Two-dimensional Maps in Multi-dimensional Worlds

Robin Roth
Assistant Professor
York University, Geography
rroth@onebox.com

Prepared for IASCP Meeting in Oaxaca Mexico August 9-13th 2004

Abstract

Mapping is fast becoming a tool of critical importance for communities rushing to render legible their longstanding claims to common property resources. Motivating the move to map is the need to have accurate representations of community needs and management practices in order to obtain more secure land tenure. However, the spatiality of local land tenure arrangements and land use practices are more varied, dynamic and multiple than are mapped two-dimensional zones of resource use and rights. The conventional tools of mapping, which map abstract space and render a complex configuration of social-ecological relationships in two-dimensional form, can have unforeseen consequences. Instead of describing already existing land use and management, community based mapping can prescribe changes in how residents manage their land, effectively becoming not only a tool for securing land tenure but also a tool for the spatial re-organization of land use and management.

This paper is based on research conducted in the mountains of Northern Thailand and examines a community based mapping project designed to help increase land security for villagers facing the establishment of a National Park. The case shows how mapping techniques that fix and simplify fluid and complex associations can become prescriptive and can actually change how people think about and manage their land. In this case, mapping promoted a change from communal to private property management and made static once flexible land use patterns. The paper does not advocate for the abandonment of two-dimensional mapping, but recommends a multi-mapping strategy to better illuminate the spatial complexity of community resource use and management. The combination of modern mapping technology and multi-media has the potential to overcome the constraints of mapping in two-dimensions.

Introduction

Community-based mapping is an increasingly popular tool for a range of participatory research and development activities. Mapping can simultaneously act as a research tool to document local resource use and management and as a tool of social action helping local communities to identify and defend their territory (Herlihy and Knapp, 2003). Techniques such as sketch mapping have long held a prominent place in participatory rural appraisal (PRA) as a means of gathering geographic information from local experts (e.g.Chambers, 1994; Rocheleau *et al.*, 1995), while the recent affordability

of GIS technology has produced increasingly sophisticated spatial representations of community resource use and management (e.g.King, 2002; McKinnon, 2001).

The availability of mapping techniques, and their adoption in community-based research and development, has coincided with the expansion of global markets and government policy into areas previously peripheral to government concern; into the territories of indigenous people and rural farmers. After a long history of being absent from government maps, such rural communities are now finding themselves and their territories the subject of government mapping practices and are finding that without maps of their own, their territories and livelihoods are being threatened by more powerful outside entities. Communities throughout the developing world are thus rushing to render legible their longstanding claims to land based resources in the hopes of protecting themselves from others laying claim to the same land and resources. They are joining with social scientists, non-government organizations (NGOs) and development organizations to 'counter map' (Peluso, 1995) their territories. Scholars and practitioners are generally in consensus that putting communities on the map is critical to their ability to defend, and in some instances acquire, secure tenure rights (Alcorn, 2000; Eghenter, 2000; Fox, 1998; Herlihy and Knapp, 2003). The growing number of initiatives worldwide that are formed to help resource-based communities map their territories confirms the popularity of such mapping strategies (Bird, 1995; McKinnon, 2001; Poole, 1995; Rambaldi and Callossa-Tarr, 2002).

Community-based mapping is not, however, unproblematic. As mapping has gained in popularity, a number of proponents of the approach have also voiced concerns about the implications of translating what are spatially complex cognitive maps and resource-use practices into simplistically bounded, two-dimensional zones of use. They express concern over the tendencies of mapping to represent communities as assumed homogeneous entities, boundaries as singular and inflexible, and dynamic systems as static (Fox, 1998; Hodgson and Schroeder, 2002; Kosek, 1998; Rocheleau, 1997). Their critique builds upon common property, environmental perception and political ecology literatures, which hint at a spatiality of community resource management that is overlapping, flexibly bounded, and is more complex than that represented in two-dimensional zones on a map. They describe community-based institutions that use

2

species-specific management, flexible tenure arrangements, and overlapping patterns of use (e.g. Berkes, 1999; Rocheleau and Ross, 1995; Vandergeest, 1996; Walker and Peters, 2001). Moreover cognitive mapping with indigenous people around the world has shown a preference for relative versus metric distance and dynamic, multiple boundaries versus static, singular ones (Fox, 1998; Woodward and Lewis, 1998). Common property institutions and their resource management practices have a complex spatiality that is not easily represented on a conventional map. The paradox, of course, is that the desire for an accurate representation of a community's needs and management practice is precisely what is motivating the move to map.

This paradox is the focus of my investigation. I argue that one of the key limitations to commonly practiced community-based mapping is the assumption that community spatial organization is somehow a given; an abstract entity that can be mapped independent of the social relations that produced it. In fact, the ready adoption of community mapping as a necessary tool used by NGOs and development agencies has encouraged a simplistic approach to spatiality. Yet, the spatial organization of community resource use and management, as indicated above, is spatially complex and the over-simplification of such complexity through the mapping of abstract space can have unforeseen consequences.

Abstract space is a measurable plane with boundaries delineating homogenous zones. It is the space of planners and cartographers seeking to delineate bounded territories for the purposes of inclusion and exclusion. It is perceived to be an empty envelope – existing *apriori* and independent of the matter it contains and the social processes that produce it (Massey, 1992; Peet, 1998; Smith and Katz , 1993). When scholars and practitioners use abstract space to describe spatial practices of resource dependant communities, they tend to represent a community's activities as though they fit precisely on a grid and neatly into bounded homogenous zones. Consequently, they inaccurately represent community activities as spatially fixed, as not being contingent upon social relations or changes in the physical environment.

In contrast to an abstract space viewed from above, the spatiality of community resource use and management consists of a relative space, produced through the activities associated with procuring a livelihood; through the interactions of material social and

ecological processes. Community resource management institutions, embodying the explicit and implicit rules and norms governing activity patterns, produce a spatial organization commonly expressed as land use classification systems, boundaries delineating rules of resource access, and the spatial and temporal distribution of activities in the landscape. The spatiality of local resource use and management is thus contingent upon, and inseparable from, their associated resource management institutions and the ecological landscapes in which they are embedded. Consequently, the conventional tools of mapping, which map abstract space as separate from the complex configuration of social-ecological relationships that produce it, can have unforeseen consequences. Instead of describing already existing land-use and management, community based mapping can fix a temporary organization in space thus prescribing changes in how residents manage their land and effectively becoming not only a tool for securing land tenure but also a tool for the spatial re-organization of land-use and management.

This paper is based on research conducted in the mountains of Northern Thailand and examines a community based mapping project designed to help increase land security for villagers facing the establishment of a National Park. Analysis of the mapping project shows that when the resulting map is attributed significant authority and the mapping process does not take into account the complexity of local spatial practice, the map can cause conflict within and between villages and precipitate significant changes in how residents manage and think about their land. The paper ends with some recommendations how we might be able to map complex spatial organization as a more accurate representation of local resource use and management.

Mae Tho National Park in Northern Thailand

The mountains of Northern Thailand have long been inhabited by ethnic minority groups, such as the Karen and Lua[1], who have managed their landscapes and livelihoods largely autonomously from government policy. Villages in the area practice a mixture of

---

[1] Other ethnic minority groups, such as the Hmong, Lahu and Akha, have migrated into the Thai highlands over the past 150 years and also operated, up until recently, autonomously from the Thai government. The research used for this paper was gathered in Karen communities.

bush fallow shifting cultivation, permanent cultivation, agroforestry, and irrigated paddy rice cultivation, and raise cattle and small livestock for subsistence and sale. Over the past 40 years, the Thai state and international development organizations have paid increasing attention to the region, first for the purposes of anti-insurgency and opium substitution and most recently for the purposes of forest and watershed conservation. The territory of many villages in the region are experiencing conservation pressure and conflict with the Thai state. This paper is based on research conducted in the Mae Tho region of Chiang Mai province, where the Thai Royal Forestry Department's (RFD)[2] is in the process of establishing Mae Tho National Park. Communities in the region are facing a sharp reduction in their agricultural land base and are thus concerned with making legible their territory for the purposes of negotiation with the state.

I conducted research in two Karen villages over a period of 12 months in 2001 and 2002. This paper focuses on the experience of Insom Village, where two years previously an NGO produced a community land-use map with the intention of helping the village secure tenure in the face of National Park establishment. Under the common restraints of few resources and little time, the map was produced using conventional participatory techniques, where cartographers, with the help of village residents and GPS units, demarcated agricultural fields, community forest, village land, irrigated paddy rice, and conservation forest. The community was unhappy with the product and as a result I became rapidly engulfed in the village leadership's desire to have me fix the map made by the NGO. For this task I combined interviews, surveys and participant observation with GPS technology and GIS software to create a map to the village's specifications.

Multidimensional Worlds

Insom Village's spatiality of resource use and management has developed in interaction with the forest-farm matrix in which they live, in relation to political and economic processes and through social relations existing within and between villages. In

---

[2] The majority of RFD staff and functions are now located in the new Ministry of Natural Resources and the Environment. During my fieldwork the RFD was still intact and thus to be historically accurate, I continue to use the term here.

order to understand the spatiality of resident livelihoods, I gathered information on agricultural activities, forest use, visits to the nearby village and livestock rearing. Using a mixture of interviews, surveys, participant observation and mapping, I documented the livelihood activities of men and women paying particular attention to seasonal and long term changes and to the way social relations shape land-use patterns. Land-use practices, activity patterns and tenure arrangements in the Karen villages of this region are spatially very complex and I have described them in detail elsewhere (Roth, 2004a). For the purposes of this paper I will briefly summarize the general fluidity and flexibility of tenure arrangements in order to illustrate the impact of the community based mapping project discussed in the following section.

The Thai State only recognizes household tenure over irrigated paddy rice and permanent cultivation and does not recognize tenure over any field left uncultivated for three or more years. Shifting cultivation land (a.k.a. swidden fields), the primary source of rice in the region, is thus legally insecure according to Thai law. Furthermore, the government does not currently recognize communal ownership of any kind, though a community forest bill is in debate (see Brenner *et al.*, 1999; Makarabhirom, 2000; Roth, 2004b). Since a minority of highland Karen residents have ownership certificates for any part of their land holdings (only 33% of households in Insom Village have legal tenure over a piece of their agricultural land), legal tenure plays but a small role in governing land and resource allocation, reallocation and ownership. Instead, village land is primarily governed through local tenure institutions.

The highland Karen landscape is a patchwork of different tenure arrangements ranging from community forest to private property, all of which contribute to a complex, overlapping and mostly flexible spatial organization. Boundaries demarcating different tenure arrangements serve very different purposes. The least strict are those demarcating shifting cultivation fields, which change annually, as new fields are cleared and planted. Moreover, they can be given or lent to other households for cultivation, eventually becoming another household's property. During preparation and cultivation, the field boundaries are porous to labor sharing, with households helping each other during clearing, burning, weeding and harvesting. Cultivated swidden fields are also porous to opportunistic gathering of vegetables by people from outside the household. Meanwhile,

after harvest the land is communally managed and is available to any household for grazing cattle, gathering herbs or hunting. Equally as flexible are the boundaries between villages, which are porous to the gathering of forest products, the grazing of cattle, and upon permission, the cultivation of swidden lands. Cash crop fields, whether they are planted annually or as an extension of the swidden cycle, are treated more as private property. Their boundaries are not porous to labor or opportunistic gathering and non-household members need permission to use or gather from the land. Likewise, certain products, such as bamboo used for building or fruit trees, regardless of where they are planted, are the property of the planter and cannot be used without permission. The strictest boundaries are those demarcating paddy rice. Equipped with state ownership certificates, paddy rice fields are managed as household property and are not accessible to non-household members. In sum, territories of households (from the size of a single tree to an entire field) and territories of villages are in some instances flexible and overlapping with the territories of other households and villages but when treated as private property become more fixed and impermeable to outsiders.

Tenure institutions help explain activity patterns and access to resources in that where people work the fields, gather vegetables, and graze cattle depends in part on where tenure arrangements allow such activity. Seasonality, which influences the availability of certain forest products and governs much agricultural activity, also shapes village activity patterns, as does the gender of the actor. For example, in the hot months, men travel far from the village to gather building materials and hunt small game, whereas women concentrate their activities along certain water sources where they can gather favorite vegetables. And cattle graze away from cultivated fields during the growing season, in the forest during the hot season and closer to the house during cold season (Roth, 2004a). Evidently, tenure arrangements as well as factors such as seasonality and gender, all contribute to complex spatial organization of village resource use and management.

The spatial complexity of resource use and management is a product of social relations. The degree to which boundaries between village or household territories are porous and overlapping depends to some extent on the type of land in question, as described above, but also on the nature of the relationship between the villages and

households in question. A close relationship, cemented through intermarriage, kinship or close friendship increases the degree of porousness and overlap. Trust indicates little need for fixed, impermeable boundaries. The impact of social relations on spatiality also extends far beyond the village territory. Market prices and access to start up funds strongly influences a household's decision to plant cash crops. The physical environment in terms of water availability and access to transportation further influences such decisions. When the conditions are favorable, more families often choose to plant cash crops in a recently cultivated swidden field. Thus when the conditions are favorable, more of a village's territory is treated as private property and is impermeable to labor sharing and opportunistic gathering.

Government policy and development projects also shape community spatiality. For instance, the promotion of fruit trees by development practitioners in the 1980s greatly expanded the amount of land under a more private tenure regime and the recent formalization of 'community forest' has taken some land out of the shifting cultivation cycle and set aside purely for forest-based gathering. In some cases, communities are voluntarily formalizing community forest and conservation forest zones in anticipation of criticism from the RFD about their ability to manage their land. These policy changes and village reactions to them, promote a spatial *reorganization* of community resource use and management. The spatiality of resource use and management is contingent in part upon social relations and tenure institutions. As social and tenure relations change, so will the spatiality of village resource use and management – space and social relations are inextricably connected.

The two-dimensional flattening of Multi-dimensional worlds

The proclaimed purpose of community-based mapping is to make legible village land-use; to map the territories the village residents use and are responsible for. Community-based mapping routinely fails, however, to recognize the complex spatiality of local resource use and management described above and proceeds to map two-dimensional zones of fixed resource use and rights. Representing spatially complex resource management and use in two-dimensions results, not merely in the visual erasure

of interesting details, but can also result in material changes to how people manage their land. It can change the spatiality of activity patterns and the associated institutions of land management.

Life history interviews and observation revealed that previous to the community mapping project Insom Village had similar land tenure institutions to those described in the previous section. Despite 33% of households having access to some paddy rice, the primary source of rice for most families came from shifting cultivation fields and thus the village as a whole has a high degree of land insecurity. In the eyes of residents, the lack of legal tenure has become a concern only since Mae Tho National Park was announced and the possibility that the state may lay territorial claim to lands integral to their livelihood became a reality. Their situation is pronounced since Insom Village is located in a valley below the National Park headquarters and residents have daily visual reminders of the imminence of the park. When in their paddy fields, the residents can see the headquarters and every time they walk into nearby Mae Tho Village to buy food or visit the health clinic, they pass through the gates of the National Park. Given this context, villagers were keen to cooperate with a National NGO when they proposed a mapping project in 1999, hoping that making their land-use needs legible would help them feel more secure vis-à-vis the park.

By 2001, when I entered the village, residents had a high level of anxiety about the map that was created for them and wanted me to immediately fix the 'mistakes'. The identified mistakes, such as labeling some fallow agricultural fields as community forest, were the result of cartographers mapping land-use as they saw it and not understanding that the current spatial organization was intertwined with the social institutions of land management (or they did not recognize the importance of such a relationship). Their attempt at making land-use legible to the forestry department in two-dimensions has thus had consequences far beyond securing land tenure. By not recognizing the social construction of space – the link between management institutions and the spatial form they take, mappers took a particular version of Insom's land-use and fixed it, literally, in space. This action coupled with the promotion of the map's authority, resulted in changes in land-use and management.

NGO Mapping Process, Results and the Author's Re-maping

The national NGO hired a consultant to conduct community mapping and record land holding and land-use of many villages in Mae Chaem District. The consultant explained that the mapping was important because the RFD is setting up a National Park, and the map will help the villagers negotiate with the RFD vis-à-vis their territory. He used the opportunity to instruct students in how to conduct community mapping using 1:10000 scale topographic maps and GPS units. The GPS was used only as a reference to map the approximate locations of the fields. The mapping team spent one or two days in the village, mapping with villagers the location of their fields and different forest categories. The consultant felt that he had mapped what the villagers told him to map. "We asked the villagers where the boundary of the village was and we asked them where their fields were and we mapped them." Clearly, his intention was simply to map the boundaries and spaces that the villagers requested (Map 1 is the resulting map).
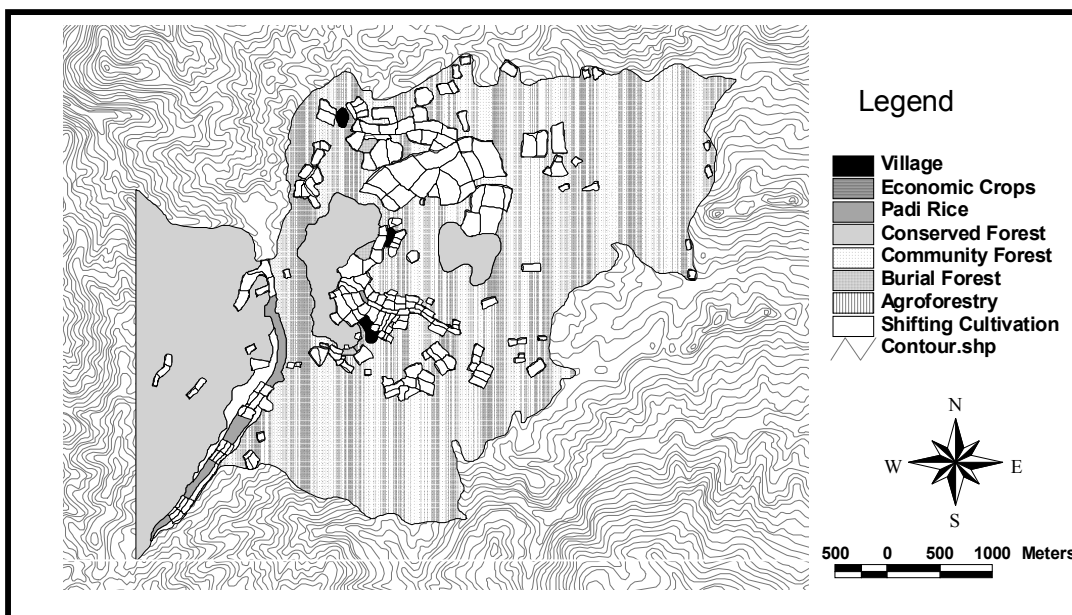
Map 1 Insom Village Land-Use Map Created by National NGO

Villagers were unhappy with the process and results. They explained to me that the consultant came for one day with five students, each of which was responsible for a

different region of the village territory. Villagers accompanied the students, but not everyone was free to go that day and because individual farmers had to stay within the region the student was mapping, he was unable to point out all of his fields. Consequently there are many fields that are not on the map and are instead categorized as community forest. Furthermore there are areas of the territory that were not visited at all by the mappers. Villagers explained that after the mapping was done the mappers "came seven months later and said 'here is the land-use of the village.'"

While there are a number of reasons why the above mapping process resulted in an incomplete map, what is important for this paper is that the conventional mapping process described above takes space and spatiality as a physical given and fails to pay attention to how that spatiality is produced. The mapping of space as though an abstract entity leads to the fixing of dynamic processes and, in the case now under examination, prescriptive changes of land management. I now turn to the mapping of agricultural land in order to illustrate these points.

The map created by the project shows households having individual ownership over agricultural fields (See Map 1); a significant departure from traditional communal ownership. Village residents confirmed that the change to private ownership happened in the past few years. One villager stated "Before the consultant came, people did it [farmed] together and didn't have ownership. We have owned our fields for three years now. Fruit orchards and paddy rice already had owners." In my conversation with the residents of Insom Village, they explained that in the years previous to the cartographers' visit, staff of the National NGO began encouraging each household to identify which agricultural field belonged to them. In conjunction with this shift from collective ownership to household ownership, the NGO asked villagers to reduce their agricultural land to between three and five fields. "At the beginning we didn't want it [separate land] but [the NGO] suggested it is a good idea. They said it was better than farming together." Interviews with NGO staff revealed the rationale behind this shift. They explained that the forestry department would be more likely to accept Insom Village's land-use if each family had less than five plots and a private property regime was preferable because no Thai laws exist that recognize collective ownership. Consequently, mappers assigned each family an identification number and labeled their fields on the map. A number of

villagers agreed with the NGO and believed the numbering of their fields would contribute to their tenure security. One farmer explained "if we have numbers on the map it will be easier to farm in the future. We won't have to be scared of people, someone from outside the village, saying that the land isn't being used."[3] While some villagers view the allocation of plots to individual families as a means of increasing land security, many more mourned the repercussions of mapping individual plots. The appearance of the map, with its clearly demarcated individual plots led villagers to believe in the permanence of these changes in agricultural ownership. This sense of immutability led to high anxiety about the map and the changes that it had wrought.

The main repercussion of the shift to individual ownership is an increase in conflict between households vis-à-vis agriculture, indicative of a change in the institutions of land allocation and reallocation. Previously, the tenure institutions of Insom Village were flexible and dynamic. Fields exchanged hands regularly and households farmed together. The conversion to household ownership effectively demarcated strict boundaries where there were none before. Such a change in spatial organization has also changed the associated social relations of land tenure. Where households once shared land, they argued over whose number would be on the map. In cases where land had changed hands decades before, households argued over who 'really' owned the land. Since families have identified particular plots as theirs, there has been a marked decrease in labor sharing in the village. As one woman put it, "we do not farm together here. We have our own land." When I inquired as to the longevity of the conflict over agricultural land we were witnessing, village residents responded that they had not had such conflict over land before the map. The map created some of this conflict because it made visible, by fixing numbers to fields, whose land was whose. For example, in the case where household 13 claimed land lent to household 5 as their own, it was not that the residents of household 13 wanted to farm it themselves, they were content to have household 5 farm it, they simply wanted to assert their ownership. Before the map there would have been little need to do so. The numbering of fields has changed how people relate to their land. Many villagers, when asked how many fields they had,

---

[3] The strong conviction displayed by some residents that numbers on a map will produce land security may represent false security since their landuse, numbers or not, remains illegal in the eyes of the Thai state.

would respond "I am number 12 on the map. How many are there? We farm in our number."

A further issue, when dynamic processes of land allocation and reallocation are made static, is the potential for pronounced stratification in the village. A key informant explained that with agricultural plots fixed in this way, some households ended up with good land and others with bad land *in perpetuity,* creating increased stratification within the village. For instance, in the past families who had wanted to try cash crop production had obtained rights to land with access to water and roads. With previous collective ownership there was always the possibility of that land changing hands and allowing a different family access to the market economy. Since households now 'own' their land, families are restricted to what they were farming when the map was created. They also feel as though they cannot return to areas left fallow by their parents historically, since those areas are now labeled community forest on the map.

Village residents attributed authority to the map. They wanted to start using fields not used for decades, but felt they could not because they were not 'on the map'. I heard numerous village residents say they wanted to farm a particular site but were scared to do so since it was not on the map. I, as the follow-up mapper, was continually asked permission to put a field on the map and by extension, permission to farm there[4]. This authority is further reflected in the village pre-occupation with accuracy. As one man put it, "If the map is not exact, then I do not trust the RFD." The village residents felt strongly that the map, if accurate, could protect them from the RFD, or other outsiders claiming their land. The authoritative and powerful map was not seen as a reflection of actual land-use, but instead it took on a prescriptive role and determined possible land-use.

The constraint of a conventional map in this case, is that an area of land is mapped either as agricultural land or forest land and the map's authority convinced villagers that there were consequences if future land-use did not adhere to the demarcated

---

[4] This asking of permission indicates a continuation of the residents relationship to the previous mappers. I spent a great deal of time explaining that I was unable to give permission for anything and that the map was to be a tool that they could use to represent their land-use to the forestry department and negotiate with them.

zones. The goal of the villagers, with me as their mapper, was thus to produce a map with the maximum amount of land shown as agricultural so as to maintain the maximum flexibility. I produced the map incrementally over a period of 9 months with the help of the village residents. Comparing the map I produced (Map 2) with the one that the NGO produced (Map 1) shows that 21.4 % of Insom Village territory (370.07/1727.73 hectares) is classified as agricultural land whereas the NGO map shows only 16.5 % of the territory (272.76/1650.21 hectares). Importantly, much of the land on Map 2 labeled as agricultural land is not currently used as such, but residents wanted to be able to use it in the future if need be.

Map 2: Land Use Map of Ban Insom Created By Robin Roth
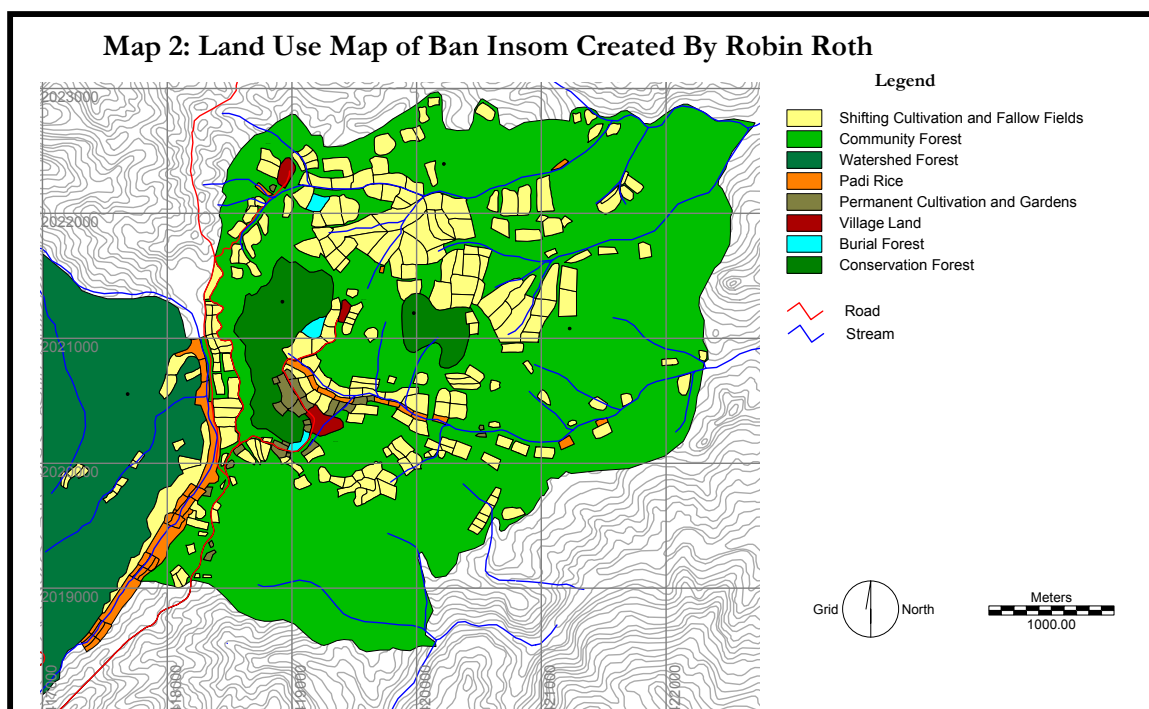
The strict division between forest land and agricultural land is a departure from traditional tenure where most forest land had the potential to be agricultural land and all agricultural land would at some point return to forest. Villagers would chose their field location based in part on soil and prevailing weather conditions; a flexibility now lost to them. Many village residents, while they understood that the NGO and the RFD wanted to keep agricultural land separate from forest land, desired a return to the more flexible arrangement. "They suggested that it was important to keep categories of land separate but now we want fields mixed in with the community forest." Upon the request of

14

residents, the map resulting from my work consequently labels fields not used for decades as part of the agricultural cycle so that village residents would not experience conflict with the RFD if they decided to farm such plots in the future.

Without an explicit understanding of current spatiality as being produced and without an exploration of how it is produced through institutions of land management, mappers end up mapping what they are shown as though it will always exist. Alternatively the observed spatiality could be understood as a moment in a network of coexisting social and environmental relations. If indeed the intention of mappers is to make legible current land-use and management, they need to better explore the processes producing the spatiality of the community. By failing to do so, they risk inadvertently creating a map which prescribes changes in land-use.

The Insom Village example shows how mapping techniques that fix and simplify fluid and complex associations can become prescriptive. The lines on the map became the guideline for management and resource access between social groups, be they villages or households. In areas where formal land tenure is not yet recognized but is being negotiated, such as in Insom Village, it is the static Cartesian map that frames future possibilities.

The Potential of Multi-mapping Dwelling Space

The experience in Insom Village also serves to illustrate a common mapping dilemma: to map or not to map. While conventional maps are not perfect and can actually serve to re-organize village land-use and management, they are not entirely negative either. On a short field visit in 2003, I found that many villages in the Mae Tho area had been experiencing increased conflict with the RFD, but Insom Village had not. Residents of Insom Village felt that this was due in part to the fact that the RFD accepted the conventional map that the NGO had made for them and that I had corrected. Despite the problems the map caused, it did make legible a particular version of village land-use and help increase village security vis-à-vis the state. Often the legal context within which the state operates demands clear boundaries and conventional maps. I did not believe that I should deny villagers access to a conventional map of their territory making them risk

one avenue towards better land security. I am thus adding my voice to the growing number of scholars and practitioners who suggest that we need to overcome the map or not to map dichotomy and participate in multi-mapping instead (Rocheleau, In Press). As illustrated in the previous sections, conventional mapping is limited in its ability to map complex space produced through social relations of land use and management. Yet we need to make such a space legible in order to avoid re-organizing the landscapes we map.

As described in the previous section, village spatiality cannot be fit neatly into containers with static boundaries, we thus need to move beyond the singular mapping of territory. A first step, even in the production of conventional maps, is to approach the task from an understanding that the visible spatial organization is but a moment in a continuously changing spatial organization contingent upon social relations. Narrow categories of use and cover can unnecessarily reify the present and make future choices limited. Mapping land using contingent categories, for example "Swidden land containing fallow," is one way to navigate overly narrow categorization and map a land category with dynamic cover classes. The cartographers should take time to involve residents in the mapping to as great an extent as possible, being careful to make the process transparent and to reduce the authority of the map over land use. Such steps can be accomplished within the common restraints of time and resources and are steps that I managed to take in re-mapping Insom Village. In the long run we need to map people's activities in the landscape from multiple perspectives, such as the gendered networks of gathering and the seasonal changes in cattle rearing. We need to map the distribution of useful species, the locations serving unique livelihood functions and needs of village residents.

The challenges to mapping a multi-dimensional space into two-dimensions are immense. Multi-mapping, as described by Rocheleau (In Press), has the potential to better illuminate village spatiality without prescribing changes to it. GIS, through its ability to store multiple layers, and mixed media can be very helpful in the efforts to multi-map village spatiality. For instance, a GIS system could store layers of vegetable gathering patterns, of rankings of important sites for livelihood, of sites important for firewood gathering and so on. And layers could be constructed from multiple perspectives within the village, from men and women or from poor and rich. The layers

could also show intensity of activity over seasons and represent, for example, how the activities might change in a drought year, showing the dynamism and multiplicity of local spatial practices. As Rocheleau (In Press) writes,

> GIS embodies a potential liberation of maps from the fixity of a single paper image, and implies the possibility of a recombinant freedom, to re-structure the data into a myriad of maps-as-contingent-products.

Significant progress is being made towards using GIS in a participatory manner (Flavelle, 1995; McKinnon, 2001; Mohamed and Ventura, 2000) and towards the incorporation of qualitative and multi-media data into a GIS database (Cieri, 2004; Williams and Dunn, 2003; Wong and Chua, 2001). Community-based mapping needs to build on these advances.

The analytical capabilities of GIS could be used, not to make one final exact village map, but to illuminate the spatial differences between social groups and the spatial complexity of local resource use and management. Rocheleau (In Press) recommends linking scanned sketch maps and photographs to illustrate the variation within the zones demarcated on conventional maps. Providing links to such materials and possibly to text describing actual practices would help make legible a rich collection of information to better inform conservation design and development projects, as well as to processes of conflict resolution. Such a GIS could help negotiate a less statically bounded solution with the forestry department; a solution that does not serve to unnecessarily re-organize spatial practice and the associated resource management institutions.

Conclusion

The convention of mapping the spatial organization of village land-use as it initially appears, effectively treats space as a statically bounded entity and results in a map that may unnecessarily contribute to the re-organization of management practices. Conversely, understanding the spatial organization of local resource use and management as produced through the act of procuring a livelihood in a particular environment and contingent on changing social, political, economic and environmental processes could result in maps and a mapping process more sensitive to the multiplicity and dynamism of village spatiality. Making local practice and needs legible does not require fitting

complex relationships into simple two-dimensional zones within a fixed grid. Making use of multi-media and the potential of GIS provides a means of making legible and accessible the multi-dimensional worlds of local resource management. Combined with a true commitment to supporting forest-based livelihoods, such mapping could result in just and sustainable solutions to land tenure conflict.

Works Cited

Alcorn, J.B. (2000). Keys to unleash mapping's good magic *PLA Notes* 39: 10-13.

Berkes, F. (1999) *Sacred Ecology: traditional ecological knowledge and resource management*. Philadelphia: Taylor and Francis.

Bird, B. (1995). The EAGLE Project: Re-mapping Canada from an Indigenous Perspective *Cultural Survival Quarterly*(Winter): 23-24.

Brenner, V., R. Buergin, C. Kessler, O. Pye, R. Schwarzmeier and R. Sprung (1999) Thailand's Community Forest Bill: U-Turn or Roundabout in Forest Policy? Graduate College on Socio-Economics of Forest Use in the Tropics and Subtropics, University of Freiburg. Freiburg, Germany.

Chambers, R. (1994). The origins and practice of participatory rural appraisal *World Development* 22: 953-969.

Cieri, M. (2004). Qualitative Research and GIS: Re-representing Space and Place from African-American Perspectives. Association of American Geographers 2004 Annual Meeting, Philadelphia, PA, March 16, 2004.

Eghenter, C. (2000). Mapping People's Forests: The Role of Mapping in Planning Community-Based Management of Conservation Areas in Indonesia. Biodiversity Support Program: Washington, DC.

Flavelle, A. (1995). Community-Based Mapping in Southeast Asia *Cultural Survival Quarterly* Winter: 72-73.

Fox, J. (1998). Mapping the Commons: The Social Context of Spatial Information Technologies *CPR Digest* 45: 1-19.

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

Hodgson, D.L. and R.A. Schroeder (2002). Dilemmas of Counter-Mapping Community Resources in Tanzania *Development and Change* 33: 79-100.

King, B. (2002). Towards a Participatory GIS: Evaluating Case Studies of Participatory Rural Appraisal and GIS in the Developing World *Cartography and geographic information science.* 29(1): 43-52.

Kosek, J. (1998). Mapping Politics *CPR Digest*(45): 4-6.

Makarabhirom, P. (2000). The evolution of Community Forestry Bill in Thailand: One more pass? *Asia-Pacific Community Forestry Newsletter* 13(2): 60-64.

Massey, D. (1992). Politics and Space/Time *The New Left Review*: 65-84.

McKinnon, J. (2001). Mobile Interactive GIS: Bringing Indigenous Knowledge and Scientific Information Together. A Narrative Account. paper presented at the International Worshop "Participatory Technology Development and Local Knowledge for Sustainable Land Use in South East Asia", Chiang Mai Thailand, 6-7 June 2001.

Mohamed, M. and S. Ventura (2000). Use of Geomatics for Mapping and Documenting Indigenous Tenure Systems *Society and Natural Resources* 13: 223-236.

Peet, R. (1998) *Modern Geographical Thought*. Oxford: Blackwell.

Peluso, N. (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 DC: Biodiversity Support Program.

Rambaldi, G. and J. Callossa-Tarr (2002) *Participatory 3-D modelling:Guiding Principles and Applications*: ASEAN Regional Center for Biodiversity Conservation.

Rocheleau, D. (1997). Musings on Mapping Against Power: comments, questions and selected examples. Paper presented at the Ford Foundation-sponsored conference 'Representing Communities: histories and politics of community-based resource management', Helen, Georgia.

Rocheleau, D. (In Press). Maps as Power-Tools: Locating 'Communities" in Space or Situating People and Ecologies in Place, in P. Brosius, Tsing, A. H.et al (eds.), *Representing Communities: Histories and Politics of Community-Based Natural Resource Management*. California:, Altamira Press.

Rocheleau, D. and L. Ross (1995). Trees as Tools, Trees as Text: Struggles Over Resources in Zambrana-Chacuey, Dominican Republic *Antipode* 27(4): 407-428.

Rocheleau, D., B. Thomas-Slayter and D. Edmonds (1995). Gendered Resource Mapping Focusing on Women's Spaces in the Landscape *Cultural Survival Quarterly* Winter: 62-68.

Roth, R. (2004a) 'Fixing' the Forest: The spatial reorganization of inhabited landscapes in Mae Tho National Park, Thailand. Ph.D. Thesis. Graduate School of Geography. Clark University. Worcester MA

Roth, R. (2004b). On the Colonial Margins and In the Global Hotspot: Forest Conflict in Highland Thailand *Asia Pacific Viewpoint* 45(1): 13-32.

Smith, N. and C. Katz (1993). Grounding Metaphor: Towards a Spatialized Politics, in M. Keith and Pile, S. (eds.), *Place and the Politics of Identity*. London:, Routledge.

Vandergeest, P. (1996). Mapping Nature: territorialization of forest rights in Thailand *Society and Natural Resources* 9: 159-175.

Walker, P. and P. Peters (2001). Maps, Metaphors, and Meanings: Boundary Struggles and Village Forest Use on Private and State Land in Malawi *Society and Natural Resources* 14: 411-424.

Williams, C. and C.E. Dunn (2003). GIS in Participatory Research: Assessing the Impact of Landmines on Communities in North-west Cambodia *Transactions in GIS* 3: 393-410.

Wong, S. and Y.L. Chua (2001). Data intermediation and beyond: Issues for web-based PPGIS *Cartographica* 38(3-4): 63-79.

Woodward, D. and G.M. Lewis (eds.) (1998) *Cartography in the traditional African, American, Arctic, Australian, and Pacific societies*. Chicago: University of Chicago Press.