualization effect of the maps is much improved after being transcribed from sketch maps on big sheets to GIS maps. This is one reason why they need GIS maps. We may take the following maps as examples.

Community maps. The evaluation group observed that most villagers who visited or participated in the group meetings could identify their own houses and some other typical construction such as toilets or dragon trees. They also could point out other households' homesteads, and explain subsequent changes, for example how many homesteads increased or decreased, who moved out of the village, and who moved in, and so forth. They also could analyze the direction of change and the reasons behind the change by themselves, for example, because the road was collapsed in many places; because the school was stopped, because the water tanks, headwater sources, and pipe lines were changed, etc. Seven households in Xia Shapu Village moved to roadside places and some villagers admired these households that could now access the main road more easily. Other villagers thought that it resulted in more difficulties, for instance, that it is more difficult to carry

agricultural crops home. Because there is no reliable road, they only can carry the crops by manpower from fields to homesteads, which is also from lowland to upland requiring more energy.

Historic transect map. This map was drawn by one woman with consultation from several elders around her. She is about forty years old and has received two years of formal school education, which is viewed as "educated" in the village. She said that she did not know very much about the situation before the 1980s, and so she just did what the elders discussed and agreed on. She put three sketch maps together, representing three periods–beginning 1950s, beginning 1980s, and 1999/current situation at that moment–and the MIGIS group transcribed them into one map.

Comparing these three periods, villagers told us that during the early 1950s, there were only eight or nine households in Xia Shapu Village and even in the early 1980s there were around twenty households at the village; however in 1999 there were about thirty households. The villagers agreed that this could be a core reason why deforestation sped up in the past ten years.

We asked her why she drew two disconnected paddy fields on the map. She said the reason was that they have different soil fertility and so, different productivity. The upper fields may only have three-quarters of the output of the lower fields. Villagers also told us the total plantation area for tea was almost the same for these three periods, but that it changed among households, with some households increasing and others decreasing. Because the households had different development situations for their family sizes, one family became several households in some cases, while other families remained single households.

We talked in detail about the planting of lemon grass. In early 1990s, the price for oil extraction from lemon grass was 100 RMB Yuan per kilogram, but it decreased to about sixteen to twenty RMB Yuan per kilogram in 1999. They said that they had wanted to stop planting lemon grass, but the government forced them to continue. This is because it destroys the forest and the whole environment. One old woman said "the MIGIS group shared information with us that there may be no forest in 2001 if you continue the planting of lemon grass and by then the village will be buried by the collapsed hills. We also realize that it is so difficult to take care of a tree for more than thirty years but so easy to chip it for extracting lemon grass oil. We cannot cut tree and we must plant more trees for ourselves and also for next generations…" Her idea was supported by all participants in the group meeting. They said that they would not plant any lemon grass even though the price for lemon grass oil later jumped to 200 RMB Yuan per kilogram.

Villagers may analyze their situations and difficulties more clearly by using maps. The MIGIS group report mentioned that the villagers themselves felt that a map provides a very strong approach in helping them to understand their living situations more clearly. For instance, through resource mapping, villagers found that environment degradation is the biggest difficulty these two villages are facing, which results in paddy fields being destroyed, and declines in water sources and soil productivity. In the ten years before 1999, these two villages lost more than 60% of their forests and most of that were headwater forests. This deforested land was opened into farming land for crops so it lost its original fertility and productivity, which again resulted in high soil erosion, collapse of ditches, and rapid decrease of surface water. In 1999, villagers more and more depend on rainfall for farming (before they could use spring water for farming which came from forests).

The evaluation group also was told that these two villages had formulated and started to implement the new villagers' regulations and rules by themselves after the MIGIS activity. The villagers' regulations and rules do not allow villagers to cut trees freely, and they are not allowed to graze animals in the forests. Most visited villagers said the forests are getting better and better since village cadres and villagers are now more concerned.

During the evaluation process we also learned that villagers in Shang Shapu employed local customs to rank the problems and difficulties they are facing. They told us that they found it difficult to do the ranking when the MIGIS group requested they think about the three most urgent problems and difficulties they want resolved. A while later a middle-aged woman said "why don't we let all meeting participants have a choice?" Then another old man suggested giving ten corns to each participant and having them put down more corns for the most urgent problems and less for those not as urgent. Finally they arrived at a solution. Some participants put eight or seven corns for what they think it is the most urgent problem or difficulty; some of them put six or five corns and some others just four corns. Learning from the villagers, the MIGIS group improved the ranking method in Xia Shapu Village. They gave each participant six corns and suggested that for the most urgent problem or difficulty they put down one corn, the less urgent problem or difficulty they put down two corns and for the last one they put down three corns. By doing this, the MIGIS group can perform simple statistical analysis to arrive at a rough conclusion.

Villagers expressed great interest in the MIGIS mapping initiative. During the evaluation period, we asked several questions regarding the process. The first one was who participated in the mapping activities. Villagers who participated in the group meetings or interviews all told us that both the MIGIS group and the village cadres asked all villagers who were interested to participate. During the first two days not many villagers participated, so the village cadres made announcements by households. However, about four days later there were so many villagers participating that the mapping process became difficult. Because there were so many people around the big sheet expressing quite different ideas, it was difficult to make progress at some points. MIGIS decided to post copies of the sketch maps in a public place so that people could express their different ideas on the copies. From this discussion we can say that the mapping process was open to any villagers who were interested. There were no prior criteria for the selection of participants. However it became apparent that participation is a process that takes time, especially when local communities do not understand the objectives of intervention from outsiders.

Villagers who participated in the mapping process and who were interviewed by the evaluation group said that it took a lot of time. The active woman who did the historic transect map told us that she spent almost the whole day on the maps with several elders, so there was no time for meals or for cooking food for pigs. Another old man said that the MIGIS team stayed in the villages for almost two months, which was longer than the working team assigned for guiding land reform in 1952. The MIGIS group's workload was perhaps heavier than the working team's. This also took a lot of time for the villagers. However he added "we like them. They almost became village members. We hope they may come back often…"

We also asked village cadres how awareness and a sense of place were enhanced. The Shang Shapu Village headman said that there was no obvious change concerning villagers' awareness and sense of place. However more and more villagers are paying attention to the improvement of living conditions. This is why they decided to plant the Chinese fir seedlings on the collective forest land, rather than allocating the seedlings to each household to plant on their own contracting hills. He also told us that right now it is easier to mobilize villagers to contribute labor for public works such as the construction of hygiene toilets or the drinking water scheme. On the other hand, the Xia Shapu Village headman shared a very interesting story. He said that before the mapping, it was very difficult to organize villagers' meetings, but now the situation is much different. All households may have a member at the villagers' meeting. Those that were absent or busy with other activities would make excuses to the village head. They would come to visit the headman to learn the agenda and contents of the meeting after the meeting when they had time. He also told us that before there were many disputes, even conflicts between households. However, recently there were few disputes. In

the whole of 2003, no disputes occurred in the village.

We then asked him the relationship between this situation and the mapping. He said he did not know if there was a direct linkage between the two. However he could say that the MIGIS group really helped villagers recognize the importance of good relationships among households through the venn diagram. They reminded villagers that, especially in the poorer villages, the villagers themselves can be the most reliable group. Moreover they demonstrated that the village could make progress when united.

CONCLUSION

The villagers actively participated in the MIGIS mapping process. They analyzed their situation systematically through this process. They understood that environmental degradation is an important constraint for their livelihood, security, and future development.

During the mapping process, the sketch mapping approach and maps took key roles for both the MIGIS group and the villagers. It is not only a communication tool for them to exchange ideas and information efficiently, but also an approach for communities to collectively analyze their own situations, as well as a learning tool for both sides to learn about each other. For instance, the MIGIS group learned how to set up the ranking exercise better from the locals and to use handy and familiar materials. This is most important for the less developed communities where local people have limited chances to communicate with outsiders. For our targeted communities, there is another barrier as most villagers cannot speak Mandarin.

The mapping process also sparked local communities to improve their living conditions through road construction, reforestation, the construction of bio-gas systems, and drinking water schemes. We cannot say that all these villager-driven activities directly resulted from the mapping initiative, but we can at least say that the mapping initiative catalyzed villagers' actions.

Community-based discussion and decision making processes were initiated. Villagers' regulations and rules were formulated and implemented. Villagers' meetings became an important vehicle for decision making related to the communities' public affairs such as with the revision of the drinking water scheme construction design made with the government bureau.

The communication and information sharing channel between local communities and government bureaus was enhanced. The villagers may bring their concerns and needs to relevant government agencies, as in the cases of requesting seedlings or financial support for bio-gas systems construction.

The evaluation group also strongly felt that any research oriented project may have risks, especially in satisfying local communities' practical needs. The women's association head said that what she drew on maps were what existed now as well as what she hoped to have one day. One arguable question is what will happen when they finally find out that mapping and maps alone could not give them what they had expected.

More importantly, community participation mapping can be one efficient way to empower local communities, but it is not the only way. Much depends on the participation of the people. We look forward to developing new results with powerful community participation approaches, including mapping.

REFERENCES

1. http://www.travelchinaguide.com/intro/nationality/hani/
2. http://www.hani-akha.org/mpcd/hani-akha/geography.html
3. MIGIS Study Report

1 Mr. Zhao Yaqiao, Ms. Wu Chengrui, and Ms. Fu Yunbo from the Center for Community Development Studies and Mr. Heng Chunqing from the Luchun Environment Protection Bureau participated in the field studies. Ms. Wu Chengrui prepared the Chinese draft report which was a source of data and information for this report. I hereby express my sincere thanks to all of them. I also appreciate Dr. Jefferson Fox, a senior fellow from the East-West Center, who gave his heartfelt recommendations from the statement of the theme to the writing, and who spent lots of time editing.

2 This group consisted of Dr. Cai Kui from Yunnan University; Dr. Ma Hunag-cheng from Southwest Forestry College (based in Yunnan); Dr. Jack McConchie from the Institute of Geography, School of Earth Sciences, Victoria University of Wellington; Ms Jean McKinnon, from KINSA Associates, Wellington; and Dr John McKinnon, the from Institute of Geography, School of Earth Sciences, Victoria University of Wellington.

3 The evaluation group consisted of Professor Zheng Baohua, Mr. Zhao Yaqiao, Ms. Wu Chengrui, and Ms. Fu Yunbo, all of CDS and Mr. Heng Chunqing of the Luchun Environmental Protection Bureau, who was the senior translator for the MIGIS working group as well as for our field studies.

4 They have been referred to as "Hani," "Heni," "Budu," "Biyue," "Yani," etc. and in Northern Thailand and Laos they are called “Akha.”

5 For details, see http://www.travelchinaguide.com/intro/nationality/hani/ and http://www.hani-akha.org/mpcd/hani-akha/geography.html

6 15 mu is equal to 1 hectare.

7 The interviews were conducted with the help of Mr. Heng Chunqing, a Hani-Mandarin interpreter. A Beima is religious person whose major responsibilities are (1) to organize religious ritual ceremonies and (2) to pray for a family member who is getting sick or feels uncomfortable.

8 This refers to a land policy that had been implemented in early 1980s whereby the central government allocated most collectively owned forest land either to individual rural households as “free-holding hills” or to individual households and/or users groups as “contracting hills.” The differences between “free-holding” and “contracting” hills are (1) there are trees on a contracting hill but none on a free-holding hill; (2) on a contracting hill, households have management responsibility, but derive only 60 to 80 percent of the benefits; by contrast, households have full ownership of trees on a free-holding hill and derive 100 percent of the benefits; (3) the area allotted to each household for a free-holding hill is usually smaller, in the range of three to five mu. The allotment of a contracting hill may be larger, ranging from ten mu up to one hundred mu.

9 In P. R. China, according to law, most of the rural land belongs to a collective, a natural village in most cases, but individual households may have use rights. What we refer to here as “private forest land” is land individual households only have use rights to.

10 The official exchange is 8.27 RMB Yuan is equal to 1 US dollar.

11 This is an indigenous practice used by many minority groups such as Hani, Miao, Yao, Naxi, Dai, Zhuang, Lisu, Luhu, etc. in Yunnan Province. The fines were set as follows: sacred forests, 3 RMB Yuan per centimeter charged by diameter of stump; headwater forests, 2 RMB Yuan per centimeter; other forests, including cardamom trees, 2 RMB Yuan per centimeter.

APPENDIX

Big Events in Shang Shapu and Xia Shapu Villages after mapping activities in 1999

Events / Dates	Results / Remarks
Irrigating water taker is selected by villagers April 1994	The approach is quite conventional, with the old persons discussing and listing two or three candidates, and villagers showing their hands to vote for the candidate they support.
About thirty villagers from the two villages suffer stomach aches April to July 1999	Most are children and women. Villagers thought it was caused by dirty water polluted by the waste and rubbish storing farm.
All households from Shang Shapu Village send a family member to check on the current situation regarding forest protection June 16, 1999	The goal was to take back private forest land characterized by poor management and bare hills for collective management (only in terms of use-rights).
Household head (usually man) meet to discuss drinking water scheme construction issues for each village June 23, 1999	There was no result since they did not know what the county environment bureau was planning.
Village head from Xia Shapu visits Shang Shapu Village's head to negotiate the second road construction issue July 5, 1999	Because each side does not occupy its own land, there was no progress.
Villagers provide voluntarily labor for farming irrigation system maintenance July 1999	In this yearly village tradition, villagers repair the ditch with input from each household, usually on the first day of Lunar June.
Xia Shapu villagers develop the second road November & December 1999	It took them more than two months, but it was damaged in April 2000, after being only used one month.
Six villagers pass away in Shang Shapu Village The whole 1999	No one knew the reason for these deaths; nothing like it had ever happened in the past.
Villagers from Shang Shapu Village plant trees collectively June 30, 2000	The county forestry bureau provided five thousand seedlings of Chinese fir, but the survival rate was only about 50 percent, much lower than the normal 85 percent.
Shang Shapu Village constructs hygiene toilet August 2000	Suggested by the MIGIS group and by the county environment protection bureau.

Events / Dates	Results / Remarks
Bio-gas systems construction November to December 2000	All households in the two villages benefited. Many villagers had very positive reactions, especially since it helped protect forests, eased the labor burden, and saved energy.
Villagers' regulations and rules formulation and implementation Year 2000	The two villages formulated and implemented some villagers' regulations and rules after many meetings.
More than fifty villagers suffer from stomach ache problems April & May 2002	Shang Shapu victims were all children, and Xia Shapu's were all young laborers, as in 1999.
The third road construction September to December 2002	The construction was organized by the township government, and the two villages contributed labor. The road was cut off again in June 2003 because of heavy rain. It lasted only three months.
Drinking water scheme construction in two villages April & May 2003	Villagers gained access to clean drinking water.

DEVELOPMENT OF RURAL COMMUNITY CAPACITY THROUGH SPATIAL INFORMATION TECHNOLOGY:

THE CASE OF TRINITY COMMUNITY GIS

By Yvonne Everett and Phil Towle

Spatial Information Technology (SIT)–which includes Geographic Information Systems (GIS) and Global Positioning Systems (GPS)–is often characterized by its users' dependence on SIT experts to create the outputs. An alternative model is for SIT users to become their own experts. The latter, more empowering approach, is often reserved for universities, large businesses, and others with considerable financial resources. Trinity Community GIS (TC GIS) was created to develop community SIT capacity. This ten-year project was designed to train people in SIT and to make the technology available to a rural community and its members. This paper assesses the impacts of SIT on a forest-dependent community in northwestern California. The assessment is based on a formal survey that was mailed, e-mailed, or hand delivered to individuals and groups with whom TC GIS has worked, and a critical assessment by outside reviewers from the East-West Center and the University of Hawai'i with expertise in SIT dissemination. Whether this approach can be replicated and its implications for broader efforts to build community capacity are also evaluated. Sections of the paper discuss how the project has influenced community capacity; the costs to the community; the original goals of TC GIS and the degree to which they have been achieved or not; the degree to which the TC GIS approach could be replicated; and finally how our results relate to community-based resource management, SIT, and community capacity building more broadly. In brief, it was found that for this community, access to SIT increased community capacity in terms of human and social capital by training individuals and by raising the general level of awareness of SIT, thus enabling community members to take a stronger role in natural resource management decisions that affect them all. The community was able to use SIT as a tool to argue for protection of its resource rights and to successfully compete against other communities without the same access to SIT tools for natural resource management.

Spatial information technology (SIT) refers to a set of potentially empowering analytical tools including geographic information systems (GIS), global positioning systems (GPS), and remote sensing image analysis software (Fox et al. 2003). Differences in access to SIT thus imply differences in degrees of empowerment, especially in the case of highly technical and costly forms of SIT such as GIS and GPS. This raises questions about whether different levels of access to SIT might advantage urban over rural communities, or government agencies over local communities or non-governmental organizations (NGOs).

The Trinity Community GIS project (TC GIS) was launched in 1993 to address such concerns through a joint effort of several state, federal, and local organizations, led by the University of California Berkeley (UC) Cooperative Extension and the Trinity BioRegion Group (TBRG). Central among these concerns was the extent to which enabling rural

communities to take advantage of SIT would shape decision making about natural resources management by enabling communities to better and more fully participate in and influence political processes and policies that affect them. It was anticipated that access to SIT, for example in the form of the ability to manipulate GIS for their own purposes, could increase rural communities' understanding, capacity for self-determination, and/or access to resources.

This paper represents an effort–based upon TC GIS documents, a survey of a subset of Trinity County citizens, and the decade-long experiences of the project co-directors–to evaluate the degree to which enabling and increasing rural community access to SIT can be correlated with community capacity-building. For the purpose of this study, community capacity is defined as an independent variable that affects community responses to changes in land management, where higher capacity communities are more adaptable (FEMAT 1993, VII-45; Kusel 2001).

BACKGROUND

Along with the spread of computer technology, SIT–and in particular GIS and GPS–emerged from university laboratories in the1980s (Fox et al. 2003). Because of its costs and highly technical nature, there were significant initial (and sometimes persistent) entry barriers to using GIS. Concerns about equity and public access to information were raised, for example, regarding governments' use of SIT that the majority of the public did not understand and to which they did not have equal access. Particular concerns were raised regarding the prospect of already disadvantaged segments of society, such as rural populations (Fortman et al. 1989, 44-50), being left further behind by unequal access to SIT. One area of relevance was natural resource management and the degree to which forest-dependent communities would be able to understand and participate in decisions made using SIT about forest resources on public lands.

In the early 1990s (and even today in many cases), people living in rural communities, local governments, service districts, and community-based organizations did not generally have direct access to SIT. Contracting with outside consultants to develop maps and other SIT outputs became the dominant model for disseminating SIT within rural communities. However, those contracting for SIT often did not really understand the technology, did not control the databases, could not use the tools associated with SIT, and were not capable of manipulating or maintaining SIT data.

Concerns about dependency led to the development of a decentralizing and capacity-building approach based on helping communities develop their own SIT applications and expertise (Radke and Everett 1993). Since community capacity can be defined as a combination of available and applied physical, human, financial, cultural, and social capital (Kusel 2001), such an approach to enhancing SIT-related community capacities can be anticipated to have

wider socioethical impacts. This research project analyzes an attempt to implement a community capacity-building model aimed at empowering people to address community concerns more effectively locally, and to better represent community interests in regional, state, and national policy arenas.

TRINITY COMMUNITY GIS

TC GIS, an NGO in Trinity County in northwestern California, began its effort to disseminate SIT in 1993 with the goals of: (1) developing local community capacity to use SIT; (2) providing local access to and training in the use of GIS and GPS technologies; and (3) helping provide new avenues of employment to local people for SIT-related work. A further goal was to promote the use of SIT in ways that would include local knowledge and experience in planning for public and private land management and to encourage collaborative development of new approaches to landscape analysis and ecosystem management (USDA, Forest Service 1994). In sum, TC GIS has worked to enhance communications between the rural periphery, including public lands, and the administrative centers at the regional, state, and federal levels.

History

TC GIS emerged from a particular context of change in natural resource policy and management and of newly emerging technology. In the early 1990s, land management in the Pacific Northwest of the United States changed dramatically when a federal court injunction required the federal government to come up with a new approach to public forest management, resulting in large decreases in timber volumes harvested from public lands, which in turn created severe economic problems in forest dependent communities (USDA, Forest Service 1994).

Trinity County is a 2,000,000 acre mountainous, and remote county with a population that has been stable at around 14,000 for forty years or more. Over 75 percent of the land is managed in national forests by the federal government. The shift away from timber management toward ecosystem management on public lands in this highly forest-dependent county had been played up into an ugly "jobs vs. the environment" conflict situation. As a result, a group of volunteers, representing the full range of local natural resource stakeholders and the United States Forest Service, formed the Trinity Bioregion Group (TBRG), using consensus to find common ground on forest policy issues and to make recommendations regarding USFS management decisions.

At the same time, SIT was beginning to become available to public agencies. The emerging use of SIT for public resource management had implications relevant to both forest management and to rural communities near national forests. First, by its nature as a form of "remote sensing" rather than on-site assessment, there was considerable potential for error in SIT application. Second, the advent of SIT led to new employment opportunities for those trained to use the technology. Members of the TBRG sought to ensure their access to GIS. In 1993, the TBRG contacted two UC-based researchers interested in testing a community capacity-building alternative to the external consultant model of SIT dissemination. John Radke and Yvonne Everett agreed to work with the TBRG, and Everett went on to become co-director of TC GIS.

With coordinated funding support for a pilot project from the UC Berkeley Cooperative Extension, the California State Resources Agency, and several federal agencies, one of the researchers and two TBRG members initiated Trinity Community GIS in the small Trinity County town of Hayfork. TC GIS began building local GIS capacity by meeting regularly with a TBRG GIS committee, and by writing curricula for and teaching entry-level mapping and GIS courses that included such skills as map reading, photointerpretation, use of GPS units, digitizing, geopositioning, database development, spatial data manipulation, output development, and introductory GIS-based landscape analysis. At this time, TC GIS also began a longstanding and mutually beneficial relationship with the Watershed Research and Training Center (WRTC), another

Hayfork based NGO focused on community forestry that had emerged in response to changes in federal land management policy.

TC GIS maintained close contact with the university and established links with Shasta (Community) College, TNET (a local digital network), the USFS, local government agencies, schools, and other interested community members. Staff capacity developed gradually in parallel with efforts of the "expert" researcher to combine carrying out training courses with building a research program focused on applying GIS and participatory methods to locally identified, natural resource-related problems. Important to TC GIS's development was a grant from the USFS Pacific Southwest Research Station (PSW) for research on the USFS's Hayfork Adaptive Management Area (AMA), community GIS, non-timber forest products (NTFPs), and fire management. Other essential elements included participation in the Environmental Systems Research Institute's (ESRI) Environmental Conservation Program and the Society for Conservation GIS (SCGIS). TC GIS could not function without support from ESRI software and data grants. TC GIS also received software support from Sure!MAPS, Symantec, Microsoft, and SweGIS.

Since capacity-building is in itself a process, parallels between the evolution of TC GIS as an NGO and the growth of community capacity are useful for examining the social and ethical implications of SIT, as well as TC GIS's efforts to support community use of SIT. These efforts began with explanations of and training in SIT technology and progressed to using SIT for community mapping that was used to compete for government sponsored natural resource projects and to defend resource rights in court.

METHODS

At the SIT Conference in Chiang Mai in June, 2003, TC GIS decided to study what impacts their implementation of SIT had upon local rural community capacities and how these impacts were manifested. We decided to do this by conducting a survey of our community "peers"–people who had worked with or been trained by TC GIS in one way or another. At the outset it must be stated that the survey was carried out by TC GIS and not by independent researchers, and thus one would expect the responses returned to be largely favorable. Further, the small sample size limits the universality of the results.

In June of 2004, TC GIS designed and sent out over one hundred survey forms consisting of thirty-one questions (twenty-two multiple choice and nine text answers). When data from the thirty-two responses received were entered into SPSS software and descriptive statistics and cross-tabulations were calculated, the perceived value of SIT became apparent. Responses from the 30 percent of the survey pool who participated were so overwhelmingly positive that the results merit discussion.

Bearing in mind that most of the participants have had some interaction with TC GIS:

- All respondents said that SIT is at least somewhat important for natural resource management, while 56.3 percent found SIT to be critically important.
- When asked if their experience with TC GIS training workshops or products had made them more confident in understanding SIT outputs used in public presentations, over half agreed with another one-third citing strong agreement.
- Survey responses were on the same order for Trinity County residents' increased ability to participate in discussions and decision processes in natural resources management based on the use of SIT products.
- Survey responses showed 75 percent supportive of the idea that TC GIS helped county residents, public officials, and land managers be more aware of SIT and increased residents', officials', and managers' abilities to develop and use SIT.
- 90 percent of respondents said that residents of Trinity County have had more access to SIT in the last ten years because of TC GIS. (When broken into two groups, one trained in SIT by TC GIS and thus

SURVEY RESPONSE DATA

#	Content	Yes	No	N/A		Agree More	Agree	Neutral	Disagree	Disagree More	No Response
8	GIS important for nat. resource mangmnt?					18	11	3			
9	confident in understanding maps?					13	18	1			
10	TC GIS training --> more confident?					10	16	6			
11	SIT --> better understanding?					11	17	2	1		1
12	TC GIS increased Commun.'s particip.?					11	17	4			
13	TC GIS --> Commun. more aware of SIT?					6	18	8			
14	TC GIS --> officials/mngrs more aware SIT?					12	14	5			1
15	TC GIS --> more Commun.use of SIT?					8	15	9			
16	TC GIS --> more off.s/mngrs use SIT?					7	15	9			1
17	TC GIS --> Commun.'s access SIT?					15	14	2			1
19	TC GIS -- > TBioR access $?					5	14	9			4
21	use SIT in nat. resource mngmnt?	24	5								3
26	TC GIS training helped get job?	2	2	26							2
27	TC GIS training help do job?	12	0	18							2
28	used TC GIS maps?	27	1								4
30	worked w/ TC GIS to produce SIT?	17	14								1

Table 1*

*Partial data set–other data are either Age/Education/Residence (Profile data) or text responses. Of the respondents, 84% (27/32) lived in Trinity County; 75% (24/32) were 40 to 65 years old. All respondents completed high school, 34% completed a bachelor's degree and 21% indicated a graduate degree. Survey responses to Question Nos. 4 to 6.

likely to be more knowledgeable about SIT (n = 13), and one not specifically trained in SIT by TC GIS (n =19), the tendency toward strongly agreeing with the idea that TC GIS played a significant role was stronger in the former group.)

ANALYSIS

Building community capacity through SIT

Community capacity can be defined as a community's ability to respond to external and internal stresses and to collectively create and take advantage of opportunities (Kusel 2001). Kusel points out that with increasing local reliance, differential response capacities may significantly affect community well being.

Community capacity is comprised of several elements:

1. Physical Capital: infrastructure, resources, equipment, buildings, open space;
2. Human Capital: skills, education, experience of residents, contacts;
3. Financial: locally accessible money and credit;
4. Cultural Capital: myths, beliefs, norms that organize groups;
5. Social Capital: relationships built, ability to organize and work together to address community concerns; civic engagement, access to resources.

For the sake of this analysis, the resource of spatial information is considered a hybrid of physical capacity and human capital.

Community capacity may be assessed by identifying residents' ability to meet needs, create local opportunities, and adapt to changing conditions. SIT training can provide tools to help communities perform these tasks: perceptual tools such as maps; contextual tools such as awareness of potential impacts; and understanding tools such as a sense of location and connectedness.

In assessing the influence of SIT on community capacity it is important to clarify what SIT capacity was in Trinity County to begin with in 1993 and what is there now. This analysis recognizes that TC GIS and its supporters, the TBRG and the WRTC, were not the only source or cause of community capacity development through SIT implementation.

1. Physical Capacity (infrastructure, resources, equipment, buildings, open space) In 1993, not many people had or used computers, there were no publicly accessible computers, and SIT capacity was limited pretty much to the use of printed maps.

In 2004, computer equipment, software and Internet access are now widespread, but with limited high-speed data lines. There are publicly accessible computers at two public libraries and most of the schools are wired to the Internet. Within the county, there are GIS "shops" at one USFS office, one county office (the Planning Department, which provides SIT for all county agencies), and two NGOs, TC GIS (which makes it available to the general public) and the Trinity County Resource Conservation District (RCD). Many public agencies at several levels, some businesses and NGOs, and some individuals now use SIT in some form (though some only use SIT products such as maps).

Other changes in physical capacity due at least in part to SIT use include: road and culvert inventories, placement, and conditions and other erosion control projects, especially to protect fisheries; better and more efficient use of equipment and water resources and various resource planning and treatments for fire prevention and suppression; better recreational trail systems (construction, maintenance, and utilization) and natural areas' boundaries; property parcel lines and realignments; and emergency services design and planning.

2. Human Capacity (skills, education, experience of residents, contacts) In 1993, a handful of people in Trinity County were able to use computers. Few residents had access to e-mail. Few residents had heard of GIS and almost none were GIS users.

In 2004, many Trinity County residents have access to and use e-mail and the Internet. TC GIS has trained upwards of one hundred fifty people and about one hundred use SIT products (mainly maps) directly (75 percent), while about twenty to thirty develop GIS data layers on their own and can be considered "users" (more than one-third of responses). Hundreds of community members and regional partners are familiar with GIS and GPS. There is some awareness in the schools (K-12), but there are no formal classes locally. Shasta Community College (shared by three counties) has an SIT department, staff, and curriculum.

SIT has also broadened thinking beyond individual property lines to neighborhoods, watersheds, and regions. SIT has helped many people to understand, become more sophisticated about, and participate in planning processes, especially natural resource and fire management planning on both public and private lands. Some people have the confidence to be more involved now (97 percent), 84 percent because of TC GIS. Maps have been used to familiarize and organize community members around such things as airport and highway construction; public and private timber harvesting; fire prevention and protection; pesticide spraying; and recreation opportunities. In the authors' personal experiences, people have been moved by maps to get involved through greater awareness of location or proximity of proposed projects and/or better understanding of potential impacts.

Other changes due at least in part to SIT include providing products for use in instruction, education, and schools, and identifying research ideas, issues and opportunities.

3. Financial Capacity (locally accessible money and credit)
Increasing community financial capacity was not a direct goal of TC GIS. However, in 1993, any SIT projects in Trinity County involved money flowing out of the community to purchase SIT products and services. In addition, the area was in dire economic straights due to drastic reductions in timber harvests on public lands.

By 2004, community mapping has helped to develop funding for various projects, especially those concerning fire prevention, safety, and suppression (Everett 2004). Increased SIT capacity has brought research funding, grants, and some SIT development contracts and has facilitated funding programs and research studies. Implementing SIT has broadened local capacities to procure funding for natural resource development, restoration, and jobs. Funded projects include contracts to map and inventory areas to identify problems and opportunities; mapping projects; and projects involving the monitoring of progress, results, and changes. SIT use has also facilitated public agency resource management work, leading to increased natural resource utilization, products, and jobs. One example is the development of locally available capacity to bid for contracts to conduct the preproject analysis required of federal land managers by the National Environmental Policy Act (NEPA), for which use of SIT is a critical component.

4. Cultural Capacity influenced by SIT
Cultural capacity includes myths, beliefs, and norms that organize groups. While some people have difficulty relating to the abstract symbols called "maps," many people at least understand what maps are. In 1993, other than a few natural resources managers, the community was largely unaware of SIT. However, many people did use maps for tourism, recreation, hunting, fishing, hiking, and camping.

Maps can create a "birds-eye-view" of surroundings, vividly demonstrating interconnectedness and possible land use impacts that residents had not been aware of before. With SIT, local maps began to provide information beyond topography, streams, and roads, to illustrate land-use practices and to provide current and historical photos of the landscape indicating rates of change in the past and potential future impacts. In 2004, a greater awareness of spatial relationships in the landscape has led to a more sophisticated connectedness to natural resources, with increased and more effective participation in various

planning processes, especially with public agencies with an eye towards sustainable development. SIT therefore influenced changes in perception and practice with regard to, for example, land use planning and practices (increased likelihood of participation); site-specific fire dangers and prevention (increased awareness and sensitivity to conditions and dangers); and recreation and tourism opportunities (greater focus on the outdoors).

Research using SIT has also led to changes in approaches to non-timber forest products (NTFP) including increased interest and utilization as well as developing agency management strategies (Everett 2001; Lonner 2002; Clifford 2004). There is increased interest in watershed analysis based attempts at integrated resource management and rehabilitation that rely on SIT and that involve the community or that are contracted out to the community (USDA, Forest Service 1994a, 1998). One local Native American tribe is using TC GIS support to develop maps illustrating their historical uses of territory to obtain federal tribal status. The county is using SIT to establish an Emergency 911 system with caller ID and spatial locations and has already provided hard copy maps to benefit other operations such as volunteer fire departments, emergency search and rescue, and medical evacuation teams.

There has been some resistance to mapping, common in remote areas. People with libertarian values or concerns about "government interference" are generally opposed to mapping and identifying residences and land parcels. Some people are concerned that mapping will lead to rezoning, enforcement of building codes, and increased property taxes. Others opposed are people involved in illicit activities such as drug cultivation or manufacturing; fish and wildlife poaching; and theft of resources such as timber, firewood, minerals, or water.

5. Social Capacity built through SIT

Social capacity includes relationships built in the community, and the ability of its members to organize and work together to address community concerns that might range from civic engagement in general to capturing access to otherwise unavailable resources.

In 1993, SIT had little impact on the community other than maps being used for recreation and for natural resource project management. By 2004, many people in the community had developed more of a sense of place. There is also an increased emphasis on understanding the concept of "place," including such factors as proximity, connectedness, and duration, which has helped people concerned about the same issue find each other and work together. This has led to greater sophistication in public discussions and debates among communities and with public and private resource managers. For example, the Trinity County Fire-Safe Council (TCFSC) used community mapping to produce extensive collaboration between the public, fire managers, and resource managers (TCFSC 1999), which is leading in turn to better public policy (a county fire management plan) and funding for fire preparation and suppression projects (Everett 2004). Better understanding of land-use planning and its potential impacts led to extensive public involvement in a highway relocation project and a community airport expansion. Better understanding of resource problems and opportunities has led to the development of NTFP utilization and a nascent small diameter timber utilization industry, which in turn helps with fire fuel reduction.

Most public and many private land or natural resource planning processes now include at a minimum SIT generated maps of proposed project areas and sometimes use SIT analyses to assess possible impacts. Locally generated SIT is being used by groups working on, for example, a public/private land exchange community forest project on land managed by the Bureau of Land Management (BLM) near Weaverville (the county seat); a water quality monitoring plan, that will include identifying recently sprayed watersheds; the proposed airport and highway projects; Trinity River water allocation; public resource management and access to the resources; and recreation opportunities. The Yurok, Karuk, and Hoopa

tribes are using SIT to map reservations and ancestral territories, and in tribal management of natural resources.

As part of SIT training, TC GIS always stresses that the first step is to decide what the purpose of SIT use is and to plan from there in terms of what data are to be collected, how they are to be used, and who will own and control the data. Since much of the data TC GIS uses come from public agencies, public resources, or already public information, most TC GIS data are freely available unless it is established from the outset of a project that the data are proprietary or of a sensitive nature. Also established early on are any distribution rights, e.g., no distribution, limited distribution, display but no sharing, by permission only.

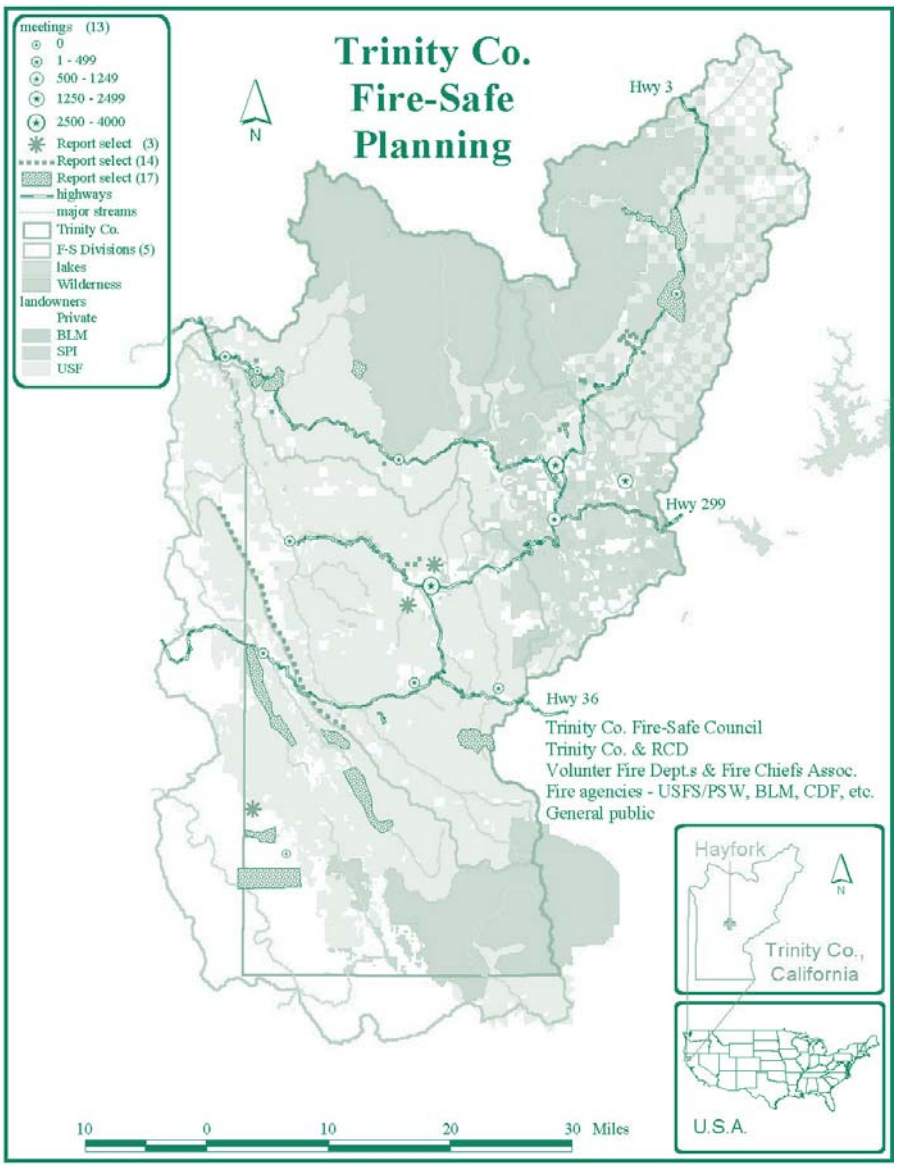
EXAMPLES: One example of a major project with several offshoots involving SIT is the work of the Trinity County Fire-Safe Council. The Trinity area is subject to large, severe wild fires. In 1987, for example, over 20,000 hectares burned in the county as part of a total of over 100,000 ha burned in a large lightning storm. These types of events occurring across California led to the establishment of a state-level Fire-Safe Council to coordinate fire management at the state, regional, and local levels and to support local level efforts at fire management (California Fire Safe Council 2004). In 1998, the Trinity County Fire-Safe Council (TCFSC) was formed, bringing together fire fighters, agencies, and the public. They soon recognized the need for landscape scale planning.

SIT was used to develop base data layers for community mapping. Public meetings were organized by local volunteer fire departments. (Other than public agencies, there is only one full-time, paid fire official in the county.) Maps were used to illustrate current conditions and to facilitate participation by recruiting local meeting participants to identify (1) available resources for emergency response such as water sources, logistical locations, unidentified roads, and fuel breaks; (2) potential hazards such as locked gates, weak bridges, bad roads, and fuel concentrations; and (3) possible solutions including fuel reduction work, enhanced communications, local maps and equipment acquisition. Working together on the maps led to better understanding of the process, resource conditions, and agency limitations along with more confident participation and more collaboration, especially among normally antagonistic groups such as loggers and environmentalists or recreationists and developers (Everett et al. 2000).

Through this process, over one hundred potential projects were identified. This led to education and outreach to thousands of people, community members and beyond, which led in turn to identifying, procuring funding for, and implementing over thirty-five projects so far. These projects brought with them jobs along with a sense of community self-reliance and better relations with government agencies. Another product of this process is a nearly complete draft county fire management plan (TCRCD 2004).

Other examples of projects benefiting from SIT are resource management efforts. In 1993, only the USFS used SIT to a small extent in the Trinity area. Now several federal and state agencies, Trinity County, the timber industry, the WRTC, and the RCD all use SIT to analyze conditions, identify problems and potential solutions, procure funding,

and implement projects. Some NGOs also use SIT products. Projects range from forest restoration and fuels reduction to resource inventories and management (roads, timber, NTFP, fisheries, and wildlife). SIT is also used in efforts to defend resource access. TC GIS has worked with the County Planning Department's Natural Resources Division to develop a GIS on the use of Trinity River water for irrigation of selenium polluted soils in the San Joaquin Valley. This is a critical issue for Trinity County because historically up to 90 percent of the flow of the Trinity River has been diverted for uses in the Central Valley. The county, along with the local tribes and other stakeholders, has been embroiled in a battle to reduce the outtake from the river for over twenty years. The ability to use SIT to make the argument that precious water that could have come from the Trinity River is wasted or misused was important in Trinity County testimony before the State Water Resources Control Board. SIT development has also empowered the public through better understanding which has enhanced citizen participation, especially in management planning on public and private lands.



There are also several projects informed by SIT that are not explicitly related to natural resources. The county Emergency 911 project (which used a lot of the Fire-Safe SIT data) used SIT to develop street addresses for use with telephone companies to give caller-ID locations to emergency dispatchers. Local street maps have also been developed for volunteer fire departments, agency fire fighters, and the US Postal Service.

To what degree have TC GIS goals related to training, employment, and community capacity been met or not and what has been achieved to date?

From the beginning, TC GIS identified several groups for SIT training. First TC GIS trained twenty-three people with a professional interest in GIS who saw the need for a community GIS database and the value of building local capacity. Then there were over ninety high school graduates and displaced forest workers, who after introductory training courses, could fill entry level SIT technical positions. In addition local youths participating in the WRTC summer camp receive SIT instruction. There

have been thirty-six participants in three sessions to date. Further, TC GIS works with and has trained fifteen regional partners such as tribes and other community-based organizations. Finally TC GIS has sought to make the community at large aware of SIT concepts and the existing capacity available to the general public. Overall, more than one hundred fifty people have been formally trained to some extent, with others reached individually or through collaborative groups or organizations, ranging from an hour long discussion to workshops or conferences lasting two or more days to formal semester long courses for community college credit.

Job Creation–What happened with the people TC GIS trained?

The initial assumption that jobs related to SIT would become available through local national forest offices as they began to implement ecosystem management proved to be unrealistic. TC GIS itself received only three USFS SIT related contracts in ten years, and the RCD also performed only a limited amount of USFS SIT work. One large timber company with extensive lands in the area also centralized its GIS capacity elsewhere. People who went from TC GIS training to more advanced SIT college work have all had to leave the area to find jobs in SIT.

photo: C. Fall, 2001

In Trinity County today, the RCD employs one full time and one part time GIS technician, and some of their workers are trained in SIT as are some of the WRTC crews. The County Planning Department hired a full time GIS staff person in 2002 who may soon be looking for an assistant. Both of the full time SIT users in the county received some training in college, had other job related experience elsewhere, and participated in TC GIS training. The USFS currently employs two people in SIT at the local level; however, when these people retire this year, the positions will be lost as USFS SIT is now centralized at the forest level about 100 km away. Additional specialists use SIT occasionally in their work, reducing demands for a full scale GIS shop. Some of these people received training from TC GIS. TC GIS employs two people part time. This handful of local GIS users communicate, share data and experiences, and occasionally collaborates on SIT related projects. Thus, SIT expertise in Trinity County today is somewhat decentralized, with professionals located in various agencies and NGOs. In addition, some private individuals who have become adept at using GIS and/or GPS use them for managing their own land.

The fact that SIT employment seems to have stabilized at current levels implies that SIT capacity is probably saturated for the time being, adequately serving the growth in community capacities it has contributed to so far, especially as more people provide their own occasional needs for SIT. Only the current county budget crunch has prevented the Planning Department from hiring an assistant GIS technician to serve the growing demands of county departments for SIT products as they become more familiar with the technology and its possibilities.

CONCLUSIONS

SIT training provides people and communities with tools that can be used for more sophisticated understanding of place and location. SIT products, especially maps, can be used to alert people to situations and opportunities and can help them to work together and find common ground through their connectedness.

In the Trinity County, California case, SIT tools have produced a number of changes. Community mapping has led to increased opportunities for public involvement, for utilizing specialized local knowledge, and for addressing local concerns. SIT training has produced more sophisticated understanding and participation from the general public in collaborative natural resource project planning. This is particularly true in the Fire-Safe program's use of participatory mapping. Communities began to understand common locations and problems and currently available resources. SIT capacity in some cases has allowed Trinity County to compete for and capture scarce resources; for example, a number of SIT-based fire management planning proposals, e.g., for fuels reduction, have received federal funding and have been implemented on the ground.

Property institutions in the U.S. are fairly static. In California, the only places where SIT might produce changes in legal status are in the case of the mapping of ancestral territories with the Nor-Rel-Muk Nation, which is seeking federal recognition as a tribe, and the case of the Trinity River water allocations disputes which will probably continue for many years. SIT was also used in the case of a pesticide spraying violation that led to a settlement rather than a court decision and some funding for the development and implementation of a county water quality monitoring plan. SIT in California generally does not cause boundary disputes because of the reasonably settled nature of property law but can clarify land use issues, make for more sophisticated discussions, and facilitate finding common ground.

In terms of economic development, the Trinity area is severely depressed. SIT has provided some help in this area, facilitating project planning and proposal development. Especially in the case of the fire-safe program, the use of SIT has helped to identify problem areas and develop project proposals for firebreaks and fuels reductions, leading to funding and the implementation of projects. Training the work force and developing SIT capacity has also made it possible for the RCD and the WRTC to bid successfully for work in natural resource planning, inventories, development, rehabilitation, and monitoring.

The California case has shown that the community capacity-building model of technology diffusion does work to build capacity and empower the public. TC GIS is unable to say that it does so better than the consultant model, but the approach used has resulted in a decentralization of SIT capacity in the county and did not create dependence upon one commercial source for SIT. Advances in computer hardware have made it possible to house SIT capacity on consumer PCs (personal computers). There are also more types of increasingly sophisticated mapping software, which tends to lower some financial and technical barriers to SIT development. A centralized expert model could have been too expensive to achieve similar social capacity building results: for instance, a business might not have been able to provide the same level of skills at low cost or on a volunteer basis to the Trinity County Fire-Safe Council. Centralization probably would not have produced the same levels of community access, involvement, and utilization.

TC GIS has been a model of collaboration and cooperation on several levels. The Trinity County community already had good capacity for cooperation and collaboration (e.g., TBRG) and was able to find and develop SIT when it became more widely available. The above average to enthusiastic assessment of TC GIS' role in SIT dissemination from those who chose to respond to the survey is one measure of local residents' appreciation. Those who now use SIT in Trinity County represent a wide range of people from local

government, NGO, and agency staff, to land owners, environmental activists, retired community members, and summer camp youth. It can also be noted that the origins of the experiment were collaborative, with several local, state, and federal agencies and the University of California pooling funds and resources to support the effort.

There were critical errors in some of the initial assumptions TC GIS and its supporters made. The idea that the USFS would provide SIT-related jobs or contracts for local residents trained in GIS was an illusion. TC GIS did not think ahead to assess the potential demand for formal training in GIS and quickly saturated the demand for professional level skills in the area. Luckily the organization was able to shift gears toward participatory research using SIT to capture funding support that allowed TC GIS to continue to support its free public access approach to SIT training. At the current level of SIT distribution and demand in the county, the training capacity of TC GIS is no longer needed and is being phased out, with some of its expertise and access to the technology being assumed by the WRTC.

TC GIS staff believes that this model could be replicated. The approach of capacity building through publicly accessible training and service might be applied in many cases for diffusion of information and technology. Specifically with SIT in California, similar efforts should be easier and quicker to launch today than was for the case for TC GIS, since the technology is more widespread, less expensive, and more accessible to communities. Certain public agencies that initially were cool to the efforts of TC GIS to demonstrate GIS now clamor for SIT services. Communities with access to a community college and a TC GIS-like NGO might be particularly able to adopt SIT rapidly.

Timing may be the most important factor in SIT adoption, i.e., when is a community ripe for SIT development? A major prerequisite is either understanding of the potential of SIT or education in SIT applications, factors that may have to come from outside a community. The timing may also be different in different areas, depending on the level of formal education and access to computer technology. In the California case, the combination of a community with some familiarity with maps that was organized and looking for help in building landscape analysis capacity, and the university and agencies looking for opportunities to develop and extend SIT worked to overcome the difficult barriers.

REFERENCES

California Fire Safe Council. 2004. Available at www.firesafecouncil.org

Clifford, P. M. 2004. Integrating logistic regression and GIS to predict the distribution of *Petasites frigidus var. Palmatus* in the Klamath Mountain subregion, California. M. S. Thesis, Humboldt State University.

Everett, Y. 2004. Community participation in fire management planning: The Trinity County Fire Safe Council's fire plan. In *Proceedings of the Fire Ecology Conference, December 25, 2002, San Diego, California*. USFS PSW GTR 189 (in press).

Everett, Y. 2001. Participatory research for adaptive ecosystem management: A case of non-timber forest products. *Journal of Sustainable Forestry* 13 (1-2): 335-358.

Everett, Y., N. Doyas, P. Frost, K. Sheen, and P. Towle. 2000. *Recommendations on Trinity County values at risk from fire and prefire fuels treatment opportunities drawn from community meetings 1999/2000.* (Draft Report to the Trinity County Fire Safe Council from the Trinity County Resource Conservation District and the Watershed Research and Training Center.) Weaverville, Calif. (76 pages + 5 CD ROMs of GIS data.)

FEMAT. 1993. *Forest ecosystem management: An ecological, economic, and social assessment. (Report of the F. E. M. Assessment Team.)* USDA/USDI/US Dept. of Commerce/EPA.

Fortman, L. P., J. Kusel, and S. Fairfax. 1989. Community stability: The foresters' figleaf. In *Community Stability in Forest Based Communities*, edited by D. LeMaster and J. Beuter. Beaverton, Ore.: Timber Press.

Fox, J., R. R. Rindfuss, S. J. Walsh, and V. Mishra, eds.. 2003. *People and the environment: Approaches for linking household and community surveys to remote sensing and GIS.* Boston: Kluwer Academic Pubs.

Kusel, J. 2001. Assessing well-being in forest dependent communities. *Journal of Sustainable Forestry* 13 (1-2): 359-384.

Lonner, J. D. 2002. Determining the sustainable harvest of Oregongrape (*Berberis nervosa*). M. S. Thesis, Natural Resources: Forestry, Humboldt State University.

Radke, J., and Y. Everett. 1993. *Klamath GIS project proposal to University of California Cooperative Extension and the California Biodiversity Executive Council.* University of California, Berkeley Department of City and Regional Planning and Landscape Design.

Rambaldi, G. and J., Callosa-Tarr. July 2002. *Participatory 3D Modeling: Guiding Principles and Applications.* ASEAN Regional Centre for Biodiversity Conservation.

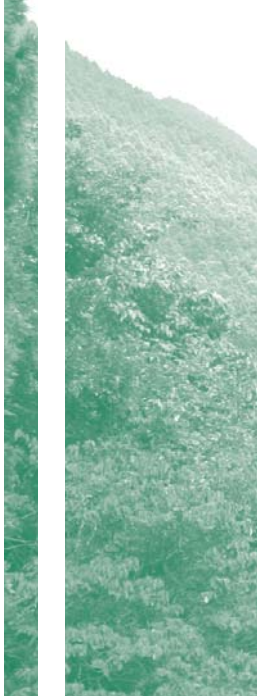
TCFSC. 1999. *Memorandum of understanding.* Trinity County Fire Safe Council, Trinity County, California.

TCRCD. 2004. *Draft Trinity County Fire Management Plan.* Available at www.tcrcd.net (Forest Health frame).

USDA, Forest Service. 1994. *Record of decision for amendments to Forest Service and Bureau of Land Management planning documents within the range of the northern spotted owl.* USDA/USDI. Available at www.or.blm.gov/ForestPlan/NWFPTitl.htm

USDA, Forest Service. 1994a. *Butter Creek watershed analysis.* South Fork Trinity River, Shasta Trinity National Forest, Hayfork Ranger District..

USDA, Forest Service. 1998. *East Fork/Smoky Creek watershed analysis.* South Fork Trinity River, Shasta Trinity National Forest, Hayfork Ranger District.



COMMUNITY-BASED MAPPING:

A TOOL TO GAIN RECOGNITION & AND RESPECT OF NATIVE CUSTOMARY RIGHTS TO LAND IN SARAWAK

By Mark Bujang

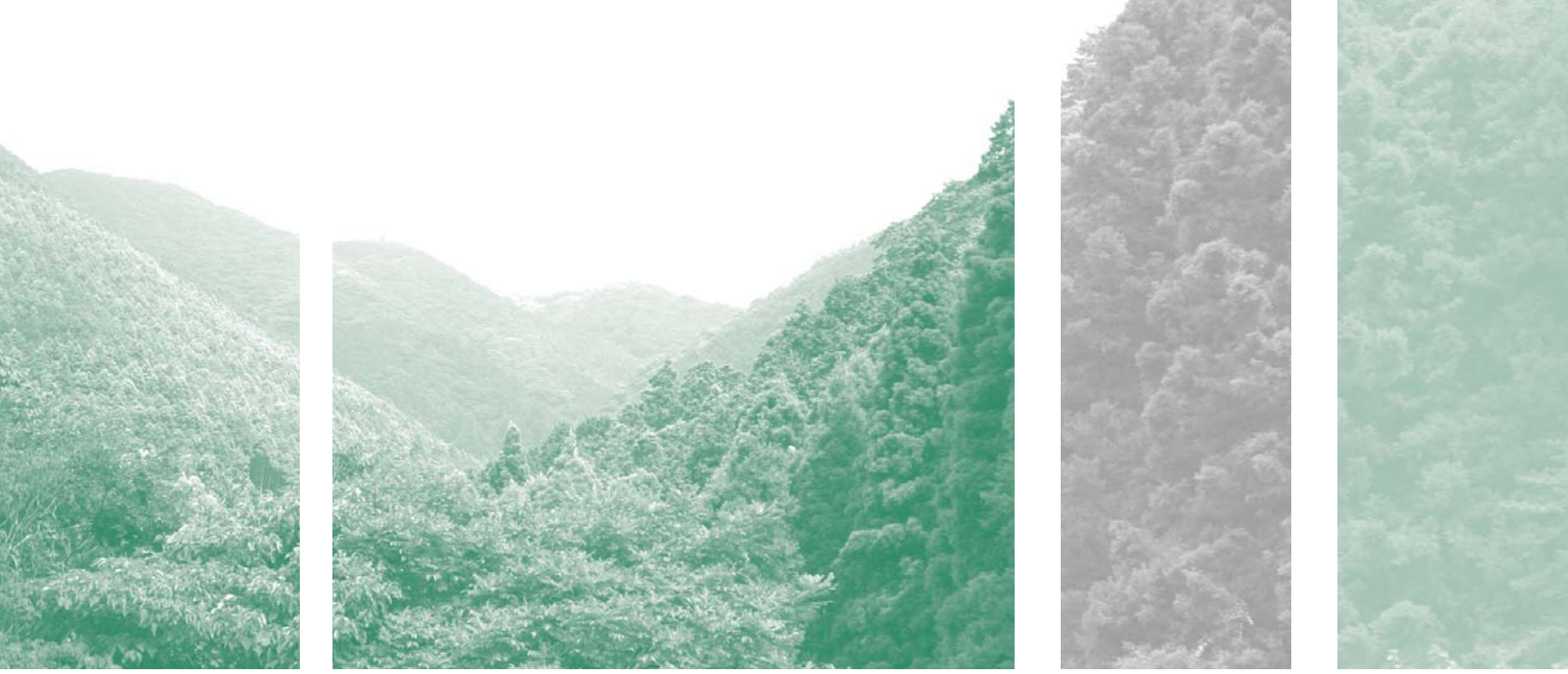
This paper documents the experiences of several community-based organizations assisting Dayak people to claim their customary lands in Sarawak, Malaysia. Community-based organizations initiated mapping as a tool for negotiations with other villages and state agencies but met limited success with fulfilling this objective. Instead, mapping has been more effective as a tool for providing supporting evidence for native customary rights claims in courts. Maps need to be accurate in order to be used in court but too much information revealed on a map could have damaging effects for communities. These community-based organizations felt there is a need for a mapping protocol. Communities should agree not only on what features are to be mapped but also on the accuracy of the information. The groups cannot produce maps quickly enough to meet the demands placed on them by communities and they also face a lack of trained personal and candidates for training.

The Dayak's native customary rights to land and its resources were recognized during the period of the Brooke government and the British Colonial Administration and continued when Sarawak gained independence and joined the Federation of Malaysia.[1] It was never abolished by any legislation up to the present day. However, large portions of the native customary lands of the Dayaks are not officially demarcated.

Today the Dayak's land territory faces an increasing threat from commercial logging, plantations, and other extractive industries. The state government plans to develop 3 million hectares of state land for oil palm plantations and 1.5 million hectares for industrial forests. Continued encroachment on native customary lands by logging and plantation companies have brought about conflicts between the longhouse/village community, the private sector, and the state authorities.

The Dayaks have taken various actions to defend their customary rights, ranging from writing protest letters to state authorities, to setting up blockades on native customary lands, to filing legal suits against encroachments by private corporations. In court, however, the burden of proof falls heavily on the communities. Requests by the Dayak communities to have their customary land officially delineated are often ignored by the state government. This situation provides a context to the increasing value of community maps in the expectation that the maps can strengthen communities' claims in court.

Initially, leaders and professionals within the Dayak communities doubted that community maps could be acceptable as evidence of native customary rights claims in court. However, in a landmark 2000 case pitting the longhouse community of Rumah Nor against a pulp and paper company and the state government, the court ruled in favour of the community–in part because the community



map strengthened the community's claims.[2] This case showed the value of community maps in asserting native customary rights and led to other communities demanding community-based mapping of their territories. In reaction to the court's decision, the state government enacted the Sarawak Land Surveyors Ordinance in 2001 to regulate land surveying activities in the state. In the said Ordinance, Sections 20 and Section 23 are the legal maneuvers designed to make it more difficult for the community to assert claims to customary lands. Community-based mapping activities have since been labelled as subversive activities.[3]

Contrary to the conventional view, community mapping in Sarawak is not a new phenomenon. In the 1930s, the Brooke government assisted the Dayaks and Malays to map their customary land boundaries. However, a shortage of resources prevented the implementation of this effort throughout the state. The effort was also halted during the Second World War and resumed briefly during the British Colonial Administration, only to be shelved when Sarawak gained its independence in 1963.

It was not until 1992 that community mapping efforts began to resurface with several community activists discussing the need to record and demarcate the native customary lands of the Dayaks. In 1995, the Borneo Project organized a training session in community-based mapping for NGOs and CBOs in Sarawak so the communities could produce their own maps.[4] From 1997 onwards, BRIMAS has been in the forefront of community-based mapping activities in Sarawak, receiving many requests from communities to map customary lands and to conduct training sessions in mapping. The enactment of the Land and Surveyors Ordinance, however, has created an uncertain future for community-based mapping in Sarawak.

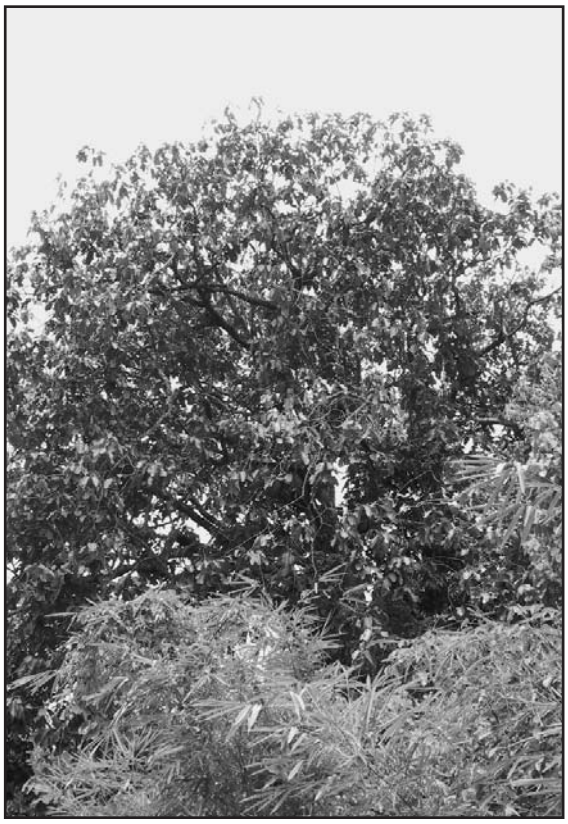
This paper explains how community-based mapping serves as a tool for the indigenous Dayaks in upholding their native customary rights to land in Sarawak. It will also attempt to counter the misrepresentation of community-based mapping activities as subversive, and instead present them as legitimate community actions.

METHODS[5]

Since 2003, BRIMAS, a non-governmental organization (NGO) based Miri, Sarawak, Malaysia, has assisted in mapping the customary land areas of thirty-three communities using hand-held Global Positioning System (GPS) devices that subsequently were built into a Geographic Information System (GIS).[6] Each of the thirty-three communities surveyed consisted of one or several longhouses/villages that shared a common customary land boundary. For each community, a meeting was held prior to and after the completion of the field mapping activities. In these meetings, we gathered background information such as existing maps, identified communal boundaries as agreed to by the groups, and clarified the

purposes/objectives of mapping the communities' customary land boundaries. We also addressed issues such as how to organize the field survey and what information should be mapped, while taking note of their concerns regarding map usage.

The community meetings were generally organized in the evenings when most of the longhouse/village members could be present. Yet not all would attend the meeting for various reasons. Some of these reasons included community members needed to work on their farms, for example during paddy planting and harvesting season; some members had moved away from their longhouse to settle in towns and cities in search for employment; and some members did not support community mapping activities or the cause of defending their land rights due to fear of being penalized by the state government or because they supported the government's plan to develop their customary land.



During the day when most of the villagers were out in their fields, site visits were organized to survey the customary land boundaries, farm plots, gravesites, previous settlements or historical sites, communal forests, spiritual sites, and areas encroached upon and damaged by logging or plantation activities. Strategies on how and what to map were discussed based on what was seen during these site visits.

For this research, we used questionnaires to interview members of the thirty-three communities, focusing on community leaders or villagers with an intimate knowledge of their customary land. In addition, a volunteer with the Borneo Project conducted interviews with officials from community-based organizations (CBOs) and local and international NGOs involved with community mapping activities in Sarawak. CBOs involved in this research are Keruan and UBRA (Uma Bawang Residents Association) while NGOs involved are BRIMAS, Sahabat Alam Malaysia (SAM or Friends of the Earth, Malaysia) and the Borneo Project. In the interviews, we asked how the NGOs got involved in community-based mapping, how they arrived at decisions on using different technologies, and how other socio-ethical issues of mapping related to the various actors. Discussion and information sharing with the Borneo Project took place through written correspondence.

BACKGROUND

The Borneo Project was formed in 1991 by a group of volunteers based in Berkeley, California to support Borneo's indigenous peoples, particularly in Sarawak, in their struggle to regain control of their ancestral lands. In 1995, the Borneo Project was instrumental in initiating the first community-based mapping workshop in Sarawak. Participants who graduated from this workshop have helped establish community-based mapping activities for NGOs and CBOs in Sarawak.

Keruan is an association formed in the early 1990s by Penan community leaders who hail from the Upper Baram region in the Miri Division to look into land rights issues affecting the Penans. Their community mapping efforts began in

1994 and 1995 with community mappers producing hand drawn maps of the mid- and upper Baram regions. Keruan is based in Kota Kinabalu, Sabah,

UBRA was formed in 1989 by the Kayan community living in the longhouse of Uma Bawang, Sungai Keluan, Baram to promote the rights and interests of individuals and the community. In 1995, UBRA began its involvement in community-based mapping through a mapping training workshop conducted by the Borneo Project. In 1996, UBRA produced a hand drawn community map of their customary land area.

SAM, a non-governmental organization involved in environment and development issues in Malaysia, was founded in 1977. In the 1980s SAM became actively involved with environmental and customary land rights issues in Sarawak. Their community-based mapping effort in Sarawak began in 1995 after they had received training from the Borneo Project. Their mapping activities mainly focused on villages in the lower and mid-Baram regions. SAM is the first NGO to apply GIS in their community mapping activities. SAM's headquarters is in Penang, but it also has a base in Marudi, Sarawak.

BRIMAS is a grassroots organization that was officially formed in 1993 to look into indigenous peoples' concerns regarding native customary rights, the environment, and development issues on the Dayak's customary lands. BRIMAS community mappers received training from the Borneo Project in 1995 and 1997. Initially, the community mapping activities were carried out in the lower Baram regions, but were later extended to other communities throughout Sarawak. Toward the end of 2002, BRIMAS began to adopt the use of GIS, with funding assistance from Europe to procure hardware and from ESRI (Environmental System Research Institute) for the software. Currently, BRIMAS is actively assisting communities in filing legal claims for native customary rights with community maps being used as evidence.

RESEARCH FINDINGS AND ANALYSIS

Reasons for mapping

Threats of encroachment into customary lands led to the demand by indigenous peoples to have the state government delineate their boundaries. The state government has been slow in responding to these requests, and do so only if the Dayaks would agree to submit to the state's land development policies–policies that actually violate the native customary rights of the Dayaks. As a result, many communities, together with the CBOs and NGOs involved in this research, felt the need to take it upon themselves to document and delineate their customary lands.

The initial expectation for community-based mapping was that the community would use the maps as a tool for negotiations with other parties; this has had limited success. For example, after Keruan assisted in mapping the Penan areas, the villages in Upper Baram used the maps to show timber companies the extent of their customary land territory, forcing some companies to pay the villages "goodwill money" to compensate for logs extracted from the land. However, this did not mean that the companies would stop their encroachment nor would they acknowledge the native customary rights of the community.

Community maps have been most effective as supporting evidence for native customary rights claims in court. The community maps could show communities' historical and continuous occupation of their land. For example, in the Rumah Nor case, the judge went to great lengths in his judgment to describe a definition of native customary rights that extends not only to the longhouse and the cultivated land around it but that also includes areas in the forest used by the people to hunt, fish, and obtain forest products. The court then judged that witnesses' testimonies regarding the community's chronological history of settlement, customary land boundaries, and utilization of the lands as consistent

with the documentation as presented through photographs and community maps. With the Rumah Nor's victory in 2000, demand and interest for community mapping grew within the ranks of community mappers in Sarawak.

The use of community maps in court has subsequently been written up in law reports and journals, which has helped to preserve the communities' knowledge of their territory. These written materials also serve as an alternative official documentation against the state Land and Surveys Department's refusal to acknowledge and document the communities' native customary rights claims.

Although hand drawn community maps were already effective in asserting communities' native customary rights, they have their limitations. Hand drawn maps take time to produce, and this could hinder the efforts of communities who filed land dispute cases in court. Moreover, hand drawn maps' utility as tools for resource management is limited when dealing with land use patterns that are constantly changing. For these reasons, BRIMAS decided to adopt geographic information systems (GIS) technology in 2002. With the upgrade in technology, BRIMAS enhanced its capacity to analyze and document significant spatial features within the communities' territories.

What maps were produced?

With the proliferation of community mapping activities by different actors, it is important to standardize the production of community maps that are being brought to courts or used for other purposes by the community.

On the one hand, community maps submitted as evidence in court need to be well defined and need to use accurate data for the maps to have legal bearing in court. For example, in 1998 a court dismissed a community's case due to technical errors on its map. In 2003, another community that had worked on their map for two years had to redo their map in order to file it in court because the map did not provide enough information and contained errors. These problems occurred because some community mappers were not adequately trained. They might have difficulties in using a GPS or may not have properly documented events during the field survey, for example. Furthermore, many organizations do not have a proper system for field data organization, which often hampers data access and compilation. For example, BRIMAS has seen a lawyer who was representing a community in court who could not access mapping data due to improper organization. Since the data were still raw, the lawyer had difficulty interpreting it.

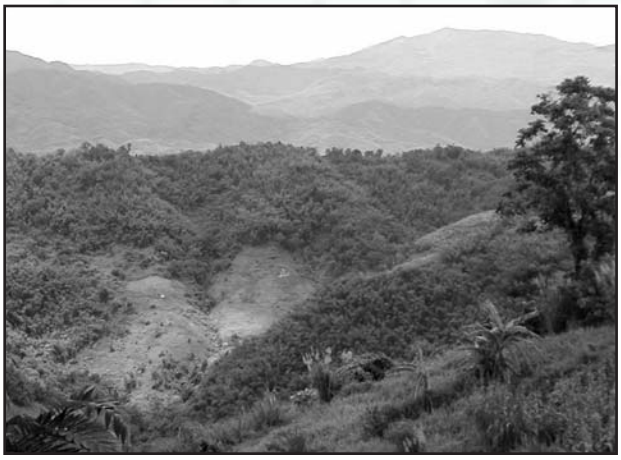
On the other hand, too much information revealed on a map–for example, the location of valuable resources that could be exploited by outsiders with access to the maps–could have damaging effects for the communities and organizations involved. It is important that communities identify information that is deemed to be sensitive and exclude it from maps, particularly if it is not essential for the purpose of showing evidence of occupation.

The community should agree not only on what features are going to be mapped, but also on the accuracy of the information. The community maps produced for court cases can be divided into two categories. The first type focuses on a community's contiguous customary land territory (*pemakai menoa*). These include the boundaries of communal lands (*antara menoa*); of individual farm plots or plots left to fallow (*temuda*); of present longhouses (*rumah panjai*), villages (*kampong*) or farm huts (*langkau umai*); of communal forests (*pulau*); of previous settlements (*tembawai*); of gravesites (*pendam*), spiritual or sacred sites and historical sites; and of hunting and foraging grounds and waterways.

Occasionally, there were minor disagreements among community members regarding the location of communal or individual customary land boundaries. Conflicting schedules between organizations carrying out mapping activities and community members' schedules as dictated by agricultural growing sometimes results in community members being unable to participate in meetings held prior

to the mapping. These disagreements are generally resolved through adat either by the council of elders or the Native Court system.[7] The NGOs or CBOs assisting the communities in mapping would not engage in mapping activities until the differences are resolved.

The second category of community maps focuses on areas that were in dispute with interests from outside the community. These maps generally did not generate disagreements within the community, and showed areas where logging and plantation activities overlap with the customary land of the communities.



During the last GIS training workshop held in August 2004 in Miri, Sarawak, participants expressed the need for a protocol for mappers, CBOs, and NGOs involved in community-based mapping in Sarawak.[8] In this workshop, it was agreed that each group would create a "community mapping form" at the beginning of each new community mapping project. The form would have information on the location of the area to be mapped, its objectives, the people involved, schedule of activities, record of activities, compilation of data, and evaluation of the project. In addition, the protocol would need to address the issue of ownership of the maps and how much information should be mapped.

BRIMAS' current practice is to give copies of the maps it produces to the communities, whose leaders or longhouse/village committee would be the custodians of the maps. While BRIMAS keeps digital and hard copies as well as the data in its GIS database, any party that wishes to access the maps and data at BRIMAS would need to get the consent of the communities involved. Any future revisions that BRIMAS would like to make to the maps would also need the consent of the communities.

Potential misuse of spatial information

During BRIMAS' community meetings, one of the concerns raised was the potential of maps being misused by individuals for their own personal gain. This concern was highlighted because in some communities, there have been cases of entrusted individuals or community leaders who were co-opted by corporations wanting to exploit the communities' land and resources. An example of this occurred in Ulu Teru, Baram where the community leader (*Penghulu*), a few longhouse headmen (*Tuai Rumah*), and a few members of the community sided with a company who wished to lease the customary lands of the Iban communities for an oil palm plantation.

This case underlines the power of maps and why community mapping is important to counter mapping by private interests. The company had done a mapping survey and recognized only the cultivated areas (*temuda*) of those who supported the plan. For those who did not support the plan, their temuda and the rest of their customary land were classified as state land, as in the case of the Sungai Bong community.

There are also cases where corporations persuaded a neighboring community to side with them against another community. An example of this occurred in Ulu Baram between a Penan and Kenyah village, where the Penans had filed a court case against a logging company for encroachment. In response, the company got the Kenyah to side with them and filed an affidavit claiming the disputed area was in their territory.

Corporations have also collaborated with government

agencies and international funding agencies to map forested areas within the customary land in the name of "sustainable logging." The maps would include the community's longhouse/village but not address other customary rights that normally fall under pemakai menua. For example, the failed FOMISS project in the Upper Baram region neglected the rights of the communities, prompting these communities to pursue court recognition of their rights to the area (Colchester 2000).[9]

There have also been cases where individuals approached BRIMAS to produce a community map with the intent of using the map to negotiate with corporations while ignoring the rights of other community members. Having NGOs produce a map would be much cheaper than engaging a private mapping company. It is therefore imperative for NGOs such as BRIMAS to screen these requests to avoid being engaged in mapping activities that would infringe upon the native customary rights of the community as a whole.

Limitations and challenges of community-based mapping

The demand for community mapping is increasing all over the state, putting tremendous strain on NGOs and CBOs who are already heavily burdened with their current workload. Most acutely, there are very few skilled and knowledgeable personnel within the NGOs who work with community maps. Some groups still lack the necessary knowledge and skills to produce maps that meet the standards required for the maps to be admissible in court. More training could enhance their capacity, but resources for training are in short supply.

It is also difficult to get quality candidates for training, especially among youths in the community because there are few youths in the longhouses because they are employed elsewhere; among those who are present, there is a lack of interest because of the pressing need for employment and raising families; and those working for the government fear retribution by the state should they become engaged in mapping activities.

At present, training participants tend to be from the older generation with some being illiterate or poorly educated, limiting their ability to understand the mapping process or the usage of a GPS tool. Because of this, most communities prefer that NGOs carry out the mapping activities as opposed to their own community mappers. The usage of GIS further limits the participation of the communities in producing their maps, since only a select few who have the skill and knowledge in information technology could participate in the GIS training.

Community mapping also faces the challenge of accessing secondary information to create base maps because state law prohibits the distribution of the government's spatial information such as aerial photographs or large scale topographic maps without a "valid" reason. Unfortunately, asserting the native customary rights claims of the community is not considered to be a legitimate cause. Some groups have resorted to using satellite imagery to substitute for topographic maps and aerial photographs, but the cost of obtaining these images could be prohibitive.

In light of the enactment of the Land and Surveyors Ordinance, it is still uncertain whether participatory community maps will still be admissible as evidence in future court proceedings. As of this writing, there are more than forty native customary rights land claims cases that have been filed in court, and about half of them were filed after the enactment of the said ordinance.

The challenge now is to synergize the diverse efforts to defend the land rights of the indigenous Dayaks, and one step toward this goal is to decriminalize community mapping. Involvement and support from intellectuals and leaders from both the Dayak community and the general public are vital to counter the misrepresentation of community mapping in Sarawak. The state legislators, the majority of whom are Dayaks, would have to be influenced to make the right decisions for the good of their community.

CONCLUSIONS

For too long now, the Dayaks in Sarawak have battled the Sarawak State government over logging, plantation operations, and other extractive "development" activities on land that the people claim they have customary rights over. Although the state has conceded that the indigenous peoples do have customary rights on land surrounding their longhouse/village and on nearby cultivated areas, it has consistently disputed the natives' claims to the pemakai menoa especially with regard to the pulau.

This research has allowed community mappers in Sarawak, already burdened with overwhelming work, the chance to reflect and critically evaluate their current mapping activities. From this reflection, it is clear that while community mapping could be a powerful strategy to assert the native customary rights of the Dayaks in Sarawak, it also faces practical and ethical challenges. For NGOs sponsoring community mapping, it is critical to attend to these issues in order to assure that the use of spatial information technology does not ironically undermine the rights of the communities they intend to protect.

1 "Native customary rights" (NCR) is defined in Section 2 (a) of the Sarawak Land Code Chap. 81, 1958 which reads, "land in which native customary rights, whether communal or otherwise, have lawfully been created prior to the 1st day of January, 1958, and still subsists as such."

2 The case of Nor Ak Nyawai & 3 ors v Borneo Pulp Plantation Sdn. Bhd. & 2 ors, at the Kuching High Court, Sarawak.

3 Section 20: "*Approval of cadastral land surveys*: No cadastral land survey or survey plan thereof shall be accepted or adopted for the purpose of the Code or any other ~ written law unless it has been approved by the Director of Lands and Surveys or by other officer authorised by him to approve survey plans on his behalf." Section 23: "*Illegal Practice*: Any person who, not being a land surveyor, wilfully and falsely pretends or takes or uses any name or title implying that he is a land surveyor, or being a land surveyor or a Government surveyor certifies as to the accuracy of any cadastral land survey or signs or initial any survey plan, or not being a surveying assistant acting under the immediate personal direction and supervision of a land surveyor, carries out or undertakes to ~ carry out any work, in connection with a cadastral land survey, 'shall be guilty of an offence and shall, on conviction, be liable to a fine not exceeding fifty thousand Ringgit or to imprisonment not exceeding three years or to both for each offence, and to a further penalty of one thousand Ringgit for each day during the continuance of such offence."

4 The Borneo Project is an NGO based in Berkeley, California, U.S.A. and partner to this research.

5 Questions and the analytical approaches have been discussed and formulated together with Judith Mayer, a volunteer with the Borneo Project, during the East-West Center Workshop on Spatial Information Technology (SIT) in Community-Base Mapping in Chiang Mai, Thailand on 23 - 27 June 2003.

6 See Appendix A.

7 The 1992 Native Court Ordinance provides for the existence of a Native Court to administer and enforce the customary law or *adat* in the event of disputes between natives in Sarawak.

8 See Appendix B.

9 FOMISS (Forest Management Information System Sarawak) was a collaboration between the Sarawak Forest Department, the German Agency for Technical Cooperation (GTZ), and the Samling Group to set up a pilot project for a sustainable forest management system in the Ulu Baram region.

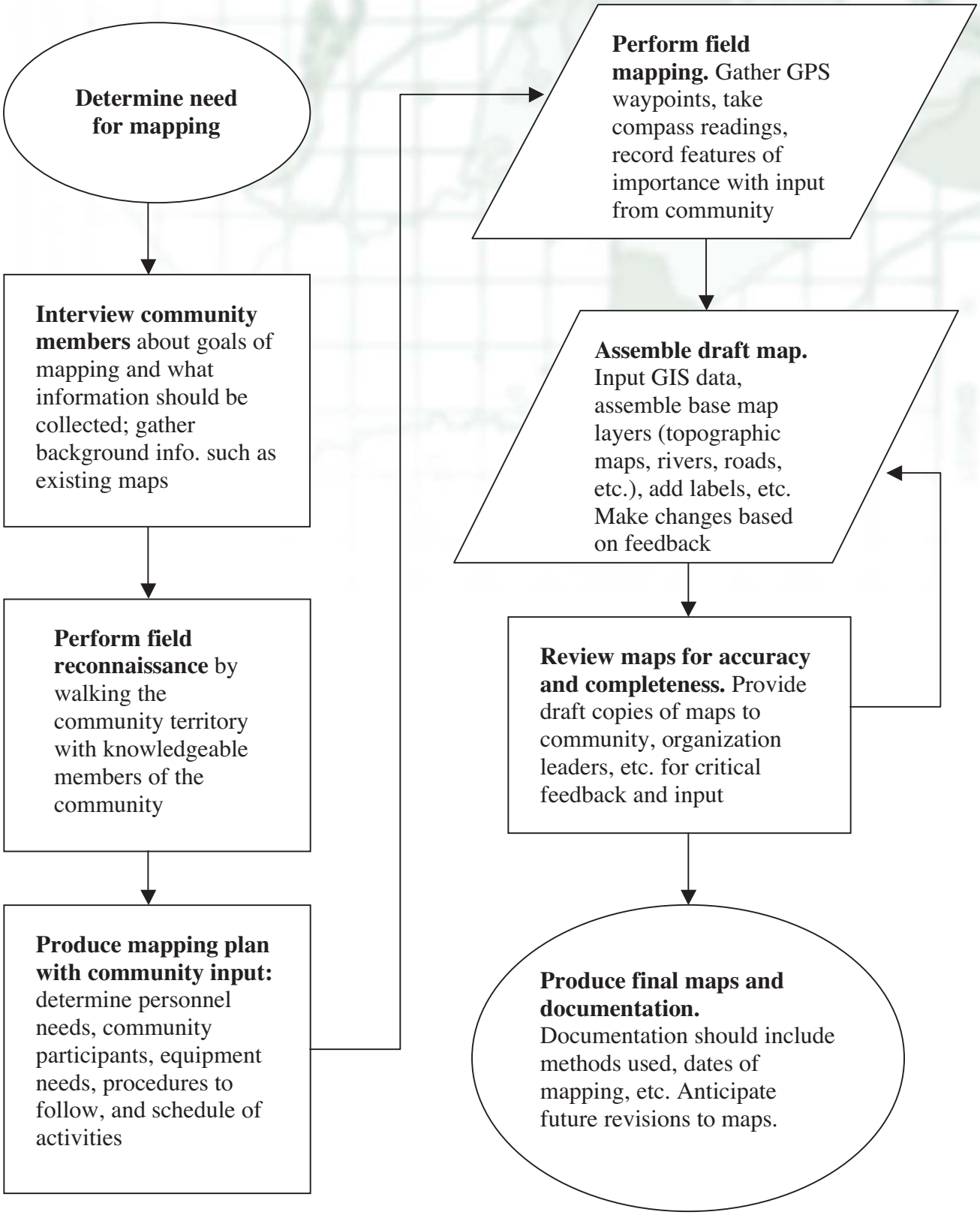
APPENDIX A

The table below lists the thirty-three communities surveyed from the start of 2003

No.	Area/Longhouse/Village	Watershed	District	Ethnic Group(s)
1.	Ba' Puak	Puak	Baram	Penan
2.	Ba' Bare	Bare	Baram	Penan
3.	Rumah Siba	Simalajau	Bintulu	Iban
4.	Plaman Engkeroh	Mongkos	Serian	Bidayuh
5.	Plaman Limi	Mongkos	Serian	Bidayuh
6.	Plaman Ri'ih Daso	Mongkos	Serian	Bidayuh
7.	Plaman Temiah Anjur	Mongkos	Serian	Bidayuh
8.	Kampung Sungai Niang	Mongkos	Serian	Bidayuh, Iban
9.	Sungai Bong	Tinjar	Baram	Iban
10.	Kampung Jepak	Kemena	Bintulu	Malay, Melanau
11.	Kampung Keranji		Lundu	Selako
12.	Sungai Limo		Lundu	Iban
13.	Ba' Madihit	Madihit	Baram	Penan
14.	Sungai Selampit	Selampit	Lundu	Bidayuh
15.	Kampung Semada		Simunjan	Iban
16.	Sungai Jenggara (Ara)	Krian	Saratok	Iban
17.	Rumah Usek	Kriok	Niah	Iban
18.	Sungai Manong	Manong	Niah	Iban
19.	Sungai Tepus-Balingian	Balingian	Balingian	Iban
20.	Ulu Limbang	Limbang	Limbang	Penan
21.	Ulu Magoh	Magoh	Baram	Penan
22.	Sungai Bawan	Bawan	Balingian	Iban
23.	Bukit Limau, Ba' Duyan	Bawan	Baram	Penan
24.	Long Teran Kanan	Tinjar	Baram	Kayan
25.	Sungai Selezu	Selezu	Sebauh	Iban
26.	Sungai Setulai	Setulai	Sebauh	Iban
27.	Rumah Nyawin		Simalajau	Iban
28.	Rumah Dundang		Simalajau	Iban
29.	Rumah Nor	Sekabai	Sebauh	Iban
30.	Kampung Lebor	Krang	Serian	Iban
31.	Kampung Merakai	Krang	Serian	Iban
32.	Sungai Basai	Basai	Balingian	Iban
33.	Rumah Mat	Lamaus	Niah	Iban

APPENDIX B

The table below lists the thirty-three communities surveyed from the start of 2003



INSTITUTIONAL IMPLICATIONS OF COUNTER-MAPPING TO INDONESIAN NGOs[1]

By Albertus Hadi Pramono

This paper seeks to answer questions concerning how SIT changes organizations and how organizations mold technology to meet their needs. NGOs in Indonesia are small organizations that are financially dependent on external sources. These groups are likely to have more difficulties in starting and keeping the technologies running. One difficulty comes from the dependence on a GIS operator who becomes a "champion" to the organization. Unlike in the U.S., however, the problem was not from fatigue, but from internal conflicts within the organizations. Another difficulty is due to their heavy dependence on external sources of funds, particularly from international funding agencies. Heavy dependence on external funding agencies requires the NGOs to build networks as a means of approaching donors. Managers of the NGOs and/or counter-mapping programs, therefore, have to set aside considerable time for fund raising, reporting, and networking. The study shows that SIT demands considerable and stable resources of NGOs to run their mapping programs. Such demand is higher for computer-based mapping technologies, which is not easy for the NGOs to meet. Two major issues the NGOs are struggling to meet are skilled personnel and funds to operate and maintain the technologies. Furthermore, this survey initially shows that SIT brings certain practices and social relations. The more sophisticated the technology the more complex the practices and social relations. Therefore proponents of counter-mapping should be aware of these problems before they make a decision to adopt SIT.

Counter-mapping is an interesting phenomenon, because it is a social movement that heavily relies on spatial information technologies (SIT) ranging from simple sketch mapping to computer-based geographic information systems (GIS) to pursue its goals. The movement grew as a reaction to land and resource conflicts in which SIT provided the technology to assert spatial claims, and it has attracted attention in geography and anthropology (Peluso 1995, Herlihy & Knapp 2003) and recently in science and technology studies (Turnbull 1998).

The availability of computer-based SIT in the form of user-friendly GIS software, low cost global positioning systems (GPS), and remote sensing image analysis software has enabled many disenfranchised groups to make their own maps, since the technology has become less expensive and more easily available. Due to this development a number of non-government organizations (NGOs) have begun using these technologies to develop a deeper and more fully conceptualized understanding of indigenous claims to land and to design resource management plans and conservation studies that are compatible with local land-use norms and practices. In the last decade, counter-mapping has gained such widespread support that it is in danger of becoming the "thing to do," a magic bullet that is applied

uncritically or simply misused. As Sieber (2000: 776) writes: "GIS may become essential to obtain grants and data, to create competing models, to 'talk the talk' of the bureaucrats, and to appear more scientific."

GIS has attracted much attention to NGOs as it provides the capability to influence public policy through the sophistication of analysis and presentation of powerful images. Sieber (2000), however, argues that in adopting this technology NGOs face particular challenges that are different from those facing government agencies and private businesses. The organizational systems of NGOs are generally more fragile, both in their ability to attract and retain resources and in their capacity for holding together memberships that consist of individuals with diverse goals and strategies. Sieber (2000) also suggests that the success of GIS ultimately rests on a group's ability to "conform" to the rules and procedures of GIS adoption.

In her research Sieber (2000) analyzed a number of case studies of urban, middle class-based environmental NGOs in the U.S. that attempted to use GIS in their organizations. She assessed five properties of the NGOs:

- Accommodation (in organizational practices)
- Centralization (in resources)
- Formalization (in structure and relations)
- Standardization (in data definition and models)
- Acquiescence (in ideology, values, strategies, and goals)

She found that some NGOs did not have the necessary GIS capacity, requiring it to outsource the program or use a member's computer to accommodate GIS. Furthermore, those that had the units tended to rely on one GIS "champion" who got burned out in a short time due to the workload. Finally, some NGOs were influential in setting the standard of work for a given area, while others had to struggle in sharing data among its members. From these findings Sieber concludes that NGOs must conform to GIS practice to ensure effective usage; however, in the actual development of their programs they molded GIS practices to their own objectives.

The current study, inspired partly by Sieber's study, brings similar questions to Indonesian NGOs that just recently started using GIS. Since many parts of the country still do not have electricity, computer users tend to concentrate in big cities. Therefore, the utilization of GIS by Indonesian NGOs may have different organizational impacts, which this study intends to explore.

This study is a part of the NSF-funded Spatial Information Technology and Society project that focuses on the organizational implications of NGOs that adopt spatial information technologies. Through this study I especially want to explore how the technology changes the organization and how the organization molds the technology to meet its needs. The concept of technology for the purpose of this project does not merely refer to

tools, but also to a web of values, practices, production systems, etc. The hypothesis this project seeks to explore is

The adoption of GIS by NGOs is problematic because of social context, the potential for co-optation, and a lack of resources.

Some of the specific questions the project seeks to explore include:

- When or how does an NGO decide whether or not to make the investment in developing a GIS component to their work? This is both a strategic question (what do we have in our "toolbox"?), as well as a logistical question (can we find the trained personnel, money, hardware, and software to make this work?).
- Can and how do NGOs sustain operating costs beyond initial investments?

In this research I survey how the adoption of counter-mapping programs and spatial information technologies affect Indonesian NGOs. Specifically I want to know:

- Why and how do NGOs adopt mapping into their programs?
- How do mapping programs affect the operations and resources (institutional and human) of the NGOs?

The survey employs semi-structured interview techniques based on two sets of questionnaires, one on counter-mapping programs in general and the other on the use of geographic information systems (GIS) in the NGOs. I interviewed at least two representatives from each NGO; one was the program manager or director, while the others were those responsible for implementing the mapping program. The respondents to this survey are from four NGOs in four different regions in Indonesia with different backgrounds: Yayasan Tananua Sumba (YTNS), Pemberdayaan Pengelolaan Sumber Daya Alam Kerakyatan Pancur Kasih (PPSDAK), Watala, and Yayasan Tanah Merdeka (YTM).

RESPONDENTS

Profiles of the respondents and brief histories of their mapping programs

1. Yayasan Tananua Sumba (Tananua Foundation of Sumba)

This Waingapu based NGO was established in 1985 by a group of community organizers who had previously worked for the Oklahoma City based World Neighbors. YTNS has a branch on nearby Flores Island and has a total paid staff of twenty-nine (as of November 2003). It is a development NGO with emphasis on natural conservation and community development, primarily through agroforestry, since droughts and food scarcity have been major threats to the region. This organization is a member of Konsorsium Pengembangan Masyarakat Nusa Tenggara (KPMNT, Consortium on Community Development in Lesser Sunda Islands), a Ford Foundation initiated network on community development previously focused on upland agriculture in the region. This consortium has five priority sites including Laiwanggi Wanggameti National Park (LWNP), where the villages in which YTNS began its agroforestry program are located.

The creation of the national park created boundary conflicts that still persist today. As one of its priority sites, KPMNT decided to start a mapping project to understand the conflicts around the park. The consortium then chose Waingapu based Koppesda, another member of the consortium, to implement the mapping activities with the assistance from the Environment Program of the East-West Center (EWC).[2] With a grant from the Ford Foundation, the EWC provided training, technical assistance, and equipment to Koppesda to develop GIS and computer-generated maps. However, in 2001 the person entrusted with the mapping left Koppesda when the project was far from completed. The EWC then approached Huki Radandima, the director of YTNS, asking his organization to become involved in the project. He agreed as he saw mapping as crucial to YTNS' community development efforts, particularly in clarifying people's rights in LWNP.

However, the equipment acquired for this mapping project remained at Koppesda, necessitating reliance on a Jakarta based consultant to finish the work and to train two YTNS staff members as surveyors. Therefore YTNS adopted SIT unplanned and unprepared as it took over the role of local partner to the EWC in order to complete an unfinished project.

2. Pemberdayaan Pengelolaan Sumber Daya Alam Kerakyatan (PPSDAK) (Empowerment of People's Natural Resource Management) Pancur Kasih

PPSDAK is a unit of SEGERAK (Sekretariat Gerakan Pemberdayaan Masyarakat Dayak, the Secretariat of the Movement of Dayak Peoples' Empowerment) Pancur Kasih, a Pontianak (West Kalimantan) based indigenous Dayak organization that was first established as a social organization with activities in education. After a new generation of university graduates of Dayak descent joined the organization, Pancur Kasih began to build a Dayak movement by establishing units to work on cooperatives, research, community forestry, and indigenous rights as a means of empowering Dayak peoples. Through its interactions with the environmental movement at the national level, Pancur Kasih learned that mapping land claims is central to defending indigenous land rights.

To tap the knowledge about mapping a researcher from the Institute of Dayakology Research and Development (IDRD), Pancur Kasih's research unit on Dayak cultures, joined mapping exercises at the site of the proposed Kayan Mentarang National Park (East Kalimantan). The Worldwide Fund for Nature (WWF) had just started employing SIT to map ancestral lands around the park as a part of its Ford Foundation funded Culture and Conservation project with the assistance of Jefferson Fox from the EWC. With the help of Frank Momberg, a consultant from the WWF, the IDRD carried out the first mapping exercise in Sidas Daya (northeast of Pontianak) in 1994. Other Dayak communities heard about this exercise and began to request Pancur Kasih to map their lands. A year later Pancur Kasih set up PPSDAK as a unit that works primarily to map indigenous Dayak lands and to advocate for the recognition of adat (indigenous) lands. With land hungry economic activities, primarily forest and plantation concessions, continuously threatening indigenous lands, requests from Dayak groups kept coming to PPSDAK asking the latter to map their kampongs (indigenous villages of Dayak peoples). This Pancur Kasih unit rapidly developed and by 2003 had mapped a total area of 1,037,709 hectares of Dayak lands or about 7% of the lands in West Kalimantan province.

With grants from the Ford Foundation and the now defunct USAID funded Biodiversity Support Program, PPSDAK now has an office that houses mapmaking equipment and GIS with a staff of thirteen, mostly those directly involved in its mapping program. To accommodate the large number of requests from Dayak communities to map their lands, PPSDAK recruits and trains non-paid community mappers who assist the NGO in promoting its mapping program to the communities and in collecting data.

I found slightly different understandings among the staff members regarding the purpose of adopting counter-mapping. One respondent said that the goal of adopting the counter-mapping program for PPSDAK is to return peoples' rights to lands and natural resources and to promote awareness of land rights. Another respondent stated that the goal is to document peoples' territories in the form of maps. Whatever the case, defending indigenous lands through mapping is the clear goal.

Due to its focus on mapping and its achievements in mapping indigenous lands, PPSDAK has been a key player, and can even be considered as a center of excellence in the counter-mapping movement in Indonesia. This organization has provided training to most Indonesian NGOs that have counter-mapping programs. Its programs cover government/business observation, media/public campaigns, environmental monitoring, and community organizing.

3. Watala

Watala was founded in 1978 as a nature lovers club by the students of the Faculty of Agriculture at the University of Lampung. This Bandarlampung (Lampung) based NGO has programs on outdoor activities and community development. This organization also has programs in environmental monitoring, environmental campaigns, community organizing, and small-scale economic enterprise development.

Watala learned counter-mapping when the Bogor (West Java) based LATIN, a national NGO active in developing community-based natural resource management models, and the Southeast Asian Regional Office of the World Agroforestry Centre (better known as ICRAF) involved this local NGO in their joint Ford Foundation funded project on the damar forests of Krui on the western coast of Lampung. Their first mapping exercise took place in 1996 with the assistance of Frank Momberg to map the lands of margas, indigenous villages in southern Sumatra. ICRAF and Watala continue their collaboration and have a new site in a mountainous area of Sumber Jaya subdistrict where migrants primarily from West Java settle on Ministry of Forestry claimed forest areas. Watala actively carries out mapping programs in this subdistrict and maintains a GIS.

4. Yayasan Tanah Merdeka (Free Land Foundation)

YTM was founded in 1992 in Palu (Central Sulawesi) by a group that split from a local development NGO over their decision to support the development of a hydroelectric power plant in nearby Lore Lindu National Park (LLNP). Since then YTM has been active in advocating indigenous land rights, initially in the park and later in a nickel mining concession in the southeastern part of the province. With a paid staff of fifteen (as of June 2004), most of whom are graduates of the local public university (Tadulako University), this group is a leading NGO in Central Sulawesi. Its programs include government monitoring, public campaigns, and community organizing.

YTM adopted counter-mapping to provide a tool for advocacy, to produce evidence of land rights, and to document forest management. Arianto Sangaji, then the head of its advocacy division, introduced mapping to the organization. Its first mapping exercise took place in 1996 in a village at the boundary of Lore Lindu National Park. Alix Flavelle, a Canadian geographer who had been active in promoting counter-mapping in Southeast Asia and who wrote a handbook on community mapping, taught the basics of mapping. Villages around the park were the target areas for the BSP funded national program of JKPP (Jaringan Kerja Pemetaan Partisipatif, Indonesia's NGO Network on Participatory Mapping) promoting counter-mapping in the country. In 1998 a mapping staff member attended a short training on mapping methodology in West Kalimantan organized by PPSDAK. With these inputs, YTM developed its own methodology and produces geo-referenced sketch maps.

CAPACITY IN SIT

The four NGOs in this survey have different capacities and approaches in their mapmaking. The range from PPSDAK with a mapping staff of ten and an active GIS unit to YTNS with two part-time mappers and no mapping equipment, and from computer generated maps (YTNS, PPSDAK, and Watala) to the geo-referenced sketch maps of YTM.[3] Nonetheless, for all of them SIT was a new "budding" that required a long process of adaptation to the technology.

When they decided to adopt counter-mapping, none of the organizations had technical expertise in mapmaking, not to mention cartography, GIS, and surveying. Only after making that decision did their staff members began to learn the basics of mapping. Among the staff members of these NGOs, only two had formal training. One person, who is at PPSDAK, graduated from a one-year diploma program in surveying that he began after he had been involved in mapping for a couple of years.[4] The other, who is with Watala, obtained a three-year diploma in surveying and is now the head of its GIS division; he joined the program three years after the organization adopted counter-mapping. Other staff members from these NGOs have first

degrees in social sciences, agriculture, and theology and some are just high school graduates. They gained knowledge on mapmaking from short training sessions, either given by consultants with training in cartography and spatial analysis or by other NGO activists (primarily from PPSDAK) with training on counter-mapping techniques.

Although all of them have compasses and measuring tapes for mapmaking, these NGOs survey the villages using hand-held geographic positioning system receivers (GPS). This shift is quite likely due to the new development of GPS, which is not only capable of taking geo-referenced positions but also of measuring distance and area. This capability virtually enables anyone to rapidly collect cartographic information.

All the respondents have computers for their work, but only PPSDAK and Watala have computers assigned specially for their mapping programs. The main reason is that only these two NGOs operate GIS units. The GIS unit at Watala is headed and operated by the abovementioned diploma holder in surveying. Meanwhile the person in charge of the unit at PPSDAK is a former field mapper with no expertise on GIS, who was appointed to take over the position when his predecessor left over turmoil within the organization.

After earlier years of manual mapmaking from which the maps are later digitized, today PPSDAK produces maps digitally based on geo-referenced spatial information from the kampongs, as technological developments allow. However, this shift creates an overload for its GIS division and its staff of two, which tries to keep up with the inflow of new maps. There is additional pressure due to PPSDAK proposals that promise to map a target number of villages within the project period. The need to meet the targeted numbers leads to an accelerated process in mapping. Such situations also occur at Watala, since their work is concentrated in one subdistrict.

ORGANIZATIONAL DYNAMICS

Given the fluid nature of NGOs whose staff members can enter and leave the organizations easily, the mapping staffs of the respondents have been relatively stable. Most staff members who started the mapping programs are still working and have become the managers or coordinators of the programs. PPSDAK, where personal conflicts between its staff and executives of its mother organization have resulted in the loss of key people, is the exception. Those who entered the mapping program later in its evolution have tended to stay at the organizations. In this survey, I did not pursue the reasons for their loyalty. However, better salaries compared to public employment, a higher level of freedom at work, opportunities to learn on the job, and travel opportunities for work and networking are quite likely to contribute to such loyalty. Staff members at PPSDAK have an even better package. In my discussions with them outside the context of this research, I sense a considerable level of economic and social security. As a part of Pancur Kasih, they have a pension plan and are members of a credit union that enables them to borrow money at low interest rates and buy their everyday needs at discounted prices. Another important reason is that all of its staff members are Dayak, and Pancur Kasih is the symbol of the reemergence of the Dayak movement.

PROGRAM MANAGEMENT

Funding

All NGOs rely heavily on external funding, primarily from international funding agencies, to develop and implement their mapping programs. The Ford Foundation and the now dissolved BSP were the major funders for these NGOs. However, only PPSDAK received large block grants directly from these funding agencies, whereas the three others obtained the monies through either a national NGO/network (Latin or JKPP) or international research organizations (such as the EWC or the ICRAF).[5] PPSDAK requires local communities to raise funds to implement the mapping exercises in their own kampongs, but these funds

are too small to pay for the full expenses of its program.

Heavy dependence on external funding creates problems for the NGOs in maintaining their equipment. All of them purchased equipment with the grants they received. After the grant period, however, some of them cannot repair, not to mention to replace, broken or lost equipment.

Time management

As is true for other NGOs, fund raising, reporting, and networking are crucial for these organizations. Fund raising involves proposal writing and negotiations with funding agencies. This can be a long process, since the grantmaking agencies may require the NGOs to frequently revise their proposals. Another possible delay in obtaining grants is that funding agencies work on certain funding cycles. Once the funds are approved, grant recipients are required to produce narrative and financial reports periodically, generally quarterly for the former and annually for the latter. In addition to producing reports for their funders, each organization generally has its own reporting system. Finally, networking often meshes with fund raising since access to donor agencies increases through it. Through networks the NGOs can advance their interests at the regional and national levels. Another important aspect is that NGOs can learn from each other about new approaches and meet key contacts for their programs, including funding agencies. This means that staff members who manage these programs have to set aside time to pursue all of these activities. The time spent on these activities reduces the time that the staff members spend implementing the programs.

The directors and/or managers interviewed in this survey have to set aside a total time of one to three months in a given year for fund raising, reporting, and networking. Over the course of the year, these activities often disrupt program implementation. Further burdens can come from activities of the NGOs outside their core business. The head of the GIS division at PPSDAK, for example, complained about this, particularly since his organization is also involved in several networks including one that monitored the 2004 parliamentary and presidential elections. On top of the demand to produce numerous maps of kampongs in a limited time, he had to coordinate hundreds of election observers in West Kalimantan.

CONCLUSION

Although the reasons for their adoption are different from those of state agencies and the corporate world, SIT and GIS require NGOs to provide the same kind of resources and practices in order to invest in and maintain the technologies for their counter-mapping programs. However, given their relatively small sizes and financial dependence on external sources, NGOs are very likely to have more difficulties in starting and keeping the technologies running. In the case of Indonesian NGOs, such a lack of resources and problems in practices are obvious, both for setting up and maintenance.

In this study I surveyed four NGOs that had somewhat similar reasons for adopting counter-mapping. Two of them employ mapping in a straightforward manner for the

photo: Martin Hardiono

photo: Martin Hardiono

purpose of defending land rights, while the other two seek to promote community-based resource management with a hidden agenda of enhancing land claims. Among the four respondents, only YTNS does not have an active mapping program because it does not possess the required resources to implement computer-based mapping. The other three NGOs have different levels of activity. PPSDAK is by far the most active one. It continues to receive requests from Dayak groups to map their lands, and it sets a target on the number of villages to be mapped within a certain time frame. On the other hand, Watala and YTM focus only on certain areas, as mapping is only a part of their community development processes.

All four NGOs developed their capacities in mapping almost from scratch since they did not have any expertise or resources when they decided to adopt counter-mapping. They learned mapping techniques from researchers or consultants, primarily those who had links with the Ford Foundation. However, they had experience in PRA, out of which approaches in counter-mapping in Indonesia grew from. They further developed their own approaches in conducting their programs. Two of them had even established GIS in a relatively short time using the grant monies they obtained to set up their counter-mapping programs. Increased accessibility of the technology largely contributed to this development. However, the adoption of GIS technology engenders several consequences that make it difficult for NGOs to maintain.

One difficulty comes from their dependence on a GIS operator who becomes a "champion" to the organization. As Sieber (2000) found in the U.S., once the "champion" leaves, the NGO has to either find someone else to replace the operator (as in the case of PPSDAK) or end its mapping program altogether (as in the case of Koppesda in Sumba).

As opposed to Sieber's examples, the problem was not from fatigue, but from internal conflicts within the organizations.

Another difficulty stems from their heavy dependence on external sources of funds, particularly from international funding agencies. Among these agencies, the Ford Foundation and the recently dissolved BSP were the major donors for, and also the key promoters of, the counter-mapping movement in Indonesia. Such dependence affects the maintenance of equipment beyond the initial investment. Once a device is broken or lost, it is unlikely to be repaired or replaced without the availability of a new grant. Therefore the equipment still seems expensive for many Indonesian NGOs despite its decreasing costs. Such dependence may even threaten the maintenance of the programs themselves, as the NGOs do not have alternative sources of funding for their mapping programs.

Heavy dependence on external funding agencies has another consequence. This dependence requires that NGOs build networks as a means of approaching donors. Managers of the NGOs and/or counter-mapping programs, therefore, have to set aside considerable time for fund raising, reporting, and networking. This load strains the managers and thus the organization as they are forced to reduce the time they devote to program implementation.

This survey shows that SIT demands considerable and stable resources in order for NGOs to run their counter-mapping programs. Such demands are higher for computer-based mapping technologies that are not easy for the NGOs to meet. Two major needs the NGOs are struggling to find are skilled personnel and funds to operate and maintain the technologies. Furthermore, this survey shows that SIT brings certain practices and social relations. The more sophisticated the technology the more complex the practices and social relations. Proponents of counter-mapping should be aware of these potential problems before they make a decision to adopt SIT.

1 Paper prepared for the writing workshop on Spatial Information Technology and Society, Honolulu, 27 September - 8 October 2004.
2 Counter-mapping activities around LWNP are known as *pemetaan akses*. The WWF's Kupang office introduced this term which may mean mapping people's accessibility to the park.
3 These two mappers were actually assigned to assist the consultant hired by the EWC in taking geo-referenced points, as the latter did much of the work in mapmaking.
4 Actually other staff members have some degree of mapmaking, but not basic knowledge of cartography. For instance, the current head of PPSDAK's Mapping Division, who is among the first employees, graduated from a vocational school in building construction and has some knowledge in map drafting which was the reason he was recruited.
5 During the 1997 economic crisis when the Indonesian currency (rupiah) devalued drastically against the U.S. dollar, PPSDAK gained a large exchange difference and was able to purchase a well-equipped office.

REFERENCES

Herlihy, P. H., and G. Knapp. 2003. Maps of, by, and for the peoples of Latin America. *Human Organization* 62(4): 303-

Peluso, N.L. 1995. Whose woods are these? Counter-mapping forest territories in Kalimantan, Indonesia. *Antipode* 27 (4): 383-406.

Sieber, R.E. 2000. Conforming (to) the opposition: The social construction of geographical information systems in social movements. *Int. J. of Geographical Information Science* 14(8): 775-793.

Turnbull, D. 1998. Mapping encounters and (en)countering maps: A critical examination of cartographic resistance. *Knowledge and Society Research in Science and Technology Studies: Knowledge Systems.* 15-44

BUILDING LOCAL CAPACITY IN USING SIT FOR NATURAL RESOURCE MANAGEMENT IN EAST SUMBA, INDONESIA[1]

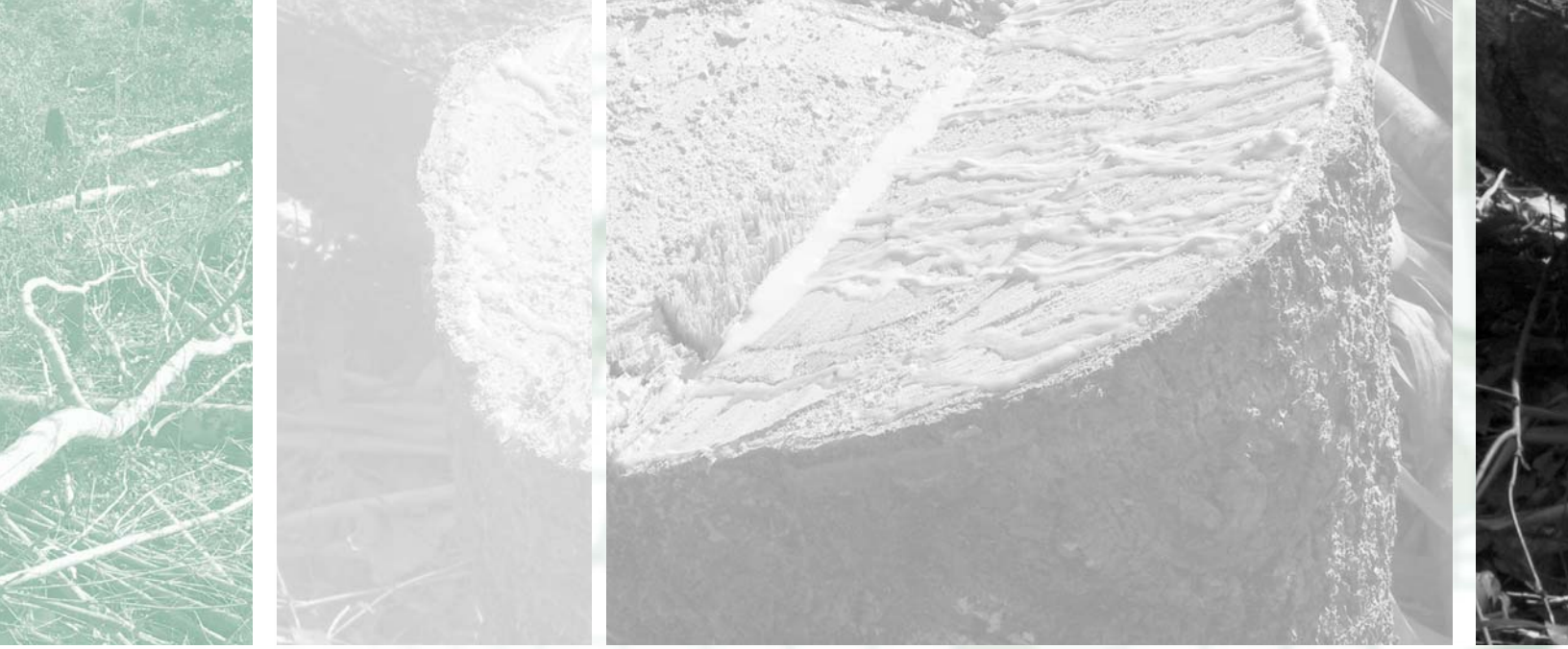
By Martin Hardiono, H. Radandima, Krisnawati Suryanata, and Jefferson Fox

This paper examines a project designed to build local capacity for natural resource management through training and by providing basic GIS equipment in order to raise the technical quality of community maps. The paper documents the contradictions that arose from this effort. On the one hand there was a need to "formalize" community maps in order to meet cartographic standards and to enhance their legitimacy for boundary negotiations against the state. On the other hand, the shift toward more technical mapping exacerbated the conceptual gaps between mapping facilitators and villagers or other stakeholders interested in natural resource management. The project managed to produce excellent GIS maps with the help of community members and encouraged villagers to "tell their own stories" through "their own maps." But the project failed in many other important respects. The project demonstrated the complexity of personnel management and inter-organizational dynamics of a loose networks of NGOs. Local capacity, in terms of both skills and equipment, was not improved. Despite numerous efforts to consult community members regarding map "ownership" throughout the mapping process, the final agreement regarding the fifteen maps that were produced by the project failed to satisfy many stakeholders.

INTRODUCTION

Spatial information technology (SIT) can be a valuable tool for the planning and management of natural resources. Maps can also be used by communities who wish to defend their customary rights against the incursions of external interests, including the state. One may argue that a community's best chance for retaining access to a resource may be to prove that they are indeed already managing it. SIT can help demonstrate the close and continuing connection between a community and their land by illustrating the spiritual, political, and economic dimensions of human land relations.

One set of methods that emphasizes mapping as a means both for understanding how communities use space and for empowering communities in defending their customary rights, is participatory rural appraisal (PRA). Participatory mapping encourages villagers to draw and model their territory and resources as a means for negotiating their rights. For example, Sirait et al. (1994) demonstrated a method for mapping the customary land systems of people living in or near a nature reserve in Indonesia using oral histories and sketch maps that was combined with data from Global Positioning System (GPS) units to produce Geographic Information System (GIS) maps. Information was gathered from different groups within the community– village elders, youths, and women. These views were then compared and discussed in order to revise village and



reserve boundaries, develop a commonly agreed zonation model, strengthen local customary institutions, and raise awareness of nature conservation.

While SIT provides tools for telling alternative spatial stories and for giving voices to people at the periphery, it is important to understand the context and complexity of these efforts. While local people's spatial knowledge may seem to be incomplete, distorted, schematized, and augmented (Downs and Stea 1973:18), they are generally fluid and flexible. Boundaries can be constantly adjusted and negotiated to respond to ecological, economic, and demographic changes. Translating these cognitive maps into cartographic maps carries the risk of weakening this fluidity. This impact is even more pronounced if the maps are considered to be "final products," neglecting the reality that working with spatial information is a process requiring revisions and changes.

Community maps are generally created through a series of interviews with local people. As such, the product is socially constructed and subject to the types of relationships that develop between villagers and the people who facilitate the mapping. Mapping facilitators play a critical role in "translating" local spatial knowledge into a cartographic map or GIS. While mapping facilitators are generally aware of epistemological biases in conventional mapping that often exclude the voices of local people, they are not immune to this problem either, especially if the facilitators come from outside the community.

Meanwhile, there is a growing realization that sketch mapping's effectiveness for asserting community rights against external interests is limited. Technical maps that meet cartographic standards are required in formal negotiations with the state. This paper examines the experience of a project whose goal was to build local capacity in the management of spatial information in Sumba, Indonesia. The project had two objectives: 1) to raise the technical measure of participatory mapping activities, which might include building GIS; and 2) to minimize the distance between mapping facilitators and communities, allowing the maps to become "living documents" that could be revised and remapped as circumstances change. The project suffered from structural challenges in both the conceptual and organizational realms that hampered its effectiveness.

BACKGROUND OF COMMUNITY MAPPING IN NUSA TENGGARA

In Nusa Tenggara, the use of maps and mapping by local communities can be traced back to the early 1980s when the World Neighbors, a U.S.-based NGO that had been working with small farmers in Sumba and Flores, introduced sketch mapping to assist in the planning of tree planting and soil conservation strategies in individual farm plots. During a series of sketch mapping exercises in the field, it

became apparent that maps and mapping were especially useful in enhancing farmers' understanding of broader environmental dynamics, shedding light on soil conservation initiatives undertaken in adjacent fields. Between 1981 and 1987, the World Neighbors carried out a series of visioning workshops for farm management and farmer-to-farmer field trips, in which sketch mapping was an effective tool for facilitating communication among farmers and for enhancing participation.

By the early 1990s, a loosely organized network of government agencies, domestic and international non-governmental organizations, universities, and community representatives from key conservation sites working in Nusa Tenggara were operating under the umbrella of the Nusa Tenggara Community Development Consortium. Consortium members met annually to share information on their work in community development, to synthesize lessons learned, to identify key themes from ongoing field programs, and to define collaborative activities. The sketch mapping capacity of the consortium was enhanced when ten people from its member organizations attended a workshop on Participatory Rural Appraisal (PRA) methods in India that included an introduction to participatory mapping.

Consortium members further realized the value of working with maps when they were confronted by regional boundary disputes. These disputes emerged when the Ministry of Forestry began to regulate access to forestlands to follow the newly established plan for forestland use (*Tata Guna Hutan Kesepakatan* or TGHK). The disputes involved discrepancies between boundaries of areas customarily claimed by the communities, those set by the Indonesian TGHK in 1984, and those set as conservation forests by the Dutch colonial administration early in the 20th century. In negotiations between local government officers and communities to resolve these discrepancies, the government officers stated that communities could continue accessing resources that they could document using at the time of the negotiation. These cases underlined the value of community mapping as a tool for negotiating and asserting the communities' claims over resources.

Consortium members realized that while local level sketch mapping was useful for farm planning and resolving intra-community conflicts, more formal maps that abided by cartographic standards were required for asserting community rights against the state. For this reason, several organizations that were members of the consortium sought and received funding from the Ford Foundation to initiate parallel projects for building local capacity for resource management in protected areas. This paper addresses the experience of a project implemented by the East-West Center that sought to improve the capacity for regional organizations to collect, analyze, and distribute spatial information. More specifically the project envisioned training three young professionals and giving them the spatial information skills necessary to work with consortium members. It included training in acquiring and analyzing spatial information, building capabilities for spatial information analysis at the local level, and conducting regional level mapping projects in Sumba.

The project began in 1997 with two main activities: training three members of local NGOs in the basic skills for acquiring and analyzing spatial information; and procuring the equipment necessary to gather and analyze spatial information. Staff members would then be assigned to work at either the local or regional level to assist other consortium members interested in acquiring maps and other forms of spatial information for their case studies. In the later stage, the project sought to help these staff members learn how to analyze data they collected in order to develop insights into resource management problems. As the staff members became proficient in the use of this technology, it was expected that they would provide training to members of local organizations and communities in using maps for communicating resource management issues to government officials and other parties.

A few key institutions within the consortium had leading roles in the project. Capacity building was based at a local

NGO that focused on facilitating communications between research institutions and grassroots organization. Staff members of other research-oriented institutions such as universities and conservation organizations took active parts in the planning and undertaking of participatory mapping activities. At the end of the project, a meeting with all stakeholders was be held to discuss the meanings and implications of participatory mapping, and to establish protocols for sharing maps, data, and systems of spatial information.

The project's design was based on several assumptions. First, participatory mapping activities would involve local communities and thus further familiarize community members with maps and working with spatial information. Through this knowledge it was hoped that villagers could tell their stories of land-use histories and practices and be empowered to claim their customary territories. Second, training key individuals would provide skilled personnel and leadership for a new regional SIT center that would be set up with a grant through this project. Third, the regional SIT center would overcome the constraints of technical access prevalent in remote provinces such as in Sumba, allowing the management of spatial information as a "living document." Lastly, the project would provide a learning experience for all stakeholders to establish working protocols for sharing spatial information that respected the rights of local communities.

REALITIES FROM THE FIELD:

Participatory Mapping and Community Participation

In participatory mapping exercises, available topographic maps were used as a tool to gather information from community members. This information was then recorded on maps that showed geographic features (roads, rivers, settlements) but that contained no annotation or place names. Community members also learned how to spatially transcribe their local information using simple SIT tools such as GPS units, compasses, measuring tapes, and clinometers. Survey results were later drawn on paper using basic trigonometry functions. While field activities were relatively simple, they were time consuming and required surveyors to traverse all the areas to be mapped. The use of aerial photographs and satellite images helped speed up the process as community members could delineate geographic features on the images prior to surveying. During postmapping consultations, community members provided corrections and annotations until they were satisfied with the product.

Before the project started a number of community members had heard about how maps and mapping could help them in solving their problems. There was general enthusiasm and openness with regard to working with maps. Even without prior experience with maps, many people could draw a sketch map and describe geographic features included in the sketch map. With some facilitation, many could also read and utilize aerial photographs and shaded relief maps. As more types of spatial data such as topographic maps, satellite images, or GIS maps were introduced, however, fewer members of the community could readily access the information. For example, when a mapping team from a local NGO brought a topographic map (scale 1:25,000) to a village, most villagers showed little interest, as they could not easily understand the map. People complained that it was too difficult to understand cartographic representations such as contour lines, and that the texts and symbols contained in the map were too small to read. Some of the maps also contained mistakes–such as the mislabeling of geographic features–that affected people's ability to associate the map with the landscape they knew and significantly distorted their first impression of the maps.

This conceptual gap in the capacity of villagers to understand the maps proved problematic as participatory mapping progressed. While villagers readily contributed the information to be mapped, assisting them in understanding and claiming their own maps was much more difficult. The project managed to produce some maps with the help of community members, but it was not

as successful in encouraging them to "tell their own stories" through "their own maps." The problem emerged from the fact that these exercises emphasized two general areas: 1) learning how to produce maps, and 2) ensuring that community members participated in documenting information embedded in the maps. Less attention, however, was given to map socialization, the process of learning how to use maps or map making for addressing tangible concerns of the community.

Villagers were only interested in joining participatory mapping activities if they felt these activities would ultimately benefit them. While activities using sketch maps could engage villagers in meaningful conversations regarding the use of maps and map-making to advance their practical needs (e.g. field planting, negotiation with neighboring farmers), participatory mapping exercises undertaken by the project could not achieve the same result for two reasons. First, it was difficult for villagers to conceive of the ways that maps could benefit them when they struggled to understand technical maps. Second, these "technical" maps were intended to be used as tools for negotiation with the state, and the process of such negotiations was both abstract and removed from the villagers' realm. At the end of the project, in spite of participatory mapping activities that were conducted in fifteen villages, the conceptual understanding of villagers as to how the maps can assist them in managing their resources remained limited.

Training and Organizational Dynamics

While a short training session might be sufficient to introduce NGO staff and community members to the use of simple SIT tools such as compasses, measuring tapes, and GPS units, understanding how to plot and analyze the data is more complex and therefore requires more time. Digital data processing requires not only more skills and analytical capability, but also the capacity to work with multiple sources of data, to choose from a variety of software, and to keep up with the (rapid) development of computing technology. The consortium's strategy was therefore to focus on developing the capacity of a few consortium staff members and to have external supports available for periodic consultation or outsourcing.

Yet it soon became apparent that even this selective strategy could not keep up with the development of GIS technology and the growing market segmentation among the various GIS software producers. To illustrate, in 1996 a WWF staff member attended basic GIS training in Samarinda that was organized by the Idrisi software project of Clark University. In this training, participants learned how GIS could help community-mapping processes. It included developing skills to use field data as inputs to GIS, preparing and printing graphical representations, and producing final maps using Idrisi. Unfortunately, it turned out that Idrisi GIS software was not widely used in Indonesia, therefore limiting the capacity of this individual for sharing data or technical support.

In 1998 staff members from two organizations that belonged to the consortium attended a six-week GIS and remote sensing training course at the East West Center in Honolulu, Hawai'i. This was followed by a series of field mapping exercises held in Nusa Tenggara involving the same trainer, trainees, and a few other people.[2] The objectives of the exercises were to establish benchmarks, to map village boundaries, and to map land cover using a combination of satellite images and field data obtained from participatory mapping. These activities went well and produced a series of maps showing village boundaries and land covers.

But the strategy of focusing capacity development on a few key individuals is vulnerable to arbitrary personnel changes, which can arise from personality conflicts or from personal decisions. In this case, a key staff member who had received intensive GIS training in Honolulu in 1998 decided to leave his organization in 1999. The other trained staff member received a promotion to lead a provincial branch of his international NGO and could not be involved in mapping activities anymore. Other locally trained staff members who had become proficient in GIS analysis also

left their organizations within a year. Further local training was also done during mapping activities that were led by mapping consultants and trainers, but they yielded similar results. By 2003, after five years of training efforts, the consortium still did not have local staff members who were capable of acquiring and analyzing spatial information.

Many trainees were also not prepared for the physical demands imposed by mapping activities, such as traversing rough terrain during field surveys. GIS analysis training was complicated by the fact that GIS infrastructure at the local level was not well established. When the project began, digital data with which to create base maps were virtually non-existent and consequently resulted in the need to manually digitize maps, a time consuming activity. Many staff members who had been excited about the potential of GIS tools in helping community mapping came away disheartened by the technical hurdles.

Developing local capacity through organizing training sessions faced another challenge related to the organizational culture of NGOs in Indonesia. For most NGO staff members, training is considered a reward for his or her service to the organization. Moreover, if a training session is conducted outside the province (or outside the country), the opportunity is highly coveted. Internal organizational politics could supersede practical rationality in deciding who should attend the training sessions. As a result, trainees attending these sessions might not be the most suitable candidates from the targeted organizations, and would not be able to make full use of their newly acquired skills. In the case of developing skills to run a GIS lab, training might involve a number of sessions to cover various topics. If an organization was overly concerned about spreading training opportunities among its staff members, a discontinuous transfer of knowledge and skills among several staff members could result, with no one person capable of managing all aspects.

Personnel skilled in spatial information analysis are still relatively scarce in 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 the salary structure of mapping and GIS technicians. Such a situation leads to tensions within NGOs, as well as relatively fast turnover of spatial information specialists.

Building A Regional SIT Center

When the project began in 1997, the equipment and software necessary for managing spatial information were relatively expensive. Computers capable of storing and processing large amounts of data were costly. A digitizer table was indispensable since digital data were neither readily available nor economical. While navigational GPS units were becoming common, the selective accuracy (SA) standard imposed by the United States only allowed accuracy of up to one hundred meters in these units, which was not sufficient for mapping ancestral land. GPS units that allowed differential correction could yield accuracy within one meter but were much more costly than the navigational GPS units.[3] Remotely sensed images such as those from Landsat TM were expensive and only available in digital tape format, necessitating a specialized tape drive that was available at only a few institutions in Indonesia. The high price of plotters precluded many GIS facilities from owning one.

Added together, the necessary costs to establish a GIS lab were generally out of reach for most NGOs in Indonesia. Meanwhile, although it was necessary to have access to all this equipment, in most cases the equipment would not be fully utilized all the time. For example, once digitizing work was completed, the digitizer would not be used for an extended period of time.

For these reasons, the idea of sharing a SIT facility among several members of the consortium was deemed sensible. The grant from the Ford Foundation provided funds to establish a small regional SIT facility within one of the member organizations.[4] But the problem of maintaining a

stable core staff skilled in managing spatial information eventually affected the effectiveness of the facility. Unclear procedures on equipment sharing were compounded by the absence of any staff members who really knew how to operate the equipment. As a result, almost none of the stakeholders within the consortium could access the SIT facility, and for years the equipment laid largely unused, a source of contention between the organization that housed the equipment and other organizations that wanted to use it.

As computing and spatial information technologies rapidly developed over the past decade, it became obvious that a working SIT facility would need to regularly upgrade its equipment and software. On the one hand, most of the equipment purchased by the original grant quickly become obsolete. On the other hand, continuing technological advances have also meant that most of the older equipment has become more affordable. Most computers available in the consumer market today can meet the minimum requirements for processing spatial information. Color printers are more affordable, and commercial printing services have become available for printing even larger maps in most provincial towns in Indonesia. The need for an expensive digitizer board has significantly declined as digital data has became available for free or at minimum cost. For example, digital topographic data for some areas in Indonesia are now available through BAKOSURTANAL, the national coordinating body for survey and mapping.[5] Even when digital data are not available, maps can be scanned at a commercial printing shop, geo-referenced, and then digitized on screen using any computer. Another significant development in spatial information technology was the elimination of the SA standard by the U.S. government. Not only have GPS units become less expensive, but any GPS equipment today can yield ten meter accuracy.

As SIT hardware components became more affordable and more spatial data became available, the challenge of building local SIT capacity has also shifted. Since hardware and software facilities are no longer exclusive, the critical need for a regional SIT center to share expensive equipment no longer exits. Any organization that decides to adopt SIT can start up with relatively inexpensive equipment and software. A different kind of regional center, however, is needed to provide continuing support to local NGOs in training local staff and interested community members, providing general troubleshooting, assisting local organizations to adapt to newer generations of technology, and helping them identify and acquire digital data from national and international sources.

SHARING THE MAPS . . . OR NOT

In spite of the problems in training and retaining local staff members, the project managed to map and build GIS for fifteen villages that lie in and around Wanggameti National Park. This effort was greatly assisted by the participation of a Sumba based NGO with close ties to the area. For each village, maps were created that showed village customary boundaries, forest boundaries, land use and vegetation cover, detailed place names including sacred and protected areas, and other resource patterns.

In March 2003, the project held a meeting with representatives from government offices, NGOs and fifteen of the participating villages in Waingapu, the district capital. Participants discussed how local people use and manage natural resources in and around the national park, key issues as perceived by communities and other stakeholders, and how maps could be used to resolve conflicts between village leaders and government officials. At this meeting, the question of map ownership was discussed.

While most people attending the meeting acknowledged that community maps belonged to and should benefit the respective village communities, opinions on the degree to which the communities should control access to and use of the spatial information varied widely. During the meeting some government officials asked if the mapping facilitator could present the GIS maps instead of the villagers. Their reasoning was that the mapping facilitator could more

readily use the available computer and digital data projector. While this reasoning seems to be innocuous, it illustrates how unequal access to technology and biases against "uneducated" villagers could effectively take control away from them. Another meeting participant suggested that all the maps and spatial data be stored in an NGO's office in the district capital to ease access by other stakeholders. Yet this arrangement would prevent the communities who are the presumed owners of the spatial data from any effective control over the way the maps are distributed and used.

Many of the villagers had initially been proud and eager to show their maps to everyone. During community consultations, however, the mapping facilitators warned the villagers of the potential risks of the maps in the hands of outsiders. Learning from experiences in other parts of the world, the mapping facilitators were aware of the risks of mapping to local people. The risks include the possibility that information embedded in the maps may be used and misused without the consent of the communities. Mapping facilitators almost always have full access to the spatial data, even more so than some of the community members themselves. The mapping facilitators in this project thus felt it to be part of their ethical obligation to clarify these risks to the villagers, and asked with whom were they willing to share the maps. Villagers initially responded that they were willing to share the maps with the other NGOs in the mapping effort but not with government officials. But the mapping facilitators reminded them that if they shared the maps with the other NGOs, they could not ensure that the maps would not then be shared with government agencies. With this new understanding, leaders of the villages decided that they would like to have a degree of control with regard to how the maps are shared.

photo: Martin Hardiono

The meeting concluded with discussions on mechanisms for making the maps accessible and on updating the living documents. Villagers expressed their wish to keep copies of the maps in the villages so that they themselves could provide them to organizations that sought them. Another set of copies were left at the office of Yayasan Tananua, a Sumba based NGO widely trusted by all the communities. These maps are outputs of a GIS that could accommodate the dynamic aspects of spatial information. But GIS also increases the structural challenges for most of the participatory mapping participants, making it difficult for them to effectively access and control the information. In a twist of irony, the digital database remains with the mapping facilitators, since there was neither anybody in the village who could utilize the data nor electricity there to power computers. As a result, these maps have not become the "living document" they were intended to be.

Critics have pointed out that if local government agencies cannot take full advantage of these maps for developing local management plans and ordinances, this multi-year

mapping project would be largely futile. One wonders if the cautions exercised by mapping consultants and facilitators in this project were unjustified. For example, while it was important to protect information on the location of unique resources or sacred sites, other geographic features and boundaries are not proprietary and could have been shared with other stakeholders. A GIS could easily handle this type of concern, and remove any layer of information deemed sensitive by community members. Unfortunately, because only hard copies were available, it was difficult to separate sensitive information from the base data. The problem was exacerbated by the conceptual and physical distance between the communities and stakeholders in Sumba and the mapping consultants in Jakarta and Honolulu, and by the fact that funding for the project was exhausted before revised maps could be made, discussed with villagers, and made available to government agencies.

This controversy points to the critical need of addressing the question of map ownership early in any community mapping initiative, and to clarify to all both the objectives and risks of recording spatial information on maps. While the project did consult villagers throughout the mapping process, it was difficult for villagers who had not been exposed to maps to fully comprehend the implications.

CONCLUSION

The experience of working with sketch mapping in Sumba shows that maps and mapping have potential for helping local communities to manage their natural resources. Confronted with regional boundary disputes against the state, community advocates realized that community maps must also abide by cartographic standards in order for them to be recognized in formal negotiations. The project we examined in this paper was designed to build local capacity in managing spatial information to achieve these two broad objectives.

Mapping, participatory or otherwise, introduces a concept that is not yet familiar to most villagers in Indonesia. To effectively work with maps, one must first overcome this barrier. The project's experience highlights the difficulty in bridging conceptual gaps among diverse stakeholders in participatory mapping. This difficulty is exacerbated by the need to elevate the technical sophistication of participatory mapping in order to enhance its legitimacy. While the shift from crude sketch mapping to technical maps that abide by cartographic standards may lend credibility in boundary negotiations against the state, it reduces the engagement of most community members and their ability to use the maps as they see fit. As a result, even though the mapping was participatory in the sense that community members were consulted and involved throughout the process, many ended up becoming alienated and did not feel that they "owned" the resulting maps.

The initial objective of the project was to enhance the capacity of consortium member organizations to utilize spatial information to better understand the problems of communities that lived within or near protected areas. The reorientation toward more technical mapping however led to the alienation of other organizations within the consortium. In the absence of reliable spatial data, mapping facilitators and technicians needed to produce base maps and therefore focused on the collection and accuracy of spatial data. Their activities became separated from activities that focused on grassroots organizing and community development. As a result, participatory mapping failed to be integrated into the broader objective of consortium member organizations.

The project managed to produce excellent GIS maps with the help of community members and to encourage villagers to "tell their own stories" through "their own maps." But the project failed in many important respects. The project attempted to build local capacity through training a few staff members in skills to acquire and manage spatial data, and through providing basic equipment for a GIS lab. The project's experience shows the complexity of personnel management and inter-organizational dynamics of a loose network such as the consortium. At the end of the project,

local capacity both in terms of skills and equipment was not improved. Finally, in spite of all the efforts to consult community members regarding map "ownership" throughout the mapping process, the final agreement regarding the fifteen maps that were produced by the project failed to satisfy many stakeholders.

1 The authors would like to acknowledge the valuable discussions with numerous individuals who shared their reflections on this project. In particular we would like to thank Larry Fisher, Suzanne Siskel, Ujjwal Pradhan, Chip Fay, and Nonette Royo. The views expressed in this paper are those of the authors.

2 The first one was held in Sesaot, Lombok to establish a methodology for mapping process that was both accurate and participatory. In October 1998, the team began to conduct participatory mapping in 5 villages close to a national park in Lombok.

3 A pair of Trimble GeoExplorer 2 units capable of differential correction in 1996 cost US $ 7,600 in 1996.

4 The lab consisted of two Acer notebook computers, an A1 size digitizer, an A2 size color printer, a laser range finder, an optical range finder, two measuring tapes, a tandem compass, and a clinometer. In addition, two GPS units capable of differential correction were loaned to the lab.

5 Some Landsat images are now available at certain centers for free, while some other centers charge a relatively low price. MODIS data (250 meter resolution) and SPOT vegetation data (1 km resolution) are also available for free, as are Digital Elevation Model data (90 meter resolution) from the NASA Shuttle Radar Topographic Mission. ASTER data (15 meter resolution) are available for a nominal fee.

REFERENCES

Herlihy, P. H., and G. Knapp. 2003. Maps of, by, and for the peoples of Latin America. Human Organization 62(4): 303-

Peluso, N.L. 1995. Whose woods are these? Counter-mapping forest territories in Kalimantan, Indonesia. Antipode 27 (4): 383-406.

Sieber, R.E. 2000. Conforming (to) the opposition: The social construction of geographical information systems in social movements. Int. J. of Geographical Information Science 14(8): 775-793.

Turnbull, D. 1998. Mapping encounters and (en)countering maps: A critical examination of cartographic resistance. Knowledge and Society Research in Science and Technology Studies: Knowledge Systems. 15-44

INDEX