Community Mapping in Borneo- Issues of Accuracy in Traditional Boundary Delineation

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Abstract

This research examines the issue of boundary accuracy in community mapping projects in Indonesian and Malaysian Borneo. Many rural communities have adopted spatial information technologies and methods to challenge 'official' maps, and to gain recognition of their customary lands and resources. Concerns have been expressed, however, about potential difficulties and impacts of community mapping, and a key issue is accuracy evaluation. Boundaries, while apparently straightforward on a map, may symbolize many different social meanings and physical manifestations. I examine how both technical and social aspects of boundary accuracy emerge through three key phases of community mapping: *field data collection*, *mapped representations*, and *applications*. Several sources of data were accessed, including journal articles, manuals, technical reports, legal documents and key informant interviews. It was found that several methods were used to map boundaries in the field. Surprisingly, some methods involved the deliberate avoidance of the boundary concept altogether. Boundaries had multiple definitions at the field data collection level, including land use, land marks, and watershed boundaries. In addition, boundaries were often contemporary responses to external pressures. Large scale environmental changes, such as logging, also impacted the memory, negotiation and location of boundaries. The physical map as well as the mapping process was found to have a role not only in *representing* spatial perceptions of boundaries but also in *producing* them. In applications of community mapping, several modes of accuracy assessment were discovered, particularly in legal contexts. These include *technical* issues such as the evaluation of the map products and skills of the facilitators, and *social* issues such as how property rights are created and how they are demonstrated using maps. I suggest that community mapping is located somewhere in the translation between how the law and local people 'see' and claim property, and conclude that both of these views need to be considered in order to achieve effective levels of accuracy.

Dedication

To
Annie Doyle
and
Phyllis Gibson,
my grandmothers.

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Chapter One:
Introduction

1.1 Introduction

The purpose of this research was to investigate the phenomenon of 'community mapping' in rural areas of Indonesian and Malaysian Borneo, and associated issues of accuracy in the mapping of traditional boundaries. Community mapping has been adopted as a tool by many rural, forest dwelling communities in these areas as a method of both documenting local land use and occupancy, and using this documentation as evidence to support claims to land, resources, and property. Local boundary mapping is often described as an important goal of these projects.

The idea for this research occurred to me while I was working as a GIS instructor and mapping consultant with community based projects in East Kalimantan, Indonesia, and Sarawak, Malaysia at various times from 1999 to 2002. I was often asked to draft maps that had been made by rural Dayak communities of their lands, resources and traditional boundaries. Although it was considered important to produce reports discussing the accuracy of the community maps, there was no existing template, to my knowledge, that outlined how to go about doing this. Certainly, assessments could be attempted regarding the instrumental accuracy of the GPS units used to collect field coordinates, the 'ethnographic' accuracy of the process used to gather the information from local informants, and of the quality of the topographic maps that were often used as a basis for plotting these coordinates. But from a wider perspective, especially considering that much of the information on the maps came from ethnographic data, and the re-interpretation of local knowledge onto a mapped format, the question remained : 'How can it be confidently stated that these maps are *right*?' There were many dimensions to this question, including both social and technical issues.

I wondered if a discussion of accuracy in community mapping could be presented that could incorporate and address the many sources and types of information that are used to compile the final maps, and the sometimes limited access to good quality cartographic materials and spatial technology.

A specific issue that often came up concerned the accuracy of mapped boundaries. From the perspective of a cartographer/draughtsperson, I was sometimes presented with boundary maps that were far from straightforward linear depictions. Sometimes 'boundaries' were shown as points on a map, with areas in between that were not delineated. Often the boundaries incorporated many different features, for example margins of land use, parts or all of watershed boundaries or water features, linear features such as roads, and/or

well-known local landmarks. This made me wonder if my experience was unique, or if this was common in the mapping of traditional boundaries on community lands in this region.

I was also interested in the potential relevance of academic studies of 'mapping and society' to this question. This literature suggested to me that the structure and composition of symbolic language, within the lexicon of conventional cartography, may be relevant to the activity of mapping local perceptions and enactments of boundaries. To me, it is the job of the cartographer to attempt to truthfully represent 'reality', if in simplified, generalized and symbolic formats. But 'reality' is a term that is contingent and subjective in nature. In the case of community mapping, representations of boundaries would ideally reflect local *perceptions* of features, as well as their specific *locations*. But given the complexity and evident difficulties with this issue, how to approach a discussion of accuracy in this light seemed to be quite a challenge. I decided to use the opportunity of graduate research at SFU to delve into this problem of accuracy and boundaries in community mapping. Through my own experiences in the field, I had become aware of many other projects that were being conducted in Borneo, and also that there were many resource people who might have valuable insights into this issue.

It was no surprise to find that the literature one community mapping often presents 'accuracy' as a key and ongoing issue that has yet to be defined and resolved satisfactorily. Concerns have been raised about the level and nature of accuracy required for this kind of mapping, and how this can be achieved within constraints of time, available resources, and funding that often characterize community mapping projects. In contrast to state-based mapping initiatives, which generally have standardized approaches and accuracy standards, community mapping projects can use a variety of methods and materials for data collection and representation, which arguably will impact their perceived or actual levels of 'accuracy'. In addition, deeper issues have been raised which can be loosely termed the 'social issues of accuracy', in critiques regarding the ability of 'western style' maps to accurately represent indigenous perceptions of land and property.

Generally questioning the 'abilities of western style maps' does not in itself provide a concrete starting point for understanding and questioning this concern. I have addressed this by examining the 'critical cartography' literature, which presents some insights about the characteristics and socio-historic context of 'western style maps' that may be relevant to more *specifically* understanding why this style of mapping may be limited in its ability to represent local perceptions of space. This literature presents several points that provide insights into the concerns expressed in the community mapping literature about the social aspects of mapping accuracy. In this thesis I draw these ideas out and show how these two streams of cartographic research and activity have much to say to one another.

The goal of this research was to look more closely at the issue of accuracy in community mapping, with special attention to the often contentious issue of local boundary

delineation. It is premised with the suggestion that the concepts of both 'accuracy' and 'boundary' must be considered as multifaceted, rather than straightforward. This means that definitions and enactments of these concepts may vary depending on the context in which they are used. Thus it is valuable to examine some specific experiences of community mapping in order to gain insights about what actually happens 'on the ground' when local boundaries are put on maps, how the maps *themselves* are received and critiqued, and often have their own stories to tell, and, finally, what happens afterward, when the maps are used for their intended or unintended purposes.

With this research I have examined how some definitions and enactments of 'boundary' and 'accuracy' arose throughout the processes and applications of community mapping. With this analysis, a perspective about 'accuracy' in local boundary delineation in community mapping is presented that details some of the technical and social aspects that were discovered.

1.2 Results

Some of the results of this study reflected expectations. It appears to be true that technical factors such as the availability of good base maps and the combination of various data sources are key aspects of accuracy considerations in community mapping. These were reflected in the responses to questions about boundary mapping methods. On a deeper level, one of the key questions was whether mapping a boundary was a straightforward exercise of translation from 'mental maps' and 'performance maps' to 'conventional (western) maps'. The results of this study suggest that this was a somewhat naive question. In most examples of boundary definition, it was found that 'boundaries' were far from straightforward translations of 'lines on the ground' to 'lines on the map'. In terms of local perceptions, boundaries could be defined by watershed boundaries, land use margins, and/or collections of landmarks with interpolated lines in-between.

In addition, there were some surprising discoveries. In some cases, boundaries could be described as contemporary responses to outside pressures. These 'boundaries' were sometimes manifested physically on the landscape, for example by the clearing and cultivation of land, the blockading of logging roads, or flagging of trees. In addition, boundaries were sometimes emergent at the time of boundary mapping processes, for example when boundary location decisions occurred as part of the mapping exercise, rather than the mapping exercise simply reflecting existing boundaries. In some cases, the notion of boundary mapping was considered so potentially transformative that it was avoided altogether by some community mapping specialists, who favoured instead the representation of land use and occupancy without strict delineations of territorial boundaries.

The 'applications' section of the research provided further insights about boundary accuracy. Key informants were asked about how the accuracy of community made boundary

maps was assessed by external actors. This was potentially a very contentious and complex issue, but the results from the interviews suggested otherwise. Judging by the results of the interviews, the 'applications' phase of community mapping, particularly in respect to how maps are assessed for accuracy by external actors, was an area that had not been given as much attention as the locally based processes of *creating* community maps. Most respondents suggested that this was an area of increasing concern to them, and many were engaged in re-visiting community mapping projects in order to assess their utility and impacts, as well as how external actors perceived their legitimacy and accuracy.

In cases that were recounted, it was often suggested that the *format* of the community maps was equally as persuasive to external actors as the field data and map representation issues that are discussed in this thesis. One respondent suggested that community produced maps were scoffed at by local authorities, but similar maps put in GIS format were more readily accepted as being accurate and legitimate. This suggests that completed maps, regardless of the processes utilized to produce them, are artefacts with power, that when applied can have both positive and negative impacts. This further underscores the need for a committed attention to accuracy at the field data collection and map representation levels. Mapping might be an important tool of empowerment, or it might be a 'Pandora's box' of potentially negative consequences. For this reason, in the words of one informant, 'it is important to get the names in the right place, and to get the associated stories right'.(Int. #3, 15).

Although the insights provided by the key informants about how community maps are applied, and how their accuracy is assessed by outside actors, were intriguing and thought provoking, they did not exactly address the question of accuracy issues in the applications phase of community mapping. In order to get a sense of how external actors might perceive the accuracy of community maps, a recent court case was reviewed in which community made maps were used as evidence in a customary land dispute in Sarawak. The perspective on boundary accuracy that appears in the final judgement of this case suggests that technical issues *are* important, such as the level of training of mapping facilitators, and the instruments and materials used in the project. The case also suggests that *social* aspects of accuracy will be evaluated using several data sources, including local testimony, but also referring to historical documentation and 'expert' testimony. In addition, legal perspectives on the entitlement to and meaning of 'property' factored into the assessment of the maps in this case.

As a final component of this study, I examine how these various findings concerning accuracy in the three stages of community mapping may be relevant to the mapping of the Nomadic Penan boundaries. Here I suggest that making accurate maps of traditional boundaries involves honouring local perceptions of space by learning about how the Nomadic Penan use, occupy and claim their territory. However, dominant legal paradigms

concerning property entitlement, particularly in the legally 'acceptable' production of native customary rights, suggest that creating maps that are accurate enough for application purposes may have to consider and incorporate the differences between how the state and local people 'see' property.

I hope that this thesis will be a contribution to the growing body of work on the broad subject of 'mapping and society'. In addition I hope it will provide some practical and empirical insights to researchers and practitioners interested in community mapping and initiatives such as 'Public Participatory GIS' (PPGIS), particularly those interested in defining and achieving adequate levels of accuracy in community based mapping projects.

1.3 Background

1.3.1 Community mapping

Community mapping is often presented as a grass roots response to state-based mapping and land acquisition, in which local claims to land have been historically under-represented. (Alcorn, 1995; Flavelle, 1996; Momberg, 1996; Peluso, 1995). It has been widely heralded as a way for local people to 'reinsert themselves' into dominant mappings of space by adopting cartographic technologies and methods that previously were only accessible to powerful members of society, and furthermore were implicated in the perseverance of these power relationships. (see Harley, 1988, 1989)

It is a strategy that has proven to be highly effective in some cases (for example see Alcorn and Royo, 2000; Nor, 2001; Peluso, 1996), and also one that can be rife with often unforeseen difficulties and impacts. (Fox et. al, 2003; Muliastra, unpub.) These impacts have been described by Fox et. al (2003) as the 'revenge' or 'ironic' effects of the implementation of spatial technology at the village level, and this is a growing area of interest amongst community mapping practitioners.

One recurrent theme throughout this movement is that it is heralded with much enthusiasm as an important and accessible way for communities to become empowered to address their immediate concerns, such as the erosion of their resource base and loss of their cultural heritage. (Alcorn, 2000; Carter et. al, 1995; Flavelle, 19967; Momberg, 1996; Sirait et. al, 1994) In some of the same literature, however, concern is expressed about the ability of Western style maps to accurately represent local perceptions of land and resources (e.g. Fox, 2002; Peluso, 1995), and also about the potential impacts of these projects. (Muliastra, unpub.; Fox et. al., 2003). The combination of hope and trepidation found in the literature implies that further research into the subject is required.

1.3.2 The issues of accuracy and boundaries in community mapping

Some difficult theoretical and practical issues arise when examining the implementation of community mapping projects, one of which is the nature and level of

accuracy in the map products and supplementary documentation. The issue of accuracy can be thought of as a social issue, in which the ability of western maps to accurately represent 'the complex relationships of traditional resource management systems' (Sirait et. al., 1994, 1) is questioned. I was interested to look further into this question in more specific terms. For example, what exactly is it about western style maps that might constrain the accurate representation of these complex relationships? Does the answer lie in the adequate implementation of standard mapping procedures, or are there deeper limitations to be found within the system of signs and symbols that structures the language of conventional mapping? This is an important issue, because as Fox (2002) suggests, mapping can potentially serve to '...destroy indigenous conceptions of space and (replace) them with imagined lines on the ground' (Fox, 2002, 66).

Others (e.g. Momberg, 1996) have framed the issue in more technical terms, where instrumental accuracy and base cartographic data quality are key factors which presumably can be accounted for and addressed systematically. The suggestion I found here was that as accuracy requirements become more rigourous, more technical approaches to mapping should be adopted.

For this research I have proposed that both of these views are important in examining the issue of accuracy in using mapping to represent traditional boundaries. In some respects, a division between 'social' and 'technical' aspects of accuracy may be a convenient heuristic that in actual practise is less clearly evident. This will be discussed later in this thesis, using empirical examples of challenges and strategies that were recounted by practitioners of community mapping.

The definition and enactment of boundaries, and how to map them 'accurately' requires a recognition that there is a relationship between their mapped representation, and their 'on the ground' understandings and manifestations, but that this relationship may not be absolutely straightforward. One of the premises of this research was that a discussion about the accuracy of boundary locations should have a parallel discussion concerning the physical and social nature of these boundaries. The term 'boundary' is a convenient and highly visible metaphor, but in practise it can imply and embody several ideas simultaneously. Other concepts may be related to and constituent of boundaries, for example 'land use', 'occupancy', 'resource use', 'entitlement', 'claim', 'territory' and 'property'.

Following this, 'boundaries' can be seen as spatial and representative metaphors that may appear straightforward on a map, but may have many different social meanings and physical manifestations in the real world. This poses an important and difficult question to community mapping proponents regarding how and if to map boundaries, how to assess their 'accuracy', and how to evaluate the potential consequences of this activity. In order to deal with accuracy issues concerning boundary mapping, these questions about the underlying

nature and multiple meanings of boundaries must be explored, within the framework of the prospects and limitations of 'western style mapping' to accurately portray them.

1.4 The Research Question

The fundamental reasoning for this research stems from the fact that the issue of 'accuracy' is identified as a key concern in much of the literature on community mapping, (e.g. Carter et. al., 1995; Peluso, 1996; Sirait et. al., 1994). However, I was unable to find any in-depth analysis of this issue. While much of the literature discusses the importance and role of 'accuracy', I found that the definition and parameters of this term were not specifically elucidated. To my interpretation, many writings on the subject implied an *a priori* definition of accuracy that was mainly concerned with the technical aspects of mapping the locations of features on the landscape. For example, a common implication is that a need for more accurate maps can be addressed by using more technically rigorous mapping tools and approaches. (e.g. see Momberg, 1996)

The purpose of this research was not to discount this framing of accuracy, because it is valid and useful. But while this view considers the importance of locational accuracy, and offers strategies to improve upon it, it does not go as far to address other concerns that have been raised in the literature regarding the accuracy of the *social meanings* of the features being mapped. Thus I proposed to widen the discussion of accuracy to include these concerns through exploratory research with community mapping practitioners and related documents. I also drew upon my own experiences working in East Kalimantan and Sarawak as a mapping consultant to identify important concepts and issues.

There is some interesting work in the Canadian context that is relevant to this discussion. For example, Tobias (2000), in his manual for First Nations traditional land use mapping, suggests that community made maps should be valid, accurate, and useful to the communities that make them. He suggests that a set of 'best practises' in regards to traditional land use mapping can and should be developed, in order to structure mapping projects so they are considered valid and accurate in their applications. This work draws upon the experiences of Delgamuukw (1997) and the earlier Baker Lake tests (Elias, 1989). Given this heritage of work in B.C., I was curious to see if a similar set of 'best practices', in regards to accurately collecting and portraying spatial and ethnographic data, was operative in community mapping projects in Borneo.

Because this work was exploratory in nature, I wanted first to discover how practitioners and potential critics discuss accuracy issues in the mapping of traditional boundaries. I identified three key phases of community mapping in which mapping accuracy would be at issue in perhaps different ways. The first phase is *field data collection,* in which performance and mental maps, such as stories and spatial knowledge about the landscape, are translated into the Euclidean spaces of more conventional, or 'Western' style

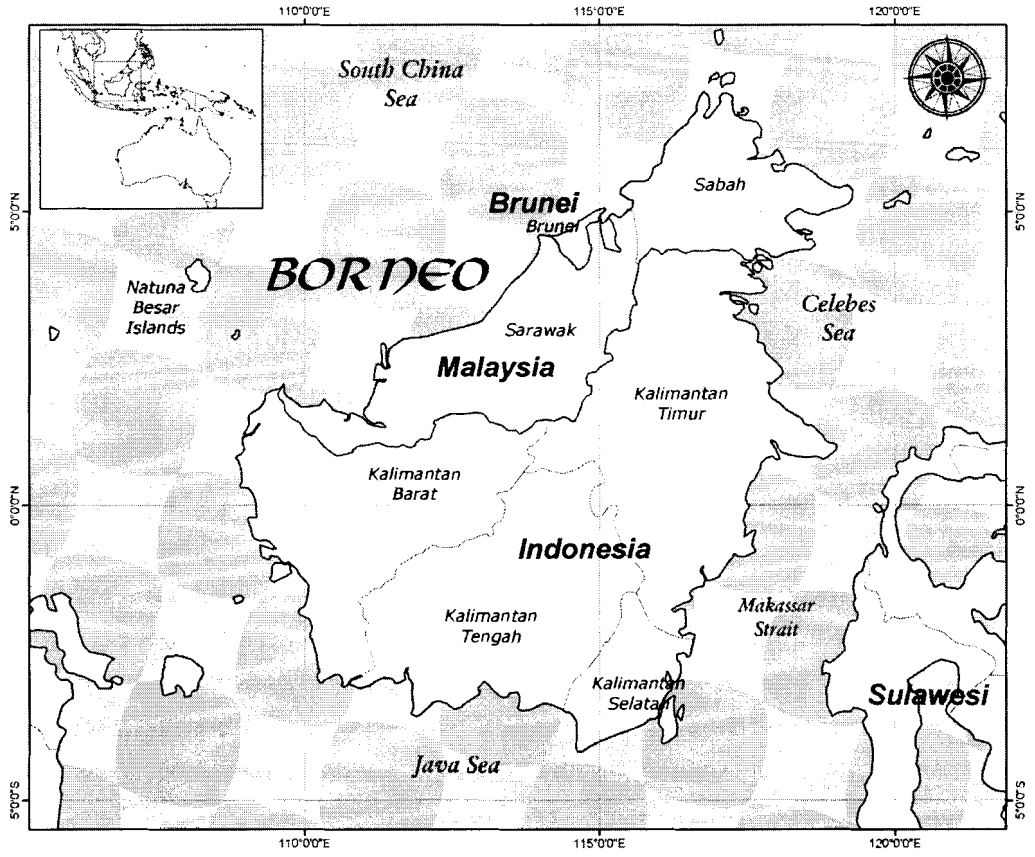
maps through map/airphoto interviews, sketch mapping, and/or locational georeferencing. The second is *mapped representations*, in which the physical map artefact is constructed and viewed, and critiqued for its levels of accuracy. The third and final stage is *applications*, in which the maps are used for specific purposes and presented to a wider milieu than the communities that sponsor their creation. The purpose of dividing community mapping into these stages was to compare and contrast how 'accuracy' might be defined and implemented. It was my hypothesis that there would be qualitative differences between these stages, in particular between what I have termed the 'social' and 'technical' aspects of accuracy. Thus I phrased the research question as the following:

'How does the concept of 'boundary accuracy' emerge through the three key phases of community mapping?'

1.5 The Study Area

The areas of concern for this study are in Malaysian and Indonesian Borneo, specifically the province of East Kalimantan, Indonesia, and the state of Sarawak, Malaysia. There has been a strong interest in community mapping by local indigenous communities and NGO's in both of these areas, and they share many similarities in their natural environment and historical/cultural context. Both of these regions have a colonial history preceding independence, and both have several co-existing ethnic groups, including Malays, Chinese and several thousands of indigenous 'Dayak' people. The indigenous people have historical claims to non-titled land that is officially considered the property of the state. Also, both have intersecting, and sometimes conflicting legal systems as they relate to land and resources, between state law, residual colonial laws, and *adat*, or customary law. I will expand on the wider historical, legal and political contexts of these areas in later chapters.

Figure 1: Study Areas: Sarawak (Malaysia) and East Kalimantan (Indonesia)



Cartography by Nathaniel Bell, 2004. Data source: ESRI

1.6 Methods, Data, Scope and Limitations

The methodology for this study was designed to meet certain objectives. The first objective was to identify how the concepts of 'accuracy' and 'boundaries' arose in the field work and mapped representation aspects of community mapping. The second was to get a sense of how community made maps are applied and critiqued in the wider milieu in terms of their perceived accuracy and validity. The final objective was to incorporate these findings into a wider contextual discussion of the methods and practices of community mapping.

Several sources of data were identified as being important to this research, including a growing body of literature regarding community mapping in Borneo. This includes journal articles, general 'how-to' manuals, more specific technical reports, legal cases in which community made maps are used as evidence, and 'grey literature' such as small NGO newsletters and internet postings. In addition, key informant interviews were conducted with community mapping specialists.

It should be made clear that this work is not an in-depth study of a particular ethnic group or village in Borneo. I will not attempt to completely explain, for example, the Nomadic Penan view of boundaries, nor the Kenyah system of property entitlement. To do

this would require extensive time, field research, funding, and language/cultural skills that were beyond the scope of this study. By extension, I am not claiming to represent a singular indigenous view of 'boundary accuracy' in community maps. Instead, I have chosen a theoretical 'jumping off point' of the general practises, products and applications of community mapping in this region. I have used this scale of inquiry in order to access, gather and compare insights from various sources that although diverse, also share similar characteristics and goals.

I have, however, discussed selected aspects of Bornean societies that are relevant to the topic, and were ultimately suggestive of common themes and concerns regarding accuracy in traditional boundary mapping. The interested reader could refer to several more in-depth studies of the many cultural groups of Borneo, their history, and their present situations, of which there are many examples. [1] In addition, they could refer to sources such as 'The Institute of Dayakology', based in West Kalimantan, which publishes written works by Dayak scholars regarding land and cultural issues in the region.

What I have tried to do in this study is draw upon the field experiences of community mappers who have worked on projects in these areas, or in some cases are indigenous to these areas themselves, as well as written testimonials from local people and NGO staff, to provide data regarding the research question.

1.7 Thesis Overview

The thesis is organized into eight chapters. Chapter 1 introduces the context and the research question. Chapter 2 includes a review of a body of literature that has been loosely termed 'critical cartography', which questions the assumed objectivity of maps and mapping methods. Selected themes from the critical cartography literature are examined that help illuminate the issue of accuracy challenges in community mapping, particularly in light of the prospects and limitations of representing indigenous spaces on maps. The relationship of this work with recent initiatives surrounding the democratisation of spatial information technology, such as Public Participation GIS (PPGIS) will be discussed here. In Chapter 3, I outline the methods, data sources, ethical issues and the scope and limitations of this research. Chapter 4 presents an historical overview of the study area, and discusses 'adat' and 'state' views of property entitlement. Chapter 5 discusses recent literature about community based mapping in Sarawak and Kalimantan, including examples of this work, challenges and risks involved, and a general overview of methods and accuracy. Chapters 6 and 7 document the

[1] For example, see Appell, (1997) on traditional land tenure; The Berkeley Borneo Project on land issues in Sarawak and other parts of Borneo; Brosius, (1986; 1992; 1997) and Sellato, (1994) on Penan culture and landscape; Hooker, (1978,2001) on *adat* law in Indonesia and Malaysia; King, (1978) on Borneo Societies; Langub, (1989;1996) on Sarawak cultural groups; Mackenzie, (2001) on Penan language; Padoch and Peluso, 1996 (eds.) on indigenous people and forest development in Borneo. See also the Borneo Research Council for a list of research interests and bibliography of works to date on Borneo (http://www1.sarawak.com.my/org/BRC/index.html)

results of the study. In Chapter 6, I discuss the findings for phases one and two that were recounted by community mapping proponents and technical reports. In Chapter 7, I discuss the results found for phase 3 regarding some applications of community mapping projects, drawing upon legal documents, technical reports, and articles. In Chapter 8, drawing on the findings of the research, as well as other sources of data, I present a brief case study of how boundary accuracy issues may be considered in the specific context of the Nomadic Penan of Sarawak. Chapter 9 will provide a summary and discussion of overall findings, explore their possible implications, and discuss future areas of study regarding this subject.

Chapter Two:
Accuracy Issues in Community Mapping- Insights from 'Critical Cartography'

2.1 Introduction

> *The rediscovery of the Ptolemaic system of co-ordinate geometry in the fifteenth century was a critical cartographic event privileging a 'Euclidean syntax' which structured European territorial control. Indeed, the graphic nature of the map gave its imperial users an arbitrary power that was easily divorced from the social responsibilities and consequences of its exercise. (Harley, 1988, 282)*

Recent works on the politics of mapping have suggested that mapping is 'pre-eminently a language of power, not of protest' (Harley, 1998, 301). On the other hand, initiatives such as community mapping and PPGIS appear to promote and celebrate, although not uncritically, the democratisation of spatial information technology (SIT) to previously disenfranchised groups. This apparent contradiction compelled me to investigate whether there were insights to be gained from the critical cartography literature that might inform the practice of community mapping in general, and the questions raised by this research in particular.

Concerns have been expressed in the literature on community mapping about the ability of western style maps to accurately represent indigenous conceptions of space. (Fox, 2001; Peluso, 1995; Sirait et. al, 1994). In addition, the choice of depicting community lands in this format may lead to potential consequences and impacts, such as 'increased conflict, resource privatisation and loss of common property'. (Fox et. al, 2003, 1) These potential risks and consequences are exacerbated, in my opinion, if a clear and workable model of accuracy is not operative in the production of the maps, particularly with respect to the use of maps to formally delineate 'boundaries' that may have been previously negotiated and enacted in different ways.

In the first section of this chapter, I explain that community mapping can be seen as a kind of 'translation' of cognitive and performance mapping, onto more conventional, Cartesian maps. In the second section, I show how critical cartography can provide insights into the issue of boundary accuracy in community mapping. This argument revolves around two ideas. The first is that community mapping can challenge the 'selectivity of content' exhibited by official maps that exclude local communities, such as official forestry concession maps in Indonesian and Malaysian Borneo by 'putting local people back on the

map'. However, according to Monmonier (1991) this 'selectivity of content' remains a definitive principle in *all* kinds of mapping, including, I would argue, projects that are community based or 'counter-hegemonic'. The reason for this is that in order to create a useful map, omissions have to be committed to achieve the goal of clarity. But there may be a certain level of orthodoxy to the manner in which content is categorized and selected, that may influence the accuracy of community maps. The second idea involves how maps can produce and reinforce knowledge and power relationships at a symbolic level as well as through their content. Throughout this chapter, I will discuss the relevance of these ideas to those presented by the PPGIS initiative and community mapping.

2.2 Defining Terms: 'Maps', 'Mental maps' and 'Performance Maps'

Although the term 'map' is a commonly used word that might not appear to need much introduction, upon exploration of the literature it can be discovered that there are many kinds of maps. These include the physical map, as well as other physical artefacts that could be considered 'maps; 'mental maps' and 'performance maps'.

'Maps' can be defined as 'graphic representations that facilitate a spatial understanding of things, concepts, conditions, processes, or events in the human world' (Woodward and Lewis, 1998). People create and use them for various purposes, as Woodward and Lewis explain:

> Human activities relevant to cartography include reducing the complexity and vastness of nature and space to a manageable representation; way finding or navigating from one point to another; spatial reckoning of generalized distances and directions...; visualizing the character of local places; articulating spatial power and control related to territoriality; and constructing spatial views of real and imagined worlds. (Woodward and Lewis, 1998, 2).

At least three approaches to studying cartography have been developed. The map can be viewed as a cognitive system, referring to mental maps that facilitate way finding as well as structure perceptions of the world; as material culture, referring to physical artefacts constructed as representations of spatial ideas; and as social constructions. (Woodward and Lewis, 1998, 4)

One of the often stated goals of community mapping is to translate the 'mental maps' people have of their lands onto the material artefact of the conventional Cartesian map, as is illustrated by this quote from a community mapping manual:

> People who live on and depend on the land already have true maps in their minds. The hunter, the farmer, and other people in the community already understand the pattern of rivers, the shape of the land and the use of the land . This handbook shows ways to draw these mental maps on paper in a way that

> everyone in the community, as well as outsiders, understand. (From the 'Community Mapping Handbook', Flavelle, 1996, 1)[2]

This raises an important concern about accuracy in community mapping. Quite possibly there are accuracy implications involved in 'translating' mental maps onto physical formats of paper or digital media. This is particularly important if we accept Harley's view of cartography and the social embeddedness of not only its purveyors, but also of its conventional signs, symbols and styles of representation. Some features and phenomena may in a sense be privileged over others in terms of the ability to represent them spatially in this format.

'Performance cartography' refers to a performance, which can be a non-material oral, visual or kinaesthetic social act, such as a story or dance, 'whose primary purpose is to define or explain spatial knowledge or practice'. (Woodward and Lewis, 1998, 5) Connections between 'performance maps', maps as 'material culture' and local people's assertions of claims to property have been discussed by Strang (2000) in relation to how aboriginal groups in Australia use

> ...performative and artefactual representations of an indigenous cultural landscape...(to)...concretize and communicate their particular moral and political position and challenge European Australians' colonial control over the land. (Strang, 2000,275)

Performance cartography, such as storytelling, can also be a source of information for community mapping projects, and is thus subject to similar issues of translation as 'mental maps'.

In considering the meaning of 'performance' and 'mental' maps, the definition of 'map' moves away from being limited by thinking only of physical artefacts, and moves towards considering 'what maps and mapping may mean among the world's people'. (Rundstrom, 1991, 3)

Examples of performance maps have also been cited from Borneo, for example in the transmission of information regarding territorial boundaries of Iban groups near Batang Ai, Sarawak, through inter-generational storytelling. (Horowitz, 1998). In other communities, for example the Penan Gang[3] of Sarawak, orally transmitted place names are powerful mnemonics not only for way finding, resource management and other day to day activities, but also as historical and spatial records of generations of occupancy and attachment to the land. (Brosius, 1986) Considering these different kinds of mapping is important to developing an understanding of accuracy issues in community mapping.

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[2] See also Natalia, 2003, 3.

[3] Here, 'Gang' refers to the name of a river in Sarawak that is the territory of a group of settled Western Penan, who thus identify themselves as 'Penan Gang'. (See Brosius, 1986)

To sum up so far, community mapping should be considered not only as the plotting of real world locations onto a conventional, physical map. Community mapping can also involve the translation of mental and performance maps, such as storytelling, onto these more conventional maps. By many accounts, it is a technique that has worked very well for local people to explain their views of land to outsiders, but concerns have also been expressed about the use and impact of this particular technique.

This theme is also addressed in the PPGIS literature, in which mapping technology is often viewed as having the ability to both empower and marginalize indigenous communities, in part by privileging 'particular conceptions and forms of knowledge, knowing and language' which may not be compatible with indigenous knowledge systems. (cf: Abbot et. al, 1998; Fox et. al, 2003; Harris and Weiner, 1998; Rundstrom, 1995).

2.3 Critical Cartography, Community Mapping and Boundary Accuracy

2.3.1 Introduction

Translating mental and performance maps onto material maps can be empowering for local communities because it can enable them to communicate with outsiders who might not understand or have access to other forms of local spatial knowledge.

With this in mind, when examining the phenomenon of community mapping, we might perhaps take issue with Harley's assertion that:

> ...the social history of maps, unlike that of literature, art, or music, appears to have few genuinely popular, alternative or subversive modes of expression. Maps are pre-eminently a language of power, not of protest. (1998, 301)

Proponents of community mapping and of initiatives such as Public Participatory GIS (PPGIS) have suggested that powerful forces of mapping *can* be democratized through the popular dissemination and adoption of cartographic tools and methods, or more broadly, spatial information technology (SIT). (cf: Abbot et. al., 1998; Alcorn, 2000; Chapin and Threlkeld, 2000; Corbett, 2003; Flavelle, 1996; Fox et. al., 2003; Harris and Weiner, 1998; Muliastra (unpub); Natalia, 2000; Peluso, 1996; Poole, 1995; Rambaldi and Callosa-Tar, 2002).

By 'subverting the cartographic texts of the enfranchised' (Rundstrom, 1991, 8) and by making SIT available to local communities, cartographers can potentially put Harley's theory into practise by challenging its main supposition of the hegemonic nature of cartography. But in order to do this, considerations of accuracy must be addressed, because inadequately translating mental and performance maps may influence local meanings of land and resource use, occupancy, territory, property and boundaries in unforeseen ways.

In this section, some of the critical cartography literature is drawn upon to elucidate some of the concerns expressed by the proponents of community mapping and PPGIS. One way of examining the role of accuracy in community mapping is to reflect on how maps purvey social and cultural values through the 'selectivity of their content' and their 'signs and styles of representation':

> Maps are never value free images; except in the narrowest Euclidean sense they are not in themselves either true or false. Both in the selectivity of their content and in their signs and styles of representation, maps are a way of conceiving, articulating, and structuring the human world which is biased towards, promoted by, and exerts influence upon particular sets of social relations. (Harley, 1988, 278)

By examining this premise, we can see how maps can be used by the powerful in society to forward their own agendas and promote the control and surveillance of space. This is exemplified in the historic role of maps in colonial empire building (Brealey, 1995; Winichakul, 1996); the territorialization of state control over forest resources (Vandergeest and Peluso, 2001); and in signalling, and perhaps being implicated in, the shift from feudal to modernist perceptions of propertied space 'as something to be measured, contained, divided, manipulated and crucially-alienated'. (Blomley, 1994, 91; see also Kain and Baigent, 1992).

Maps as providers of 'graphic inventories' of land and property lent themselves to a more efficient means of implementing social control and territorial hierarchy. Particularly in relation to the enclosure of the commons and concurrent transformations of agrarian property relationships, mapping and surveying is implicated in the 'spreading of capitalist forms of agriculture' (Harley, 1988, 285). Far from being passive and objective reflections of 'reality', maps have been historically implicated in wide reaching societal transformations of property regimes and power structures:

> In European peasant societies, former commons were now subdivided and allotted, with the help of maps, and in the 'wilderness' of former Indian lands in North America, boundary lines on the map were a medium of appropriation which those unlearned in geometrical survey methods found impossible to challenge. Maps entered the law, were attached to ordinances, acquired an aureole of science, and helped create an ethic and virtue of ever more precise definition. (Harley, 1988, 285).

This notion of 'space discipline' that Harley (also Kain and Baigent, 1992) suggests was imposed on the ordinary people of Europe during the times of enclosure, and on indigenous populations during European colonialism, has contemporary resonance in the situations of indigenous communities still operating under commons, or communally based

systems of land tenure[4], which are increasingly in tension with the property claims and resource aspirations of the state. (for example, see Hong, 1987; McCay and Fortmann, 1996)

In current struggles over local commons in rural areas in Borneo, official forestry maps show in clear terms how space is divided and apportioned for state sanctioned activities and large scale development policies. This very spatial exercise of authority, and its associated definitions of who has the right to do what, and where, by default has defined many indigenous Borneans as 'squatters on their own lands' and has served to either bar or criminalize their traditional patterns of subsistence agriculture and/or forest resource use. (Colchester, 1992) In this light it can be seen that state based and community based mapping are still dynamic forces in the creation and reflection of property regimes and entitlements in Borneo. I will discuss some specific examples of this in the next chapter.

2.3.2 'Selectivity of content' and indigenous communities in Borneo

Many areas in Sarawak and Kalimantan have been 'officially' gazetted and mapped as state land. However, these areas are *locally* claimed under customary, or *adat* law, as belonging to the communities that have lived on them for many generations. This can be demonstrated through genealogies, oral history, and through the physical existence of cultivated areas and/or forest areas claimed and used for material and cultural purposes. In both Kalimantan and Sarawak, official maps showing logging, mining and plantation entitlements have quite literally ignored these local property claims from the map,[5] instead presenting a vision of 'empty spaces' available for large scale and commercial exploitation of resources. Some communities have responded by creating maps and supporting documentation of their customary claims to land, resources and territory.

Community mapping is an interesting phenomenon because it addresses Harley's concern about the selectivity of content found in the maps of the powerful. It can be presumed that the community's maps will introduce other forms of content more representative of local perceptions of land and property, governed by *adat* rules and validated by prior use and occupancy. In terms of content, which maps are more 'accurate' cannot necessarily be judged on an objective continuum of more to less, even if the state appears to have better mastery of and access to cartographic tools and techniques[6]. Instead, as Orlove (1993) suggests, it is useful to

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[4] C. Hess (2002) defines 'common property' as a 'formal or informal property regime that allocates a bundle of rights (within a) group. Such rights may include ownership, management, use, exclusion, access of a shared resource'. see IASCP website: http://dlc.dlib.indiana.edu/cprdef.html. See also Rose, 1994 pp. 35-6 for a longer explanation.

[5] For example, see Peluso's (1995) discussion of the development of state based resource mapping in Kalimantan

[6] Although many official maps in the region are unreliable in terms of village locations and toponomy, spatial coverage and thematic concerns such as forest cover (see Peluso, 1995)

> ...challenge the fundamental assumptions underlying much of cartography and cultural geography: the notions that maps are a cultural universal and that maps, as depictions of an external reality, may be arrayed on a scale of greater or lesser accuracy (Orlove, 1993, 29).

It can be argued that community members might see *their* maps as being more accurate, in light of the content selected and displayed, and their activities of community mapping as an attempt to counter the inaccuracies of state maps.

2.3.3 Community mapping and the 'signs and styles of representation'

Cartography involves 'signs and styles of representation' which are arguably implicated in knowledge and power relationships. Here the point is not only about the historical *application* of maps, and how power structures can overtly influence content, but also how 'cartographic communication at a symbolic level can *reinforce* that exercise' (Harley, 1988, 280, my emphasis).

If so, the system of signs and symbols which are used on maps must *itself* be investigated for potentially misrepresenting indigenous knowledge and perceptions of space[7]. This reference to 'signs and symbols' can include things like the inclusion or exclusion of features, symbolization, and selective hierarchies and toponomy. (Harley, 1988, 292-295, 299-300; Orlove, 1993; Rundstrom, 1991). Does the application of this set of signs and symbols suggest certain constraints to representing local perceptions of land? In a sense, the methods and materials available to community mappers as well as the conventionality of Western cartography (see Turnbull, 1989)[8] may act as a sort of pre-existing template for the representation of community information. Physical and social features that are amenable to this template will perhaps be privileged, representationally, over other less 'mappable' entities, phenomena or relationships. Once drawn on a map, the apparent unity of a symbolic feature such as a 'boundary' may serve to mask or simplify multiple meanings, relationships and ambiguities. Thus it is useful to assessments of accuracy to re-examine apparently homogenous and unitary features, such as boundaries, and investigate their social constructions and their physical, or 'real-world' manifestations.

To do this we need to look at the physical map artefact as placed within a wider process of map making and map viewing, and look at these in wider circles of societal and cultural context. (cf: Orlove, 1993; Rundstrom, 1991) It is also important to ask specific questions about the relationship between 'on the ground' manifestations and 'on the map' representations of 'boundaries' in community mapping.

It should be kept in mind that generalization, and thus exclusion, is unavoidable in cartography. In order to create maps that communicate effectively, the cartographer must

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[7] Thank-you to Adrienne Burk for commenting on this

[8] Turnbull suggests that all maps are indexical and conventional, not just Western maps. The point is underscored because Western maps are often viewed as being objective representations of space.

apply selection, generalization and symbolization to the phenomena being mapped. But, 'although maps are not the territory, they become the territory' (Rundstrom. 1991, 6), meaning that maps can shape and influence future relationships, so the map makers must consider carefully what is excluded and included, and how these features are symbolized and represented.

It is possible then, to consider a 'boundary' delineated on a conventional map to be a symbol and an abstraction designed to represent a cluster of ideas and relationships, as well as a set of physical locations on the landscape. When thinking about the accuracy of mapped boundaries, it is necessary to explore what these ideas and relationships are, and whether the 'line on the map' adequately conveys them.

2.4 Chapter Summary

The inquiry of 'critical cartography' has posed some interesting ways of critiquing maps made by cartographers in the service of the state or other powerful members of society. There is, however, no undisputed proof that the signs and symbols of cartography are *intrinsically* bound to privilege one world view over others, or are particularly 'hegemonic' in and of themselves. However the suggestion that maps are highly implicated in the reification of space, particularly in terms of representing local claims to land or resources, or 'property' is important to this discussion. Western cartography *may* privilege certain perspectives of space over others, through conscious and unconscious distortions. We can examine two aspects of maps: the selectivity of content and their signs and styles of representation, to examine how they might 'conceive, articulate and structure the world'. (cf: Harley, 1988, 278) This may include pre-existing biases, conscious or unconscious, which can influence sets of social relations.

These fundamental ideas of critical cartography elucidate some important issues concerning accuracy in community mapping. First, that maps are more than just static representations, but involve processes and social context. Secondly, that 'accuracy' is concerned with more than simply the 'correct' location of features on a map. There are also accuracies of content, in terms of what is included, what is excluded, and how these decisions are made. And, there is the accuracy of symbolization, regarding whether the symbols chosen to represent features adequately convey the clusters of ideas and relationships that constitute them. This research focussed on *one* of these features, a 'boundary', and travels backwards and forwards through the process of mapping to unravel what these clusters of ideas and relationships are.

Community mapping might challenge the suggestion maps are tools only for the powerful by presenting a counter-hegemonic approach to the depiction of space. However, many of the observations in the critical cartography literature about the way maps work in society, particularly at the symbolic level, are important to consider. For example we can

investigate whether and how selectivity of content and signs/styles of representation are operative in what I have posed as the three phases of community mapping. In reviewing community mapping manuals, it is clear that selectivity of content is implicit in the field data collection design and in the development of conceptual categories. Community mapping employs many styles of representation and symbolic abstractions of what are not only 'places' with specific geographic coordinates, but are also defined by ideas and relationships defined by local contexts. An important and often contested aspect of these is the 'boundary', how it is represented, what meanings are implied by its representation, and what the possible implications are of representing it on maps in 'conventional' ways. In the next section the methods that were adopted to address the questions posed in this research will be discussed.

Chapter Three: Research Methods

3.1 Introduction and Research Question

3.1.1 Introduction

The methodology for this study was designed to meet certain objectives. The overall objective was to explore whether the accuracy of community maps, particularly the representation of local boundaries, could be defined and evaluated using both social and technical criteria. The first specific objective was to identify how the concepts of 'accuracy' and 'boundaries' were experienced and discussed during the stages of field data collection and of revision/critique of the community maps. The next objective was to get a sense of how community made maps are used, and how they are *critiqued* in terms of their accuracy, by actors from outside the community who are also the intended audiences of the map. The final objective was to analyse these findings using a framework based on ideas surrounding accuracies of content, location and symbolization.

3.1.2 The research question

The focus of this research has been to address concerns arising in the literature about the issue of accuracy in community mapping, including 'technical issues' such as the quality and availability of base maps, and the use of instruments such as GPS, and 'social issues', particularly concerning whether the syntax of Western-style maps can adequately represent the location and meaning of community boundaries. Of interest to this research is Orlove's suggestion that differences between mapping approaches, for example between state and community maps, do not imply a spectrum of more to less accuracy, but rather...

> ...challenge the fundamental assumptions underlying much of cartography and cultural geography: the notions that maps are a cultural universal and that maps, as depictions of an external reality, may be arrayed on a scale of greater or lesser accuracy'(Orlove, 1993, 29)

Following Orlove, one of the premises of this research was that no neutral position can be taken in which to assess the degree of accuracy of community maps. In this case, this is because of nebulous concepts of 'community'and 'participation', the wide variety of techniques and purposes found in community mapping and the concurrent lack of any given 'standard' guidelines about mapping accuracy in this context.

However, weaving through this confusing morass are two important threads. The first is that local people will probably have more detailed and accurate information about local place names, land use and occupancy, and boundary locations than state based mapping agencies. The second is that they will often *not* have access to the best source materials, such

as reliable topographic maps, and spatial information technologies. Concerns about accuracy really should explore how projects work with available resources to create products that are *sufficiently* accurate for their purposes. One of the first questions to ask then, is what *is* 'sufficiently accurate'? For example, a 'sufficiently accurate' community map may have to meet the following criteria:

- acceptable *spatial (locational)* accuracy of features mapped for the intended purpose of the map
- acceptable levels of participation and representation to make it a 'community' map
- opportunities for revision and correction at the community level, and
- acceptability to relevant 'outsiders' as being valid and accurate

This suggests that examining accuracy issues should include both how the maps are made and how they are ultimately critiqued. Both of these stages may present possible barriers and opportunities for achieving these criteria . Also, considering Harley's notion that the way maps represent social meaning is mediated through a set of signs and symbols that are culturally and historically rooted, it is important to ask if some features are 'easier' to map than others, and whether this privileges certain conceptions of space over others.

An approach was developed which examines the concept of 'accuracy' as it emerges through what I have identified as the three key phases of community mapping projects: field data collection, mapped representations, and wider applications of the mapping projects. These phases are admittedly for heuristic purposes, and in reality there may be different ways to break down this process, as well as a certain fluidity between phases. However, it is conceptually useful to identify the major stages of difference between map process, product, and application.

As previously suggested, when thinking about the accuracy of mapped boundaries, it is necessary to explore the ideas, relationships and physical aspects of the landscape that constitute them, and to consider whether a 'line on the map' adequately conveys this. This involves asking how community boundaries are determined and mapped in the field, about particular challenges involved in doing this, and how the accuracy of these mappings is verified. Secondly, it involves examining how the concept of 'accuracy' is enacted *after* the map is completed, whether for further verification with local people involved in the process or in the ultimate uses and applications of the maps. Thus I have structured and expanded upon the research question as follows:

RESEARCH QUESTION:

How does the concept of 'boundary accuracy' emerge through the three key phases of community mapping?

ASSOCIATED QUESTIONS

1. PHASE ONE: FIELD MAPPING
-What methods are used to map boundaries?
-What are the challenges/implications involved in combining different types and sources of data?
-How is the boundary determined?
-What challenges come up in identifying and georeferencing boundaries in the field?
-Are some types of information difficult to map in 2-D cartographic space?
-How is boundary accuracy verified?

2. PHASE TWO: MAPPED REPRESENTATIONS
-What *is* a sufficiently 'accurate' community map?
-How do local people respond to/critique the maps?
-Are accuracy reports produced? What do they entail?

3. PHASE THREE: APPLICATIONS
-How are the maps used in specific contexts?
-How do outside actors respond to/critique the maps in terms of their perceived accuracy?

3.2 Key Concepts

3.2.1 Introduction

The research focuses on two key aspects of boundary accuracy issues in community mapping projects-the 'technical' and the 'social'. The first of these concerns the methods, materials, and types of data used in the mapping project . Judging from the literature and my own experience, I assumed it was likely that *multiple* methods and a *variety* of materials and data were used in the community mapping projects studied, for example, sketch mapping, map interviews using topographic base maps, GPS data collection, and satellite imagery. The significance of this is that in the compilation and presentation of one or a few final map products, these varying forms of data and materials are presented in a composite manner, which may have important implications in discussions of accuracy. My basic assumption about 'technical problems' in accuracy is that they might have fairly straightforward, albeit difficult to achieve, 'technical solutions'.

The 'social' aspect of accuracy concerns the potential for nuances in meanings and interpretations of mapped features, for example territorial boundaries. It has been suggested that this potential for nuance may be of extreme importance to locational and conceptual accuracy in the presentation of local information, and also may play a role in the potentially

transformative impacts of the maps. This can be examined by looking at a notion of 'social accuracy' from two directions. First, it can be questioned whether boundary lines represented on maps as linear symbols accurately represent local perceptions, definitions and enactments of boundaries. In translating mental and performance maps of boundaries and territory to a line symbol in Cartesian space, a new representational mode is employed. The question posed by this research is how accurate is this symbolization? As some have suggested, drawing lines on maps can serve to destroy or transform local meanings of dynamic property systems. By inquiring into the 'social accuracy' of the mapped boundary, particularly at the field data collection phase, I sought empirical examples of possible tensions between local perceptions of boundaries and their mapped linear counterparts. In questioning this aspect of accuracy, it is necessary not only to ask about methods and materials available to community mappers, which will shed light on more technical questions, but also to ask how boundaries are determined in the field, and whether any challenges arise when attempting to represent them with linear symbols in Cartesian space.

A second aspect of 'social accuracy' concerns how the maps are evaluated by external actors, such as in legal applications where the maps need to be justifiable to challenges. Criteria used to evaluate the accuracy of maps in their applications involve not only technical requirements, but also include what the law 'sees' as an accurate representation of community boundaries. For example, it is potentially possible for local communities to hire professional surveyors to make accurate maps of their territories, but it is also necessary to support the location of the boundaries with other substantive arguments besides locational and technical accuracy.

In the research, I inquired about the methods used to map boundaries, the challenges came up during the mapping process, and how the maps were ultimately perceived in terms of their 'accuracy'. Through this, occasions were identified when accuracy issues where 'technical' in nature, when they were 'social', and when there was perhaps a combination of these at work. The information discovered provided empirical examples for an analysis of accuracies of content, location and symbolization, and also provided an opportunity to present the experiential knowledge of community mapping practitioners about how they have addressed these difficult issues. In order to help ascertain what 'technical' and 'social' aspects of boundary accuracy may entail, I reviewed some of the cartographic literature for definitions of 'accuracy' in maps, and have contextualized them in terms of community mapping. (3.2.2) I also present a discussion about the 'boundary' concept and how it relates to mapping. (3.2.3)

3.2.2 'Accuracy'

In very general terms, 'accuracy' can be defined as

> ...the degree to which information on a map or in a digital database matches true or accepted values. Accuracy is an issue pertaining to the quality of data

> and the number of errors contained in a dataset or map. (Foote and Huebner, 2000,1)

The authors of this definition go on to suggest that

> ...it is possible to consider horizontal and vertical accuracy with respect to geographic position, as well as attribute, conceptual, and logical accuracy. (Foote and Huebner, 2000,1)

Issues of error and inaccuracy are extremely important considerations in the creation of community maps, or 'spatial datasets' in general.[9] (Foote and Huebner, 2000) One of the key sources of error is from the integration of different types of data that were produced under different conditions, for example different scales, and different levels of accuracy and precision. In any project that integrates different types and sources of data, there will be an inheritance of error issues, which may also combine and produce new ones. As discussed in chapter 3, community mapping integrates multiple data sources and types, as it often employs some combination of official topographic maps, often enlarged with photocopiers, remotely sensed images, 'sketch maps', 'map interviews', and GPS collected coordinates of 'real world' locations of features.

Of key importance is that there is more than one type of accuracy involved in mapping. These include 'positional accuracy', 'attribute accuracy', 'conceptual accuracy', and 'logical accuracy'. (Foote and Huebner, 2000)[10]

A related term is 'precision'. Accuracy and precision, while closely related, do not mean the same thing. 'Accuracy' can be thought of as 'the degree to which information on a map...matches true or accepted values'. (Foote and Huebner, 2000, 2). In the case of this study, a 'value' can potentially mean both physical phenomena, such as the location of a landmark site like a mountain that partially describes the location of boundaries, or a set of social meanings which describe location and meanings of boundaries.

Precision refers to the 'level of measurement, and exactness of description...'(Foote and Huebner, 2000, 2). Information, whether qualitative or quantitative, can be very precise, and yet still not accurate, and the reverse is also true. A common mistake in mapping projects is to confuse or equate these two concepts. For example, if my height is 1.6256 meters, it is more 'accurate' to say my height is 'about 1.6 meters' than to say it is '1.8901 meters', even though the second measurement is more precise.

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[9] Foote and Huebner are specifically talking about spatial datasets for GIS, but I am employing their discussion for all spatial datasets, including those produced by community mapping. This approach is justified, I believe, as increasing numbers of community mapping initiatives are choosing to use GIS as part of their spectrum of methods and approaches, and also because similar principles apply whether or not spatial data are automated.

[10] See Foote and Huebner (2000) for a detailed explanation of these and other types of accuracy

Qualitative information can also vary in accuracy and precision. For example, a spatial feature, such as a georeferenced farmer's field, may have many attributes associated with it[11]. If Mr. Smith's field is being mapped, and he plants corn and rice in it, it is more accurate to say 'This is Mr. Smith's field' than to say 'This is Mrs. Clancey's field and she uses it for rice, cassava, and fruit crops', even though the second description is more precise.

Without considering the relationship and importance of these two concepts, there can be errors such as false precision and false accuracy. This refers to the reporting of findings at a level of accuracy and/or precision that are impossible to achieve with source materials. This becomes increasingly important when evaluating projects that have several sources of data, some at very different levels of accuracy and precision than others.

Accuracy is also related to scale. For example, in a 1:50,000 map, a 1mm 'line feature' which implies no area, can actually encompass 50 meters of area in the real world. A similar issue exists with points, which, in a conventionally cartographic sense, imply no area or distance, but rather a distinct x,y location. Abstraction, generalization and exaggeration are also things to consider with mapping accuracy, as are symbol adjustments such as line widths, types, colours and patterns (Robinson et. al., 1995). These are standard concerns and principles of any cartographic exercise, and also help to shed light on my concern with 'accuracies of content, location and symbolization', and how these are inherently, within the rubric of cartographic design, related. The following sub-sections expand on the meanings of positional, attribute, and conceptual accuracy, and describe how they are of concern to community mapping projects.

3.2.2.1: Positional accuracy and precision

Positional accuracy refers to both horizontal and vertical positions, and basically refers to the question of whether a mapped feature corresponds positionally on the map to its actual location on the ground. This kind accuracy is also tied to the scale of the map. Changing the scale from small to large through photocopying enlargement, a technique often used in community mapping projects, (e.g. Flavelle, 1996; Momberg et al, 1996) or using GIS 'zoom in' utilities, does not improve the accuracy or precision of a map.

Most mapping agencies have fairly rigorous positional accuracy standards for different scale maps. One of the questions introduced in the discussion of accuracy in community mapping is regarding positional accuracy of features mapped, which will depend on the types of materials and tools available (for example the scale and quality of base maps, whether they were enlarged by photocopying or GIS methods, and the quality of GPS units used).

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[11] 'Attribute' data means qualitative information associated with 'spatial' data, which describes location, usually in terms of x,y coordinates on a Cartesian plane system. GIS is very useful and powerful because it can combine spatial and attribute information for combined storage, analyses, and output.

In terms of the second question of the research, which involves possible nuances, meanings, and perceptions of mapped features, positional accuracy, defined by Foote and Huebner as 'a measurement of the variance of map features and the true position of the attribute' (2000, 6), may be more difficult to achieve while mapping certain features. This is because *positional accuracy is closely influenced by the type of data being recorded.* For example, some features are easy to locate and represent cartographically if they are well defined, and relatively discrete, such as roads, buildings, and gravesites. Other features may be more difficult to locate specifically, and their mapped representation may be an estimate or abstraction of the cartographer. This might apply in situations such as the mapping of boundaries that are not distinctly linear, or the use of maps that attempt to 'locate' ethnographic data that while spatial in some senses, are difficult to portray with a solely Cartesian syntax. Many phenomena, while spatial in nature, do not have easily specified locations, but may occur in a general area, and also may move over time and space.

3.2.2.2 Attribute accuracy and precision

Attribute accuracy refers to the accuracy of non-spatial, qualitative data that are associated with mapped features. In community based mapping, this is often termed 'ethnographic data'. In a GIS this information would be stored in database files linked to mapped features in some way, for example through a relational database using linking 'keys' common to both the spatial and non-spatial data. In community mapping projects this may be done through the upkeep of field notebooks, which include visual or written information about the feature identity and location. Sources of error in the accuracy of content, that is the correct labelling and presence of features, may arise from the omission or misrepresentation of certain information.

3.2.2.3 Conceptual accuracy and precision

Conceptual accuracy and precision involves how real world phenomena are abstracted and classified on maps, and is of key importance to inquiring about the mapping of 'boundaries', and other types of community information. The way real world phenomena are abstracted and, for example, how categories of information are developed, will influence how the information can be displayed and used. (Foote and Huebner, 2000) In order for conceptual accuracy to be considered adequate, it should suit the intended use of the information. Assessing this involves determining how this was done at the field data collection/map presentation levels for various mapped features, and evaluating whether the ways in which the real world phenomena were abstracted were appropriate for the intended uses of the maps, *and* whether they accurately represented the phenomena being mapped.

3.2.2.4 Logical accuracy and precision

This refers to whether the use of the information in the spatial database is logical. That is, is the information used to present arguments, make decisions, or conduct analysis

adequately suited to the purpose? It also refers to the appropriate comparison of different types of spatial and attribute information. For the purpose of this study, I have suggested that evaluating accuracy should include a determination of how the community maps are applied or evaluated, and how the information is collected and presented.

3.2.3 'Boundaries'

The concept of boundaries has preoccupied Geographers for some time, (for example, see Newman and Paasi, 1998) and can be an abstract notion with fluid meanings. For this study, the concept was based on the idea that although perhaps less distinct in the 'real world', there is often a specifically represented cartographic form. The boundary's cartographic form can involve a *linear* feature on a map indicating length but not area, and an implication of a specific location that should have an accurate correlation in the real world. Although often represented in linear form, the mapped boundary can also imply an *area*, or territory, that will have a unifying characteristic, whether physical or social, that lends meaning to its location and nature. The 'real world' correlate of the mapped boundary refers to how people perceive and enact notions of boundary, and to physical examples of this boundary on the landscape. It is a conceptual challenge to consider a 'boundary' as a specific 'thing', and yet at the same time question this conceptualization. The approach taken to address this challenge was to use a reified notion of 'boundary' as a guiding yet problematic term. In order to do this, both the textual and interview data were used to discover instances that may support the notion of a 'reified boundary', or elucidate where and how this conceptualization may be problematic.

3.3. Research Design

3.3.1. Choice of research methods

The research was designed to be exploratory and qualitative in nature. A flexible approach was sought that could access, analyse and compare data from sources identified as potentially important to the research: the opinions and experiences of experts and local people in the field, and textual sources such as maps, technical manuals, reports and court cases involving community maps entered as evidence.

Both the nature of the research question and the nature of the data of interest appeared best suited to a qualitative research approach, which is 'the analysis of words and images, rather than numbers' (Silverman, 2000, 8) or a study that 'yields ...observations not easily reduced to numbers' (Babbie, 1992,285) . This approach is suited to descriptive, rather than quantifiable data, and is suited to interpreting 'meanings' rather than directly observing and measuring 'behaviour'.

To structure the inquiry, two key concepts were identified-'accuracy' and 'boundaries'. According to Babbie, (1992) it is important in social research to specify the

meaning of concepts in order to research them. However, it was one of the premises, and of key interest to this research that multiple meanings of these concepts might be discovered. Babbie (1992) suggests that in cases such as this, several different, yet clear definitions of the concept can be outlined before doing research, and this outline can serve as a kind of guide to elucidating how the respondents define the concepts.

3.3.2 Data sources

This study used several sources of data. The first was conducting interviews with individuals having what is considered by the researcher important knowledge concerning the role of accuracy in community mapping projects in Borneo. No formal sampling of this population was undertaken, but a sense of potential informants was developed through reviewing the literature, conducting internet searches, and asking key informants for referrals to other potential informants. The indicator for the 'expertise' of these informants was that they had published writings on the subject and/or had extensive field experience, and/or were knowledgeable about, or members of, the communities involved in the mapping projects.

Another source of information was examples of community maps. Permission for their use was provided by 'gatekeepers', in all cases NGO staff members who had facilitated the mapping projects. Because some of the information provided on the maps could be considered sensitive, and the property of the community in question, steps were taken to ensure the security of this mapped information. These steps involved removing indicative geographic coordinates and place names while retaining the story of the overall mapping methodology and resultant 'types' of information portrayed. It cannot be assumed that the examples used are representative of all community maps produced in Borneo, but it was considered useful to examine them for findings that may be suggestive of cases elsewhere. Other sources of information were also accessed, such as community mapping manuals, reports, and a relevant court case that discussed the use of community mapping as legal evidence for an NCR case in Sarawak.

3.3.3 The 'three phases of community mapping'

In order to address the question 'How does the concept of 'boundary accuracy' emerge through the three key phases of community mapping?', I have divided 'community mapping' into three stages in which ideas about 'accuracy' may emerge . These are: field mapping, mapped representations, and applications. It was assumed that throughout these three stages, discussions of 'boundaries' and 'accuracy' would be evident, as well as discussions of other issues.

In broad strokes, the goal was to get a good picture of the production, presentation and use of community maps, and also to discover and analyze specific discussions surrounding accuracy and boundaries. Dividing the mapping project into stages and drawing out themes of 'accuracy' and 'boundaries' through each, has the advantage of looking at

mapping not only as a singular activity or 'product', but as a process with historical and social context. Since this project views community mapping as a purposeful activity with potential advantages and drawbacks, this was one approach that was amenable to comparing data gleaned from various stages of this process.

The limitations of this approach are that the data are partial, and comparisons are made between different kinds of data acquired, for example, from qualitative assessments of interview data, and interpretations of 'texts' such as physical maps, mapping manuals and court documents. Silverman (2000) suggests that texts and documents such as maps can be analysed qualitatively to promote an understanding of language and sign systems. Interviews, on the other hand, can be used to uncover descriptions of 'experience'. But underlying this, in this research, is the logic that in an 'ideal world' there would be consistency between these data. That is, understandings based at the field data collection phase should be consistent with what is represented on the map, and how the map is later applied. In uncovering potential differences, or inconsistencies, I would suggest that we get closer to understanding the issue of accuracy in community mapping.

3.3.3.1 Phase one: field data collection

Field data collection in community based mapping can be defined as the collection and documentation of information from local people regarding the location of their natural resources, land use zones, important cultural sites, and boundaries. It can involve interviewing and sketch mapping exercises, which are later transferred to topographic maps, and also field survey methods in which the actual site locations are recording using compass triangulation techniques and GPS.

This phase of mapping was of great interest as it may imply the 'moment' of documenting dynamic local knowledge systems, such as those communicated through mental or performance maps, onto more conventional maps, a process that is described in the literature with seemingly equal amounts of enthusiasm for its potential benefits, and trepidation for its potential pitfalls. Much of the literature alludes to the *power* of mapping to protect local land rights, and the *limitations* of mapping to accurately reflect dynamic local systems of resource management and allocation. (e.g. Fox, 2000; Peluso, 1995; Sirait et al. 1994) But there was very little elaboration about where these hopes and fears came from, specifically. The goal of this phase of the research was to find specific instances that may illustrate challenges of accuracy in community mapping. For the field data collection phase, a more detailed account was sought regarding this aspect, in a sense, an analysis of 'the practice' of community mapping.

The method for examining Phase One follows Orlove's (1993) description of an 'analysis of practice' in regards to community made maps. This approach, Orlove suggests, focuses on the ways in which people draw on maps, includes viewers and their ways of

looking at maps, and also includes the notion that people have a specific purpose for using a map. I have expanded on Orlove's method by suggesting that an analysis of the practice of community mapping may also include uncovering some difficulties and challenges that may arise from asking people to represent their local knowledge and systems of land use cartographically. I have suggested that these challenges may be accounted for partially through the availability of resources to the community mappers. There is also, however, the need to consider the potential and limitations of *the cartographic form* of communication itself, to represent local features accurately. This includes an understanding of the potentials and limitations of the lexicon of western, or 'conventional' mapping, which is a set of recognizable signs and symbols on an abstract, uniform and absolute space. (e.g. see Turnbull, 1989).

Key informant interviews

Key informants were interviewed on the basis of their experience in community mapping in these regions, or having other specialized knowledge of the region. These informants could be considered 'experts' in that they had extensive field experience working with community mapping projects in Borneo, and in many cases had published articles and/or books on the subject. Some key informants were not 'community mapping experts' per se, but had been involved in anthropological or ethnographic studies in the region, and were well placed to offer their interpretations of local perceptions of landscape and resource management systems. It must be said that while interesting and useful, the opinions of 'experts' regarding local perceptions of landscape is not the same as collecting information from the local people themselves, as much of the information is 'second hand' and filtered through the identity and positionality of the respondents. Some of the 'experts' interviewed were also local people from the areas of study, who were also involved in some way with the mapping project, and their particular experiences and points of view are considered invaluable to this study. It is a weakness of this study that a more thorough and representative example of the views and experiences of local people themselves was not included. The reason for this non-inclusion was not a lack of recognition of its importance, but a limitation of funding and opportunity, and also the ethical considerations involved with critiquing the process of community mapping with specific communities still involved with using this tool to pursue important issues.

The interviews were semi-structured and open ended in format (see Appendix II). The questions were detailed, often tailored to the experiences of individual informants, and sought information that was not available from technical reports or scholarly papers. A total of 13 interviews were conducted and transcribed. They varied in length from 1 to 40 pages of written transcription. Six interviews were conducted in-person, three by telephone and four by e-mail. Upon reflection, I would suggest that 'in-person' was the mode of interview that was the most valuable, because the interviews were long and detailed. Some informants who

responded by e-mail communicated that the interview questions seemed too long and complicated and involved a lot of writing on their part. In some cases this resulted in hesitancy to complete the interview, and on some occasions extreme brevity in answering the questions. The opportunity for the informants to 'talk through' the interview was, in hindsight, beneficial to gathering the nuanced reflections that were sought for this research question. Nevertheless, access to e-mail and long-distance telephone widened the field of potential informants and for this reason was invaluable.

Community mapping manuals/technical reports

Both generic community mapping manuals, and specific reports about the mapping projects in the regions of question were reviewed. A comparison of manuals and reports was of interest to the researcher because the manuals imply an 'ideal' approach to community mapping, and the technical reports suggest a more grounded reflection on the actual process that occurred. That is, manuals suggest how 'accuracy' might be considered in an abstract context, whereas the interviews might provide more information about how the idea of accuracy works out in practice. The approach taken was to search for the themes mentioned above as mentioned in these texts. Relevant passages were coded and used for further discussion and analysis.

3.3.4 Phase two: map production and presentation

The data sources for this phase were key informant interviews and community made maps.

This aspect of the research considered the final map produced by communities. Orlove's method of analyzing maps as 'texts' was employed. In this method, a series of questions are asked of the map in order to analyse its relationship to both the landscape it represents, and the social processes behind its production. This method of analysis involves examining mapping texts not only for their straightforward content, but also looking at elements such as feature selection (what is put in, what is left out), feature placement and hierarchy, naming conventions, symbology, colour, scale, authorship, margin statements, base data sources, mapped data origins and methods (if possible to ascertain), materials used, and so forth. The underlying purpose and potential viewers of the maps is also an important element of this approach, which I attempted to document through the initial key informant interviews and technical reports. Maps from two projects, one in Sarawak and one in East Kalimantan, were analysed. Although the maps were of some interest, the main findings concerning accuracy were of a more technical than social nature.

Key informants were also questioned about this phase of the mapping. The most vital question concerned the relationship between the features represented on the map, and the processes involved in their documentation. Questions were asked such as how the maps were received by the community, and whether any critiques arose surrounding the mapped

depictions of community land use and boundaries. In addition, informants were questioned about how the maps were verified for accuracy, and by what standards.

3.3.5 Phase three: applications

The data sources used to examine this phase were key informant interviews and a relevant court case documenting the use of community maps in a legal context.

This aspect of the study concerned how maps are actually used. In order to ascertain this, key informants were asked about how community made maps are used, and how they evaluated the results of this process. Some of my questions surrounded how the intended application might influence earlier decisions about what to put on the map, and how to represent community information. In a wider sense, it was proposed that intended applications might have a strong influence on the rigour and accuracy levels required of the community mapping process. For example, if the intended use of the community map is to stimulate discussion at the community level, it may have less rigorous accuracy requirements than maps intended for legal purposes. For this aspect, a court case was reviewed in which community made maps are presented as evidence of local occupancy and use of land, in order to ascertain how the 'accuracy' of community made maps is viewed from a legal perspective.

3.4 Analysis

After the data were collected about the three phases of community mapping, they were coded and grouped based on the guiding questions of the research, and also based on other categories that emerged after collecting the data. The answers discovered for the questions associated with each phase of community mapping were organized thematically and compared to answer the question 'how is the issue of accuracy conceptualized and discussed through the three key phases of community mapping?' This question was analysed by examining how accuracies of content, location and symbolization might be understood from both social and technical perspectives.

3.5 Ethics

An ethics review was conducted for the main research instrument which was an in-depth, open ended interview format. The confidentiality and voluntary nature of the interview was expressed clearly to the informants, as were the overall goals and risks of the study.

In addition, information and examples cited from community made maps and mapping project reports were conducted in such a way that the communities of origin would be kept confidential. Since the maps are often (but not always) used in venues of conflict, I did not want to express concerns about 'accuracy' in a formal way that could impact the work of community mapping projects negatively. For this reason, the discussion was kept at a

general level, in which useful findings could be communicated without causing undue attention or critique upon any one particular project.

3.6 Limitations

This ethical consideration also leads to a discussion of the limitations of this research. The main limitation of this study is one of scale and generalization. While useful information was discovered about 'accuracy issues in community boundary mapping in Borneo', it must also come with the caveat that each community involved in mapping has characteristics that are particular to that specific time, place, and context. Since a wide view was taken about 'community mapping in Borneo', the unique characteristics of specific places will not be recognized as adequately and in as much detail as is potentially possible. However, the approach chosen did present a sharing and flow of ideas. While descriptions may be too abstract to fit the context of any one particular community involved in mapping, I hope that the general findings will be useful and thought provoking.

The interviews in particular were regarded as important and appropriate sources of information for a study at this scale, as the respondents generally had been involved with several community mapping projects throughout the region, and thus could reflect on common concerns *and* provide specific empirical examples to illustrate these concerns.

As mentioned in the introduction to this thesis, this research does not attempt to portray or explain any particular *adat* system of property entitlement, nor its particular spatial expressions. Judging by the literature on this subject, this would certainly be a very interesting and relevant study, but it was beyond both the scope and ethical considerations of this project. Rather, it is revisiting and analysing stories of community mapping projects conducted with diverse *adat* communities in Borneo, and related experiences of boundary mapping and accuracy issues that emerged through this process. While I assume that there is much diversity between particular *adat* communities in how these issues might emerge, I hope that this study might provide a starting point of how to specifically inquire into, and make sense of, accuracy issues related to specific community mapping projects.

Table 1: Three Phases of Community Mapping

Questions⇒ Mapping Stage ⇓	Boundary mapping methods	Boundary definitions	Challenges		"Technical Issues"	"Social Issues"
Phase 1 Field Data Collection (data collection and map production)	What techniques and source materials are used to identify and georeference boundaries and other features?	How do local people define their territorial boundaries in the mapping exercise? Do accounts ever differ?	What challenges arise during field data collection?		Assumption: Challenges can be addressed through 'technical' means such as better base maps, GPS, etc.	Assumption: Challenges require further reflection on the social implications of maps and mapping
Phase 2 Mapped Representations (after map is produced/before viewed by 'outside actors')	How do local people respond to the maps? How is accuracy critiqued and or ensured	What do boundaries 'look like' on the final map product?/how are they symbolized?	What challenges arise during this phase/what can we learn from examining the maps?			
Phase 3 Applications (viewing of maps by 'outside actors')	How do 'outside actors' critique the accuracy of the maps	What 'boundary definitions' are employed by outside actors–do they differ from community definitions?	What challenges are involved in producing maps that are perceived as 'accurate' by outside actors?			
Analysis: How are accuracies of content, location and symbolization understood from both social and technical perspectives?						

Chapter Four:
Conflict Over Land In Indonesian And Malaysian Borneo-'*Adat*' And 'State' Views Of Property Entitlement

4.1 Introduction

> *We went to meet the surveyors again and asked them to leave because we did not want them to enter our area. Then we saw them building the road on the hills and as they came nearer we got worried. We went to the hills and put up signboards 'Do not enter this area because we do not want our area to be destroyed'. We also showed a map of our area and its boundaries. But they just threw away all the signboards. (testimony of Jawa Ipa, Ketua Kampung (Village Head) of Long Ajeng Village, Ulu Baram, Sarawak)*[12]

This chapter provides a contextual discussion about the history of current disputes over land in Indonesian and Malaysian Borneo, that have as a common theme the disjuncture between '*adat*' and 'state' views of land and property entitlement.

It is important when discussing issues of boundary accuracy in community mapping to consider the historical context of land issues in this region, and what has often been described as the disjuncture between 'state' and 'local' views of property entitlement. This is especially true when we consider that the spatial extent and meaning of indigenous land entitlement, and the 'accuracy' of its representations, can also be viewed, at least by the state and its officials, through a 'legal lens' that has been in part created by the complex colonial and postcolonial history of the region, and is also influenced by local systems of law broadly termed '*adat*'.

Thus the spatial extent and meanings of boundaries may be defined by multiple actors with multiple perspectives, all of whom have some level of interest, and some level of power, over their ultimate recognition. Looking at the development of land laws in this region can give some clues about some of these perspectives, and examining how 'boundaries' are mapped on the ground based on the 'mental maps' of local people, can illuminate others.

In a sense, community mapping in this region can be viewed as an attempt to make customary tenure 'visible', or 'legible' to the state or other competing interests. (Scott, 1998; Zerner, ed., 2003). However, in pausing to consider Scott's (1998) discussion of 'legibility'

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[12] cited in 'Not Development but Theft-The Testimony of Penan Communities in Sarawak', (IDEAL, 2000,31)

we can see that the term implies transformations of locally dynamic systems of knowledge and entitlement, to simplified landscapes that facilitate state-based control and utilitarianism. Following this, it is my contention that the project of 'legibility' through community mapping contains both promises and pitfalls. I would hope that maps that are 'accurate', particularly in terms of how they represent and communicate local dynamism and complexity, as opposed to homogeneity and simplification, might avoid some of the pitfalls and still benefit from the promises. With this in mind, it is a good starting point to examine the historical context of land issues in Borneo, because it is here that understandings of how state laws might serve to simplify local systems of property entitlement to the point where, if they are 'visible' to the state at all, their very argumentation becomes problematic.

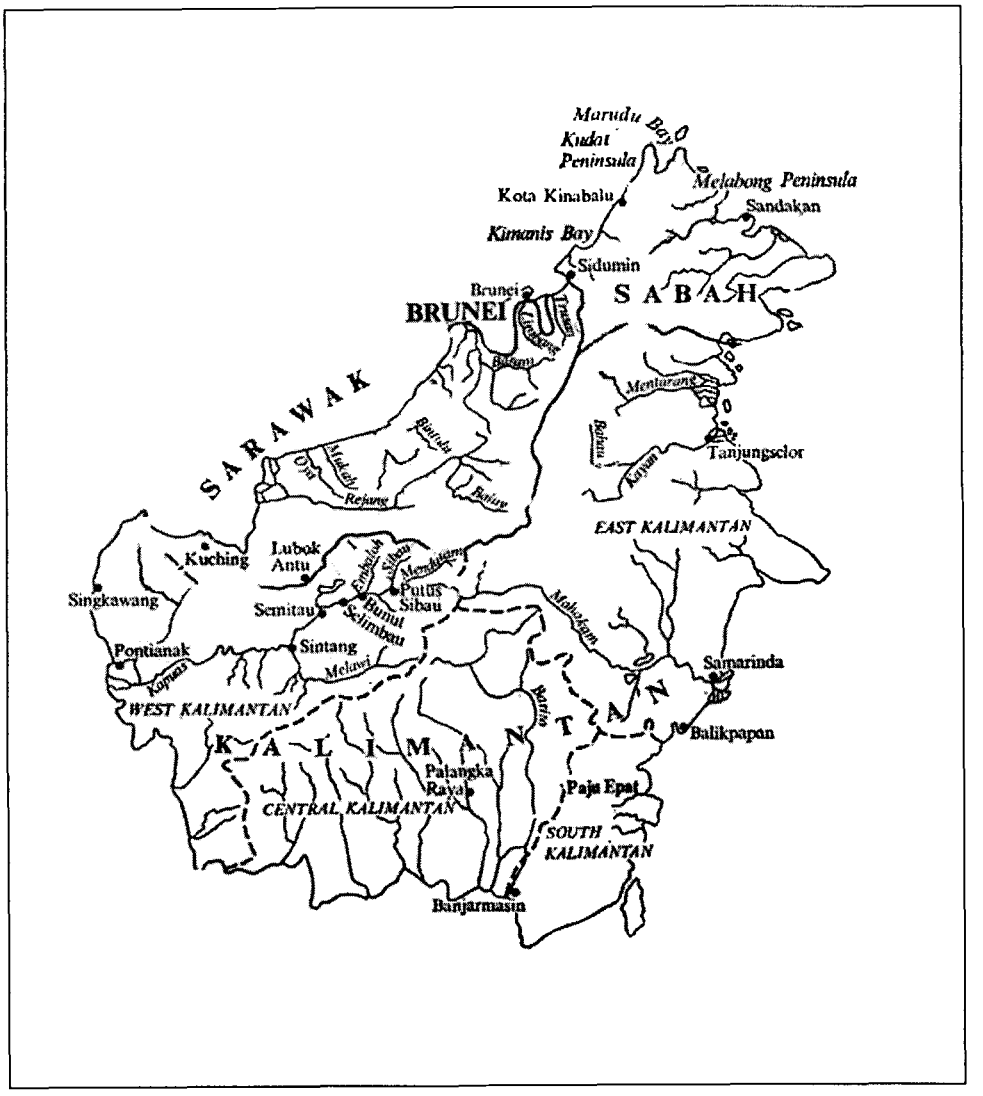
In this chapter I will discuss the historical context of this region as the source and ongoing background of land use conflict, particularly between the state and indigenous communities, and their often conflicting claims to, and perceptions of property. It must be stated, however, that the associated disjuncture between state and *adat*, or customary law that is often discussed in the literature does not necessarily entail a tidy dichotomy. In both Indonesian and Malaysian Borneo, state law has incorporated many aspects of *adat* law, and *adat* communities, far from 'static', have also changed in response to changing political, economic and environmental conditions. In assessing how mapping has been used as a response to these conflicts in order to clarify questions over land, resources and property, this complexity must be considered. I am of the opinion, however, that while attempts have been made to formally document *adat* systems of law, for example by Ter Haar in Indonesia and AJN Richards in Sarawak (discussed in Hooker, 2001) *adat* views of entitlement to property tend to be secondary to the claims of the state, as is evidenced by specific clauses in state laws governing land in both Kalimantan and Sarawak, which basically say that local rights to land can be extinguished by the state at any time.

4.2 Study Area Overview and Historical Context

4.2.1 Physical geography

Borneo is located in Southeast Asia, and is the world's third largest island with an area of roughly 746,000 square kilometres. (King, 1993) The northern third of the island is divided by the Malaysian states of Sabah and Sarawak and the small Sultanate of Brunei, and the southern two thirds by the Indonesian provinces of West, South, Central and East Kalimantan.

Figure 2: Map of Borneo



Based on King, (1978, p.xvi)

The island is characterized by three general terrain groups, including coastal areas, a mountainous interior, and in between rolling hills. Diverse tropical habitats such as swampy coastal mangroves, lowland dipterocarp rainforests and dense interior forest shelter a huge repository of biodiversity in animal and plant species. In its mountainous interior are the sources of numerous large rivers that radiate outward, which supply an important means of travel and communication through otherwise difficult terrain. (King, 1978)

4.2.2 Human population

The island of Borneo has been inhabited for at least 35,000 years and is currently home to about 16 million people. (MacKinnon and Sumardja, 1996) Compared to other areas in Indonesia and Malaysia, this population is relatively sparse. In the case of Kalimantan, this demographic reality has led to the policy of 'Transmigration', which

encourages the movement of groups from highly populated inner islands to the less populated outer islands, the effects of which have often been disasterous both socially and ecologically.

The island is culturally diverse, with several generally non-Muslim indigenous groups collectively termed 'Dayak'[13], coastal Malay communities, predominantly Muslim, and ethnic Chinese populations.

Interior Dayak groups are also known as *Orang Ulu*, which means 'people from upriver'. [14] The majority of this population is concentrated along the main rivers and practise some form of dryland swidden rice agriculture. (Voeks and Sercombe, 2000) The Penan, who traditionally were nomadic hunter gatherers, historically inhabited the more remote, densely forested areas . (Langub, 1989; Voeks and Sercombe, 2000). Of a total population of about 10,000, there are only about four hundred Penan who still practise the nomadic hunter-gatherer lifestyle, and they are located in the Apoh and Tutoh regions of the Limbang (northernmost) division of the Sarawak, and in some parts of Kalimantan and Brunei. The rest of the Penan groups have become settled or semi-nomadic in the past years due to government programs and missionization, (Langub, 1996) and are gradually adopting rice and/or cassava cultivation, as well as some cash crops. All Penan, however, still depend heavily on the communal forest areas surrounding their settlements, (Langub, 1996) and have unique patterns of occupancy and resource custodianship. (Langub, 1989) Although a small population, the situation of the Nomadic Penan is of particular interest to this study for the unique challenges it presents to community mapping advocates in using maps to represent traditional territories, in large part because their systems of occupancy and resource custodianship do not hold much currency with existing state legislation governing property entitlement.

The colonial administrations of the British in the north, and the Dutch in the south and west, had impacts on the development of post-independence laws governing entitlement to land and property. However it seems to be the general opinion in the literature that the day to day lives and systems of governance of the Orang Ulu and other Dayak groups of the interior of Borneo were not greatly disturbed until the post-independence era, in particular with the introduction of industrial logging, plantation agriculture and mining. The impact of colonialism can be seen, however, in the the types of legal recourse available in contemporary land disputes and in the particular way that the concept of 'property' has been constructed in state laws.

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[13] The term 'Dayak' is a general term referring to the non-Malay native inhabitants of the island. Its origin is uncertain and it is possible that it was adopted in a pejorative sense by the Malays and Europeans. It is now commonly used by both indigenous and non-indigenous people. (see King, 1993, 29-31)

[14] This includes the Kayan, who number about 15,000, and live in the northern interior on the middle Baram, upper Rejang and lower Tubau; Kenyah, who live along the Baram river; Kajang; Punan; Ukit; Kelabit; and Penan. It can also refer to the Lun Bawang, Lun Dayeh, Murut and Berawan people.

Since the 1960's, as part of larger scale development policies in both Malaysia and Indonesia, the forests of Borneo have been under increasing pressure of commercial exploitation such as logging, mining, and industrial plantation development. This has often had harsh effects on not only the forest environment that interior rural communities depend on, but also on the social and cultural institutions of the Dayak people. The negative impacts of large scale development in forest areas, as well as the lucrative aspects of forest resources in the region, have led to conflicts on the island between the state and industry on one hand, and local people on the other.[15]

These conflicts are often described as a disjuncture between *adat* or customary values and laws, and the laws and interests of the state, particularly in terms of natural resource development policies. In both Indonesian and Malaysian Borneo, *adat* is the general term used to describe the

> cultural beliefs, rights and responsibilities, customary laws and courts, customary practices, and self governance institutions shared by an indigenous group prior to incorporation into a colonial or post colonial state. (Alcorn, 2000, 4)

Adat can also refer to the rules of access and entitlement to resources and land, and can be understood as the basis of property institutions of customary tenure. (Peluso and Padoch, 1996)

But *adat* is not a simple term, nor is it a singular entity throughout the island of Borneo. *Adat* can have a distinct version in every tribal group or even localized community. (Hooker, 1978) Also, *adat* is not static, but dynamic in response to changing environmental, political, social and economic conditions. Various combinations of private and common property rights can vary over resource types and other factors, and also change over time. (Peluso and Padoch, 1996)

For example, in the case of Kalimantan, Ngo (1996) suggests that the lack of recognition given to customary rights to land, particularly in the Outer Islands is because the Indonesian government considers them subordinate to state laws. Although *adat* rights were recognized in the Basic Agrarian Law (BAL or UUPA) of 1960, and in the Basic Forestry Law, as well as in the Indonesian Constitution, this does not reflect actual practise. Conflict has occurred when land and property rights are interpreted differently by government and local actors. (Ngo, 1996) This conflict could perhaps be avoided if the basic principles of *adat*, including how property rights to land and trees are held, and 'the type of rights and responsibilities these entail'(Ngo, 1996, 146) are communicated effectively. Ngo (1996)

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[15] Although defining 'local' and setting it oppositionally to 'state' is not always straightforward. Local people often have diverse opinions about logging, for example and strategies to cope with its impacts. (for example see Brosius, 1997, on divergent strategies to cope with logging between the Eastern and Western Penan; and Brosius, 1999, on various Penan responses to international environmentalist movements.)

suggests the 'Local Land-use Map' as a method for resolving land conflicts involving clashing perceptions between customary and state laws concerning tenure and property rights.

This is another issue that faces those concerned with 'accuracy' in community mapping in this region. Making accurate maps that are meant to portray *adat* perspectives of land use and entitlement must surely involve a committed inquiry into local perspectives on these issues, as well as their zones of contact with state laws and legislation. The next sections will briefly describe the recent history of land issues in Sarawak and Kalimantan, in order to further illuminate this disjuncture between *adat* and state law, and the role of community mapping, including the importance of *accuracy* in community mapping, in addressing these disjunctures.

4.2.3 A brief history of land issues in Sarawak

Since the Sultan of Brunei in 1842 'gave' James Brooke, an adventurer from Britain, the territory of Sarawak in return for his assistance in quelling native uprisings, new legal paradigms regarding land and property were gradually introduced into the region by the Brooke's, and later the British regimes. This was mainly through the introduction of various statutes in law, that while on one level recognized customary rights in land, also attempted to limit and control them while bringing more areas under the purview of the state for development purposes. (Hong, 1987)

The Brooke family, known as 'the White Rajahs' remained in power until the onset of WWII, when Sarawak was occupied by the Japanese. The Brooke's regime was briefly reinstated after the war, but soon ceded Sarawak to the British crown. Although it could be argued that the colonial administration of Brookes, and later the British, provided some recognition of native customs and usufruct rights to land, they did not as clearly recognize fallow land, or communally held forest territories, and it is this contrary vision of property rights that is at the source of much of the current struggles over land and resources in the state. (World Rainforest Movement/Forests Monitor, 1998)

Although there also exists in colonial legislation, starting from the Code of Laws of 1842, some clear measures meant to protect indigenous land and autonomy, these did not serve to prevent future encroachments on indigenous communities in later years. What they did serve to do, however, was to supply an historical argument for indigenous communities about the official legal recognition of their customary claims to land, which has a certain legal weight in contemporary cases, and is also of much interest to community mapping endeavours.

Some specific examples of the Brooke's and British colonial administrations' influence on current disputes over land are seen as early as the '1863 Land Regulation', which declared that what were perceived as 'unoccupied and waste lands' were now the property of the state, (IDEAL, 1999) and the '1933 Land Settlement Order' which extended

the powers of the Land and Survey department to be able to extinguish native customary rights to land in order to purchase it for state interests. (IDEAL, 1999) Also of interest is the '1931 Land Orders I and II', which attempted to ensure that 'ownership was to be proven by titles, and any non-titled land would be considered as state land'. (IDEAL, 1999,19). Finally, the 'Forest Ordinance' of 1953, in which large areas were zoned as 'Permanent Forests' and 'Reserve Forests', served to extinguish native rights in some areas and strictly control or prohibit them in others. (WRM/FM, 1998) The ordinance empowered the Forest Department to issues licenses for logging on all but a small fraction of the forested areas in the state.

Malaysia became independent in 1957 and Sarawak and Sabah also joined the Federation of Malaysia in 1963. However, many of the laws regarding indigenous people and land that had been developed during the Brooke's era were adapted into Sarawak's land laws, which has implications to the present day (Hong, 1987). This is clearly evident in the 1958 Land Code, which up until now, with later amendments, serves as the principle land law. The 1958 Land Code classified land into categories of use and entitlement[16], including one category for 'Native Customary Land'. This was defined as 'land in which native customary rights, whether communal or otherwise, have lawfully been created prior to the 1st Day of January, 1958'. (Hong, 1987) This implied that no further customary rights could be created after this date, and is an important aspect of current debates of the extent of native customary land areas.

Unfortunately, maps defining the extent of Native Customary Land areas, or 'NCL' were not always made, and if they were, local people do not always have access to them. (WRM/FM, 1998). In addition to NCL, the code has provisions for Native Customary Rights to the use of resources on categories outside of recognized NCL, except reserve lands. (WRM/FM, 1998). The Land Code also gave the state the right to extinguish NCR and NCL, and further amendments to the code strengthened these state rights of extinguishment.[17]The Code further outlines *how* Native Customary Rights can be 'lawfully created'[18] and it is demonstrating that this has been done that is the basis of many contemporary community mapping efforts in the state.

The state of Sarawak seems to view native customary land as 'idle', and seems to support the reduction of the availability of land to natives for swidden agriculture, as is evidenced by this quote on a government sponsored website:

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[16] The Land Code classified land into five categories: Mixed Zone Land, Native Area Land, Interior Area Land, Reserved Land, and Native Customary Land. The vast majority was zoned as Interior and Reserved, which made it functionally the property of the State (Hong, 1987)

[17] See Hong, 1987; IDEAL, 1999;and WRM, 1998 for a more detailed discussion of how amendments to the Land Code in Sarawak have increased the state's right to extinguishment of NCR and NCL.

[18] The Land Code stipulates that customary rights can be acquired (prior to 1958) through 'a) the felling of virgin jungle and the occupation of the land thereby cleared; b) the planting of land with fruit trees; c)the occupation or cultivation of land; e) the use of land for any class for rights of way and f) any other lawful method' (Adam, 1998,221)

> The state government encourages the development of plantation agriculture with the view to develop idle or under-utilised land, especially Native Customary Lands. By transforming these lands into profitable plantations, the government aims to increase the income and standard of living of the rural land-owners. Large-scale land development, apart from increasing the contribution by the agricultural sector to the State's economy, will bring about: provision of basic infrastructure and social amenities to rural communities; expansion of agricultural employment opportunities (and) gradual reduction of areas normally utilised for shifting cultivation (Sarawak Government Website)

Logging began in Sarawak in the early '60's, which had a tremendous impact on the indigenous people. By the '80's, indigenous groups were conducting blockades on logging roads to protest logging encroachments and destruction of their territory. At one point there was up to 25 blockades across logging roads in the Baram and Limbang districts in Sarawak. (Borneo Project, 2002b) The state assembly responded by making blockading a logging road an illegal act. The logging and the blockading continued however, and in 1988 resulted in the arrest of 27 protesters near Long Napir in the Limbang Division. (Borneo Project, 2002c). The blockades abated in the early '90's to resume again in the late 90's and onward.

The continuing disjuncture between state land policies and local perceptions of entitlement as per *adat* laws and traditional use and occupancy can be also seen by the attention given to the issue by SUHAKAM, the national human rights agency of Malaysia. In 2001 SUHAKAM was petitioned by several indigenous communities from Sarawak regarding their dissatisfaction over the lack of resolution over land matters concerning their livelihood. (Suhakam Annual Report, 2002)

Key concerns that were expressed by the indigenous communities were that their natural resources were being depleted, and that their native customary land was not officially recognized and was encroached upon by outside interests such as large logging, plantation and mining companies.[19] The commission found that companies were 'able to obtain leases to exploit natural resources found in these lands, or in some cases they were given outright title to these lands despite protests from the communities.' (Suhakam Annual Report, 2002) The commission heard that the indigenous people declared an urgent need to 'protect their traditional lands by way of declaring such lands as native customary lands or *orang asal* reserves'. [20] The spokespeople of the indigenous communities asked that permanent title be granted to the traditional lands, 'on a community as well as on an individual basis'. (Suhakam, 2002) The report suggested that depriving the indigenous communities of their native customary land 'without due regard to their source of livelihood and traditional lifestyle results in their gradual slide deeper into poverty'. (Suhakam, 2002)

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[19] The SUHAKAM report documents that similar concerns have also been expressed by indigenous people, or 'orang asal' in Sabah and Peninsular Malaysia

[20] Similar to what has been done with 'Malay Reservation Lands' on the peninsula

The years of logging activities, which some would describe as illegal incursions, and the local response of conducting road blockades are one example of the disjuncture between state and local perceptions of land entitlement in the state, and also a precursor to other strategies of resistance, including legal action, national and international media campaigns and community mapping efforts.

The recent adoption of the *Mabo* decision in Malaysia[21] may imply that reforms to land legislation will be needed because native title rights now have a wider recognition than those outlined in the Sarawak Land Code, and now may include communal forest areas.(Hooker, 2001). This hopeful uncertainty has implications to community mapping projects in the state, which attempt to portray the spatial aspects of customary claims to land in such a manner that they have legal cogency. This is of key importance to discussions of accuracy in community mapping. Another possible result of the success of the *Rumah Nor* case was the introduction of the Land Surveyor's Bill in 2001, which may have the effect of making community made maps inadmissable as court evidence, and may even criminalize the activity of making community maps. (see Sing, 2002)

A final point to be made about Sarawak is the introduction of the *Konsep Baru*, or 'New Concept' in native customary tenure. This is an effort to involve private corporations as 'partners' in the registration and development of NCR land for oil palm plantations. In this model, the local communities consolidate and lease out their NCR land to a private company for up to 60 years, signing power of attorney over to state agencies who would ostensibly act as trustees on their behalf. (IDEAL, 1999) This essentially will promote the privatisation and large scale development of NCR lands. (see Ngidang, et. al., 2000)

4.2.4 A brief history of land issues in Kalimantan

Indonesia had a long history of colonial involvement by the Netherlands, in the form of the Dutch East India Company from the mid 17th century, to official rule by the Netherlands from 1816-1949[22] (not including the years of Japanese occupation during WWII, and a brief administration by the British from 1811-1816). Although the Dutch implemented several agricultural schemes regarding the administration and use of land, these were less applied in the outer islands, where the indigenous people continued to manage their lands according to *adat* principles rather than Dutch colonial law. (Szcaepanski, 2002)

Kalimantan became part of the Indonesian Republic after independence in 1949, and Hooker's (1978) comment that these national boundaries influence 'the scope and nature of adat' carries particular relevance in the Outer Islands, particularly in the consolidation and development of state laws and power impacting customary ownership of land and resources, which I will discuss in this section.

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[21] In Nor v Borneo Pulp and Paper, 2001

[22] called 'Netherlands East Indies' during this time

The post-colonial history of Indonesia, including Kalimantan, can be divided into roughly three sections. The first was Sukarno's era of 'Guided Democracy', which was characterized by economically nationalist policies. Industrial forestry did not have much impact on Kalimantan during this era. (Marchak, 1995)

Sukarno was supplanted by Suharto's 'New Order' (1966-1998) which saw the opening up of Indonesia to foreign investment and development, and thirty years of authoritarian rule and croneyism. Suharto's new economic policies saw the opening up of large areas of Kalimantan for logging and other large scale development. This was accompanied by a greater level of state based interest in the rural areas, for example with the passing of the Basic Forestry Law No. 5/1967 which gave the national government the power to 'control, manage and administer all state lands' (Peluso, 1995).

During this time logging in Kalimantan increased rapidly, after the creation of a national forest policy in 1967. Concessions were established based on the Basic Forestry Law which while acknowledging customary rights, states that 'public interests', or interests of the state, are to be given higher priority. (Marchak, 1995) The Basic Forestry Law stated that decisions regarding *all* forest areas and natural resources in them were now under the purview of the Ministry of Forestry, effectively nullifying local claims of ownership and management of forest resources. (Moniaga, 1993; Loffler, 1996).[23] It is not clear exactly how much overlap there was with lands held under customary tenure, as no attempts had been made to delineate these areas, nor to ascertain the population living there. (Sirait, 1994)

Post-*reformasi*, the BFL was repealed in 1999 with the Act No. 41 of 1999 on Forestry Affairs. The 1999 BFL divides forest lands into three categories: production, protection, and conservation forest. Two categories of tenure are recognized, 'private' and 'state'. *Adat* forest is defined as 'state forest where communities with customary laws are' (DTE, 2002, 15)

Planning initiatives, such as the Tata Guna Hutan Kesepakatan (TGHK) of 1984 delineated large areas of land as 'state forest'. This had the impact of reducing land available for swidden cultivation, and of formally designating many areas held under *adat* land law 'state forest'. Legitimised by the BFL, this implied that 'no individual or communal property rights (could) be registered under that National Land Agency' (Loffler, 1996)

Another important law was the Basic Agrarian Law, or BAL of 1960. (or UUPA-see Ngo) The BAL was meant to supplant the previously dual legal system of the Netherlands

[23] Article 5 of the BFL states "All forests within the territory of the Republic of Indonesia, including the natural resources they contain, are taken charge of by the State." Article 17 states: "The exercise of communal and individual rights to exploit or benefit from forests based on some or other legal regulations shall not infringe upon the achievement of the aims stated in this Law." (Loffler, 1996) The BFL classified forests as 'production forests', protection forests, nature reserve, and conversion forests.

Indies by proposing a single system of land laws for Indonesia. The Basic Agrarian Law recognizes some traditional rights, such as clearing land for swidden and harvesting forest products. However, it does not explicitly provide a mechanism for recognizing these rights in specific cases. The BAL 'emphasizes registration of land title. In contrast, customary adat law has always been based upon local knowledge of ownership and use rights, without need for paper title'. (Sczepanski, 2002,240). Of utmost importance is that the BAL suggested that Adat Law can only be recognized when it is not 'contrary to the national interests of the state' (Sczepanski, 2002,240).

The economic crisis in Asia in 1997, and widespread protests against the corruption of the regime led to Suharto resigning in May, 1998. This marked the beginning of the current era of *Reformasi* which is characterized by decentralization and ostensibly democratic reforms. This may provide new openings to re-negotiate the position of local communities in terms of rights and claims to forest resources, but as yet there is no clear consensus regarding where new authority and responsibilities over forests will be placed. (Rhee, 2002).

As Sirait et. al, (1996) suggest, 'Accurate demographic and tenurial data are a prerequisite for any credible forestry development and management program'. They may also be the basis of clarifying conflicts about land use and boundary locations. In the era of *Reformasi*, Sirait's ideas are particularly cogent, as a window of opportunity may be available to debate and reform existing modes of development and laws governing land entitlement.

4.2.5 Summary

In this section I have discussed state land and resource laws in Sarawak and Kalimantan, and how their spatial articulation and enforcement have led to a situation of uncertainty about the nature and spatial extent of customary claims to land and resources. The issue of land tenure in Borneo can be seen as background to the conflict between state development policy and local resource use by indigenous communities. However, neither state laws nor customary systems of land tenure can be viewed as static or mutually exclusive. Tenure systems are influenced by state land policy and legislation, and conversely, state law has given some extent of recognition, albeit limited, to customary claims to land and resources.

It is within the context of the evolution and relationship of state and local property systems that the work of community mapping is placed. In posing the question of 'accuracy' of mapping community 'boundaries' we need to discover how communities define and perceive their boundaries within this context. Are the boundaries mapped by local communities reflective of 'traditional' or customary ideas of territory, are they representations of contemporary responses to change, or do they represent some combination of these two? In order to investigate this question, field experiences in which boundaries are

communicated and documented onto maps, was examined, as well as the application and uses of these maps.

Chapter 5: Community Mapping in Sarawak and Kalimantan

5.1. Introduction

In this section, I will discuss some examples of community mapping from Sarawak and Kalimantan that were discovered in the literature, and some challenges and risks that have been learned through these processes. I will then discuss the spectrum of methods and approaches that are used, and some common concerns about accuracy that arise concerning the representation of traditional boundaries on maps.

As outlined in chapter 2, community mapping can pose a challenge to Harley's contention that cartography and mapping tend to support the hegemonies of the powerful. Its proponents suggest that by appropriating the technology and formats of mapping, including 'high tech' approaches such as GIS and GPS, and 'low tech' approaches such as sketch mapping and map interviews/map biographies, previously disenfranchised groups can challenge this monopoly on 'authoritative resources' by the state or capital. (Peluso, 1995, 387). One of the reasons that boundary mapping has been undertaken by local indigenous communities is that states, including Indonesia and Malaysia, have frequently failed to demarcate indigenous lands, an issue that the UN has identified as 'the greatest single problem today for indigenous peoples'. (Daes, 2001)

> Demarcation of lands is the formal process of identifying the actual locations and boundaries of indigenous lands or territories and physically marking those boundaries on the ground. Purely abstract or legal recognition of indigenous lands, territories or resources can be practically meaningless unless the physical identity of the property is determined and marked. (Daes, 2001, 43)

As part of a strategy to gain recognition of local rights to land, community mapping has been adopted as a tool to help clarify and communicate community boundaries and resource management systems. Much of the literature reviewed about this activity reflects optimism that mapping can be a means of empowerment[24] for local communities. (Alcorn, 2000; Flavelle, 1995; Momberg, 1996).

Throughout Borneo, local people and state governments often have very different priorities and perspectives regarding the ownership and use of land. Large scale activities such as logging, mining, and plantation agriculture, have led to situations of uncertainty and conflict with local communities involved in smaller scale activities such as swidden farming,

[24] although 'empowerment' is a problematic term, and should be defined when assessing the gains and implications of community mapping. see Corbett, 2003, for further discussion.

hunting, gathering and fishing. Local systems of land use and management have frequently been ignored in the drawing of timber, plantation and mining concession boundaries, and also conservation areas such as national parks, leading to a scenario of conflicting perceptions of entitlement in specific areas between adat communities and state interests.

Where maps have been used by powerful elites as a means of inscribing space and controlling resources, 'reinserting' the existence and claims of local communities can be a powerful statement. This involves an attempt to democratise both the materials and methods of cartography so that maps can be used to 'delineate and formalize claims to forest territories and resources' traditionally managed by local indigenous communities. (Peluso, 1995, 384). Alternative boundaries to the ones on planning maps, such as those created by the TGHK process in Indonesia, can be presented that more closely reflect local claims to resources and territory, and historical patterns of use and occupancy.

Community mapping is often discussed as a 'participatory methodology'. Generally it is facilitated by community organizers, whose mandate includes assuring a broad representation of social groups in the activity. The term 'participatory mapping' can imply that the project is facilitated by a professional mapping team, while the term 'community mapping is used when the mapping is facilitated by trained volunteers from the villages. (Momberg, 1996, 5). It has also been called 'community based mapping' (Flavelle, 1996), 'community based participatory mapping' (Natalia, 2000), 'counter mapping' (Peluso, 1995) and 'participatory resource mapping' (Abbot et. al, 1998)[25] The terms are usually, however, used loosely and somewhat interchangeably.

Examples of community mapping to demonstrate local perceptions of property rights have been seen in Peru (Orlove, 1993); Honduras and Panama (Chapin and Threlkeld, 2001); Canada (Aberley, 1993; Tobias, 2000); and many other parts of the world (Poole, 1995). While the goals, objectives and methods can vary, a defining feature of community mapping is that the essential source of information is local knowledge. (Poole, 1995) There is also a strong emphasis that, ideally, the initiation of the project should be from the community, that methods should be participatory and inclusive, and control of the process and products should also rest with the community and not external actors. (Flavelle, 1996; Momberg et. al, 1996), although these values are not always successfully realized. In these cases, lack of control over the final products can have what Fox et. al (2003) describe as 'revenge' or 'ironic' effects, such as increased levels of state surveillance and control, and less control over resources. (see also Abbot et. al, 1998; Muliastra, unpub.)

[25] ...or 'PRM', defined by Abbot et. al. (1998,31) as '...where local people make their own maps'. In examiing the role of GIS in participatory approaches, Abbot et. al. suggest that it is important to ask if GIS is always necessary, or if PRM can achieve the same goals.

5.2 Some Examples

One of the earliest examples of community mapping in the region was initiated in 1992 in East Kalimantan, with villages near the boundary areas of Kayan Mentarang Park. This project involved the mapping of 65 villages, involving approximately 1.5 million hectares. (Muliastra, unpub.) The purpose of this initiative was to document local perspectives about park zoning, and to resolve boundary disputes between different stakeholders. The maps were useful to the villagers not only for discussions with park officials, but also two of the villages used the maps to successfully negotiate with a timber concession not to log their restricted forest areas. Of note is that after the maps were produced, and before they were presented to the district officials, several sessions were held to

> ...reduce the potential for conflicts to arise over boundary delineations and to ensure that the community members regarded the maps as legitimate (Muliastra, unpub.)

In another area, the Centre for International Forestry Research (CIFOR) sponsored a research oriented participatory mapping project, in which 27 villages were involved. The interest was whether mapping could be a useful tool to overcome boundary and land use conflicts between villages, and with mining and logging companies operating in the area. Obstacles that were identified were a lack of unity amongst the villagers, a lack of basic resource and land-use maps, and uncertainty about rules and boundaries. (Wollenberg, 1999).

Smaller scale projects have also been undertaken by local NGO's, often working with one or a small group of villages. Several NGO's in Kalimantan have adopted the approach of incorporating mapping activities into their social and environmental reform, and indigenous empowerment agendas. (Natalia, 1999)

In Sarawak this has mainly been to provide documentation of the extent of native customary rights (NCR) and the location of traditional boundaries including settlement and farming areas, as well as communal forest areas, for legal purposes. (Cooke, 2003) A notable example is the recent court decision (*Rumah Nor v Borneo Pulp and Paper*) in which community maps were accepted as evidence of the extent of an Iban community's historical use and occupancy of the area. (Hooker, 2001)

5.3 Challenges and Risks Involved in Community Mapping

Two of the key issues that have been discussed in the literature about community mapping in this area are that local systems of tenure and property rights may not be adequately reflected using maps and social science methods, and that explicitly indicating boundaries on a map can create problems. (Peluso, 1995; Sirait et. al, 1994; Fox, 2001) Put another way, translating oral history and *adat* onto conventional maps can result in losing or changing the meaning of local knowledge. (Flavelle, 1996). In particular, delineating specific boundaries between individual or community claims may result in the transformation of

customary rights and perceptions of space. (Fox, 2001; Peluso, 1995). I have framed this as an issue of accuracy, in which I suggest that the accuracy of content, location, and symbolic representation can play a role in these transformations.

In Kalimantan, some boundary mapping projects have produced 'clear boundary regimes' (Muliastra, unpub., 12) that have acted to simplify the previous complexity and flexibility of indigenous tenure. Muliastra suggests that the boundary is a concept, rather than a reified 'thing', whose state based and customary meanings and locations may in fact differ. He suggests that attention to the process of mapping, rather than a boundary product, maybe one way of mapping boundaries in a way that does not obscure the local tenure system. This is reflected in the first project mentioned, in which boundary meanings and locations were extensively debated and documented using participatory methods. (Wollenberg, 1999).

Muliastra (unpub) draws upon selected case studies from East Kalimantan to explore the potential benefits and risks of community mapping. In this study, he found that community mapping can serve to cause, or increase conflicts particularly in areas where boundaries are uncertain, or land has a high economic value. In these cases, one community mapping 'its' boundaries can worry neighbouring communities and create tensions.

Another risk is that proprietary information, unless carefully considered and presented, can be abused (Alcorn, 2000). For example in some cases cited by Muliastra, only village heads participated in the mapping process, and then used the maps to pursue forest harvesting rights for themselves.

These concerns might be addressed by achieving appropriate levels of accuracy in community mapping. What is the 'right' way to map village boundaries and resources, and to ensure that their qualitative nature and spatial location are accurately reflected? Several factors may be operative, including the techniques and materials that are available, the levels and nature of participation, and the control and ownership of the mapping process and map products. Thus there are both technical and social dimensions to accuracies of content, location, and symbolic representation.

5.4 Community Mapping Methods and Boundary Mapping Accuracy

5.4.1 Approaches, techniques and materials used in community mapping

Community mapping projects can involve a range of approaches, techniques and materials ranging from 'low tech' such as sketch maps, to 'high tech' such as employing the use of GPS and GIS. In the literature there seems to be an orthodox view of 'accuracy', in which the implication is that when more accurate maps are needed, more technical approaches are called for. (e.g. Momberg, 1996) This certainly addresses the need for technical aspects of accuracy, but what of social perceptions of content, location, and symbolic representation

shown on maps? An interesting dilemma that I have found is that increasingly 'technical' approaches may also imply less participatory ones. (Fox et. al, 2003) But from a social perspective, the importance of triangulation of ethnographic data provided for the mapping projects means that participation levels are also important to discussions of 'accuracy'. This has also been discussed in the PPGIS literature, in which a principle has emerged which seeks to address the need to develop best practices in community mapping that can incorporate 'true participation in generating accurate spatial information' (Rambaldi et. al, 2000, 39), in order to avoid marginalizing groups from GIS in terms of access and representation.

Some of the community mapping methods commonly used are often described as 'participatory resource appraisal' or 'PRA' techniques. These are a set of low tech and accessible spatial techniques aimed at collecting community perceptions and knowledge about land and resources. They include ground mapping, sketch mapping, transect walks, and various other techniques. (see Flavelle, 1995; Momberg, 1996). These techniques are often used as sources of information for community maps.

A *ground map* uses any materials available, for example rocks, dirt and leaves. It is inexpensive and useful for preliminary discussion purposes. Ground maps are rarely used for the purpose of permanent documentation. *Sketch mapping* involves paper and pencil sketchings of local knowledge such as place names, boundaries, networks, resource use, and cultural features. It can be used as both a permanent record and as a communication tool. Sketch mapping is not georeferenced, but is often used to produce later maps that are georeferenced, for example by transferral to topographic maps of the same area using named or otherwise identified features that are mutually distinguishable. A *map interview* involves adding community information directly on to a topographic map, air photo, or satellite image, which Momberg (1996,11) suggests is useful because it puts local knowledge into a Cartesian, georeferenced framework. Some practitioners, however, have suggested that conducting primary ethnographic research using this method can have limitations due to the perceived formality and accuracy of an 'official topographic map', and thus prefer the sketch map to topographic map transferral method. (Chapin and Threlkeld, 2001). Another approach is to create a three dimensional model of a particular area based on topographic maps as the basis of sketch mapping, or interview mapping, which may be more accessible for community members to identify relevant geographic features. (Rambaldi et. al, 2000)

Guide manuals to community mapping suggest that there is an orthodox and linear process of suiting mapping techniques and materials to the level of accuracy required based on the intended use of the maps:

> In general, the more accurate you want your map to be, the more time, and possibly money you must spend, and the more precise you need to be in your technique. (Flavelle, 1996, 28)

As will be discussed in later chapters, in reality it appears that a multiplicity of methods and materials are used, depending largely upon availability, resources, and time. Although 'formal and accurate maps' may be required, for example, to seek legal acknowledgement of land claims, many forms of data collection are employed to create these maps, and these are often chosen by availability rather than suitability, per se. In the words of one community mapping consultant:

> ...there is a fair amount of talk about how communities, indigenous peoples, etc. should carefully select methodologies and technologies that are appropriate and satisfy their needs, etc. As if they had a choice! First, the vast majority --imagine villagers in Kalimantan or the Amazon Basin -- know nothing about mapping and have no sense of how to judge the different technologies. Second, they need to take what comes their way, no matter what it is, as opportunities to map their lands are few and far between. (M. Chapin, pers. com, Dec. 1, 2003)

The multiplicity of methods and approaches characteristic of community mapping, and the constraints and limitations to choosing them is important to both social and technical aspects of 'accuracy'.

5.4.2 Boundary accuracy in community mapping

In community mapping there is often a perceived need to combine the extensive knowledge of local people, for example in terms of logging activities, with sources of data that are widely perceived as 'objective'. For example, community mapping methods such as sketch mapping and basic GPS surveying can help communities identify areas within their territory that have been impacted by logging encroachments. But how these community made documents about the extent of logging are perceived in terms of their 'accuracy' in wider milieux, such as courts of law, is still somewhat unclear.

Technical solutions, such as acquiring satellite images of the territory that can objectively track the development of logging incursions could help a lot with the 'on the ground' field surveys with hiker quality[26] GPS units and map interviews, by providing triangulation of these data. Community field work, which harbours much interesting and unique information, and more technical approaches such as remote sensing interpretation, which presents information that can be considered as 'objective', are used together in terms of developing an accurate and arguable picture of land use changes in these territories.

Community mapping seems to use methods and materials that are limited by available mapping resources, time and funding. Yet the maps can be seen as having a distinct *advantage*, in terms of content, as local people are the authoritative resources of knowledge about local land use and occupancy:

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[26] By 'hiker quality' I mean models of GPS units that have positional accuracy levels of approximately 100m, which is much lower than survey quality GPS which can have positional accuracy to the cm.

> ...only you are able to make an accurate map of your history and land use and culture. That is your unique knowledge. Your maps are tools that let you record it for yourselves. (Flavelle, 1995, 3)

The necessary level of accuracy required is not always clear at the outset of a mapping project. Also, it is not always clear how the concept of 'accuracy' is defined and implemented. How do community mappers define and manage the requirement of accuracy, particularly given the limitations of resources, and the combination of many kinds of data sources and types?

Chapter 2 outlined a critical perspective on cartography such as that presented by Harley and others, which suggests at least three ways of thinking about the accuracy of community maps. These involve accuracies of content, location, and symbolization. These three related concepts are of importance in addressing Sirait et. al's (1994, 417) questions regarding the 'ability of social scientists and mapmakers to accurately capture the complex relationships of traditional resource management systems on maps'. It is clear that there are both technical and socio-cultural challenges involved in producing accurate maps of community lands.

Looking particularly at the mapping of 'boundaries', which has been a major goal of community mapping in both Indonesian and Malaysian Borneo, determining the accuracy of their delimitation on maps involves an understanding of their socio-cultural interpretations and their physical manifestation. Boundaries, suggests Sirait (1994, 411) can 'define the limits of area to which any tenurial right, duty, privilege or disability applies'. But assuming that boundaries are always synonymous with 'lines on the ground' easily translated into 'lines on the map' can be a mistake, as Sirait et. al. (1994, 411) go on to explain:

> Locally, property rights and claims were and continue to be a complex bundle of overlapping and hierarchical rights and claims distributed among many persons and related to other social relationships within and outside particular communities.

Following this, community mapping proponents suggest that not only should boundaries be mapped out, but their nature should be examined in order to understand 'indigenous ways of organizing and allocating space' (Sirait et. al. 1994, 411). Other studies have looked more closely at the role, perception, creation and maintenance of boundaries at the community level, particularly in the context of a community mapping project. (Wollenberg, 1999). On the other hand, representing boundaries as strictly linear and unambiguous may be desirable if it facilitates clear recognition of local tenure. (Sirait et. al, 1994). Mapping in a sense can formalize and concretise claims to resources, especially to territory. Peluso (1994) is concerned that presenting resources in this way could engender a reinterpretation of customary claims from those of resources with complex, overlapping and multiple meanings, to specific territory. In some cases it appears that this concern is

warranted. For example, some villagers in East Kalimantan stated that '...after seeing clearly defined boundaries they felt secure enough to enforce their own communal rights' (Muliastra, unpub.) which implies that mapping involves a higher level of formalisation of boundary claims. In some cases, boundary mapping exacerbated conflicts, particularly in cases where there were marked differences between ancestral and administrative boundaries, or where the resources had a high economic value. (Muliastra, unpub.)

5.5 Chapter Summary

In this chapter I have provided a brief sketch of the historical and political context of community mapping in Indonesian and Malaysian Borneo. Community mapping can be seen as an attempt to clarify and 'make visible' both the nature and the location of local claims to property.

I have also explained that there is a spectrum of methods and materials available to community mapping projects and have suggested that 'accuracy' is often equated with technical approaches that can georeference feature locations more precisely. In order to address concerns about the ability of 'Western style maps' to adequately represent, or in Fox's (2001) words, to 'honour' local perspectives, we also need to consider the *social* aspects of accuracy. There are two directions these considerations might take. The first is the ability of maps to accurately represent local perceptions, and the second is how maps are perceived in terms of their wider applications. It is assumed that the maps need to be *useful* for their intended applications. In unpacking concerns that have been expressed about the limitations of 'western style maps' to do this, I earlier drew upon the ideas of critical cartography to suggest that there are three ways of considering these limitations which may shed light on the subject: accuracies of content, location, and symbolization. I selected boundaries as being a useful case study, due to the high importance they are given in many mapping projects, the concurrent high level of concern expressed about the possible implications of this exercise, and also because they are a classic and elegant cartographic 'symbol' that while simple and straightforward in representation, can encompass and be constituted of several, more dynamic meanings 'in the field'.

Chapter 6: Results (I): Phases One And Two

6.1 Introduction

First, let us revisit the research question, which was : 'How does the concept of 'boundary accuracy' emerge through the three key phases of community mapping?' I suggested that accuracy issues will probably have both technical and social characteristics that need to be examined, primarily because 'technical' solutions may be straightforward, whereas 'social' solutions may require deeper inquiry into the socio-cultural implications of mapping customary boundaries. One objective of this research was to identify how the concepts of 'accuracy' and 'boundaries' were experienced and discussed during the stages of field data collection and of revision/critique of the community maps. In 'Phase One', I inquired about boundary mapping methods, boundary definition, associated challenges, and experiences in assessing 'accuracy' during field mapping. In examining 'Phase Two', I was interested in how local people responded to the completed maps, and how they critiqued them for 'accuracy'. I also examined some samples of community maps from the region, following some aspects of Orlove's method of analysing map texts, and explain how they also provide insights about the research question.

6.2 Phase One: Field Mapping

6.2.1 Introduction

What I have termed 'field mapping' can include all activities up to the point of having a concrete map product/s and supplementary products, from preparation, gathering of source materials, training, field data collection, and drawing the information onto a final map. In my opinion this is a crucial phase, as it implies 'the moment' of transferring a community's information onto a mapped format. Prior to mapping, this information is often held in individuals' mental maps of their territories, or in their 'performance maps' of oral history told through, for example, stories and songs. It also may be 'held' in connection with the landscape, in the form of physical landmarks and place names replete with information about local history and land use, as discussed by Brosius (1996) in his study of place names in the Penan Gang landscape.

In '*Phase One-Field Mapping*' I inquired about the methods that are used to map boundaries, how the boundary is determined, and about challenges that arise during this activity. I explored issues concerning combining several types and sources of data, in identifying and georeferencing boundaries in the field, and the possibility that some features may be difficult to map using two dimensional 'Cartesian space'.

To further clarify, the question regarding *how* boundaries are mapped refers to the cartographic and ethnographic techniques employed. The question regarding how the boundary is *determined* refers to how local people define and locate their boundaries, regardless of the techniques used to actually georeference them. The two questions are related, as I was interested to know how well the cartographic techniques employed 'fit' with local definitions and enactments of boundaries. The similarity and tension between these questions speaks to my concern about whether mapping formats influence the mode of expression of local boundaries, or vice versa. Finally, I asked how and if boundary accuracy was verified at this stage.

6.2.2 Methods used to map boundaries

Even amongst the small number of key informants in this study, four distinct approaches to mapping boundaries became evident. The variance between these seemed to be related to an adherence to a specifically prescribed approach, and also factors contingent on specific field conditions, such as time, available resources, the local topography, and local perceptions of 'boundary'. As expected, all of the approaches described employed multiple data sources, which included a combination of both spatial and ethnographic data. I will briefly describe these four methods:

Method 1

The first method involved using a topographic map combined with interview and sketch mapping data from the community to identify boundaries that coincide with watershed boundaries. In many cases, the 'boundary' is located as a series of points and its linear qualities are interpolations between points, as is evidenced in this quote:

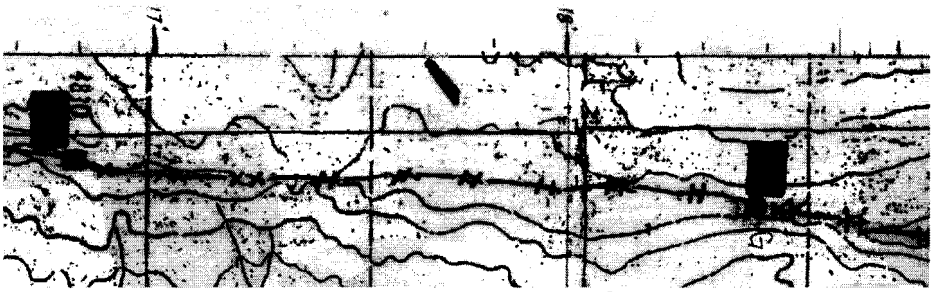
> It's often just the height of land around a watershed and it's pretty evident on a topographic map...so they just use a topographic map with a few key points. (Interview #2,3)

In order to identify the watershed boundaries in question, the process would begin by identifying and naming rivers through a map interview or sketch map, and then using these locations to identify the watershed boundaries:

> ...if there's a mapping team that's learned how to interpret the topographic map, they'll conduct a map interview by, at first at least, knowing where all the names are. It's sort of like creating a grid of rivers and roads, or rivers and footpaths, by name, and mountain peaks by name, and then they have those named reference points that they use in asking about the boundary. (Int. #3, 29)

With this approach, topographic maps are considered an important tool for identifying boundaries, as they can indicate the location of ridges and streams, and also recent cultural features such as roads which may also be important reference points.

Figure 3: Example of boundary demarcation using a topographic map indicating ridge line between two known landmarks



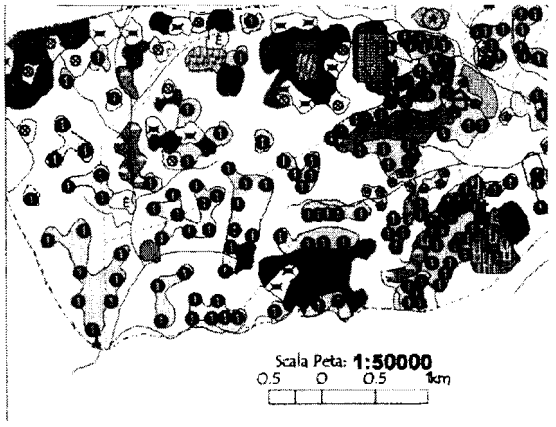
Courtesy of community mapping group

Method 2

In some cases there is either no topographic map available, or it has no relevance in determining boundaries. In this case, the boundary is identified through georeferencing it in the field with GPS or tape and compass techniques. In this case, local people 'walk' the boundaries, and are followed by mapping facilitators, who may be local people, NGO representatives, or mapping consultants, who record the GPS coordinates along the way.

> ...and then if it is...sort of rolling hills, a little harder to interpret on the topographic map, then they would walk around the boundary with a GPS (Interview 3, 15) (see also Interview 5, 8)

Figure 4: Example of boundaries mapped with GPS



Courtesy of community mapping group

Method 3

The third method discovered was termed by one of the informants as 'the head man approach'. (Int. # 4, 10). In this case the boundaries were identified *ex situ* by a representative of the community, often a village leader, who indicated on maps and/or satellite images where the boundaries of the community were:

> ...their representatives came and looked at a map showing watersheds and pointed to where the boundaries were, and named the rivers, quite completely, by just looking and pointing at the maps. This can be checked later, too. (Int. #5, 6)

> ...another approach is to gain a more unified discussion from a village head man. But this can be dangerous as different views may not emerge. (Int. #4, 10)

These first three methods seem to suggest that 'the boundary' is an identifiable entity on the ground that can be readily translated onto a topographic map through cartographic techniques and ethnographic research.

Method 4

After discussing the previous methods of boundary mapping, the fourth method discovered was surprising. This approach suggested that boundaries, as discretely defined entities, should not be mapped at all. Rather, an approach was taken to map land use and occupancy within the traditional territories in which 'boundary' as a discrete entity was purposefully NOT mapped, out of concerns for the possible implications of doing so.

> They were mapping land use around the park. They were not mapping boundaries. Mapping boundaries can lead to conflict. Maps, GPS, and GIS were used. (Int. #4, 2).

> What we learned in (place name) is that boundaries are contentious. Now there is less emphasis on boundaries. More of the work now is on mapping land use, history...we don't explicitly map boundaries anymore. (Int. #4, 8)

> ...boundaries are pretty artificial. They decided not to map them. (Int. #6, 9)

Sketch mapping

In all of the interviews, sketch mapping was considered a very important method of documenting local knowledge in a spatial format. Most informants suggested that local informants, in particular those with particular expertise about the land and its features, possessed strong 'mental maps' of their territories, and that the most efficient and accessible way of documenting this was through sketch mapping which could later be transcribed onto topographic maps. Issues of accuracy in the transferral of sketch maps to topographic maps were generally not considered of high concern, which was an unexpected finding. Methods of transferral used included cross checking with field data, base maps and air photos, GPS georeferencing, and employing topological characteristics mutually shared between sketch maps and topographic maps. Some suggested that topographic maps could be traced to provide a framework for sketch mapping, (Int. #3, #4), while others suggested that it is better to promote sketch mapping freehand and transfer later because the topographic representation of rivers, for example, could serve to stifle or intimidate the expression of local

knowledge. (Int. #6, 10) So although 'sketch mapping' was earmarked by me as potentially full of accuracy issues, particularly in the transferral of sketch to topographic maps, this was not actually considered a big challenge by the respondents. Three challenges that did come up repeatedly were the ability to find good quality base maps, the implications of combining base map sources, and the inaccessibility of certain boundary areas, which I will discuss further below.

Challenges

1. Finding good quality topographic maps

Finding good quality topographic maps that could be used as 'base maps' was frequently identified as a challenge. The quality of topographic maps is often tested during field mapping, because even government issued topographic maps will often show rivers that are not in the correct location, and need to be rectified with field work (Int #4, 8; Int. #8, 15; Int. #10, 8,9; Int.#13,1)

> ...we had a map, and we knew it was probably pretty crappy, so (name) went along the river and just surveyed the river. So, they just took a boat and went up the river and did the GPS reading at each branch. Because we work a lot from the rivers and the branches. (Int. #8, 15)

The quality of base map information was also addressed in some projects through discussions with local people about names and locations of features. (Int. #6), so in these ways government produced base maps were corrected and improved for accuracy before field work was conducted.

2. Combining data for base maps

Another challenge was in *combining* base map data. It appears that data sources chosen for the base map information are simply the best that can be found for a particular area. These might be derived from topographic maps, in which the best (i.e., largest) scale that has been used is 1:25,000 (Int. #4), air photos, or satellite imagery (Int. #5, #8). At times, base map data from various sources needs to be combined in order to achieve coverage of the whole area being mapped, as will be demonstrated later in the section regarding Phase II. This was discussed by a community mapping consultant who works in Sarawak:

> ...this is a big issue. Base maps can be made from satellite imagery, but if there is a topographic map around you can check the two and update information...But apparently there often is quite a bit of 'rubber sheeting'[27], definitely a combination of data sources is often used. Sometimes one source will have good information about something, and another source, good information about something else. I think the important thing is to show where the information came from , the sources of the map. There are all kinds

[27] "Rubber Sheeting" has been defined as: "A procedure to adjust coverage features in a non-uniform manner. Links representing from- and to-locations are used to define the adjustment". (www.esri.com)

of ways to do mapping. If the topographic maps are available, they are preferable...(Int. #5, 6)

3. Impossible to traverse boundary on foot

Some informants had experiences where the boundaries were too expansive to literally walk around given the amount of time and resources available, or simply because the terrain was too difficult. In these cases, the boundary was indicated using triangulation methods from and to known landmarks that were also visible on the map, and the boundary in between these points was interpolated. (Int. #3)

6.2.3 Boundary determination

The 'social' aspect of accuracy concerns the potential for nuances in meanings and interpretations of mapped features, for example territorial boundaries. In this section, I asked how community boundaries were determined, if any interesting challenges came up while determining the boundaries, and how accuracy was verified. In this discussion, these potential 'nuances of meaning' relating to a singular mapped entity (the boundary) become clearly evident.

If boundary mapping methods give us an idea about how the boundaries are *located* on the map, using various cartographic and field techniques, then boundary determination should give insights about the *nature* of those boundaries. In the literature about community mapping, it was often suggested that accuracy is an important issue due to the questionable ability of 'western style' maps to accurately portray the dynamic nature of customary land use and ownership. In this part of the research, I wanted to ask whether specific instances of this issue came up during the community mapping process. That is, is the accuracy issue simply a function of the availability of mapping resources such as good base maps and GPS units, or is it more complex, relating to the use of a culturally specific form of communication, to represent landscapes of communities rooted in other cultures? The responses in the interviews were not conclusive. They do suggest, however, that the meaning, location and nature of boundaries on the ground are often more nuanced and complicated than their mapped, often linear, counterparts.

How are the boundaries determined?

A broad range of answers came up for this question. Three important distinctions were the determination of boundaries based on natural features, or 'landmarks' on the landscape, margins of agricultural land use, and prior administrative boundaries. It appears that boundaries are sometimes reflective of traditional perspectives of territory, sometimes reflective of responses to external pressure, and often are a combination of these. Boundaries are not necessarily reflective of an innate geographic feature that relates to a solid community based understanding, but often are negotiated, and re-negotiated with neighbours, with individuals in the community, and with changes in the physical and socio-economic

environment. That being said, according to the interview respondents, the physical landscape remains a very important factor in boundary conceptualisation and its ultimate representation on maps.

As previously suggested, the determination of boundaries may be influenced by the topography of the local landscape. For example, an informant who had worked in the West Kutai region of East Kalimantan suggested that certain boundaries were obvious, because they used a river or stream, and yet others were in fact 'a lot less obvious' (Int. #2, 3) because the 'stark and obvious' boundaries of ridges were less evident in lowland dipterocarp forest areas. This was contrasted in projects that were done in more topographically distinct areas, about which one community mapping facilitator said:

> I've heard people speak verbally about boundaries by naming rivers or mountain peaks, basically (Int. #3, 20)

In the interior areas of Sarawak, for example, where there are extensive river systems and clear topographic relief, boundaries were determined mainly by first identifying and naming the local 'grid' of river systems and major landmarks such as mountain peaks, and using this to determine the boundaries. (Int. #3)

In other areas boundaries were discussed in terms of land use. For example, one project determined the community's boundaries by marking the extent of historical areas of cultivation:

> But they did actually have a ladang there about twenty years ago, so there's a lot of forest gardens all the way down...so they really see that as marking the extremity of their boundary (Int #2, 3)

A suggestion arose in more than one interview that boundary determination might depend on the *nature* of resource use and occupancy. For example, farming areas might have firm boundaries around individual fields, (Int. #3, 20) but communally claimed areas such as forests might have more fluid or less clear boundaries. A particularly engaging example was recounted by one informant regarding how a semi-Nomadic Penan community strategically cleared fields in their communal forest area to stop the construction of logging roads:

> ...this one group is trying to put in its claims to a fairly large amount of land by trying to make a circle of these fields. (Int. #1, 8)

In this sense a new 'boundary' was constructed based on ideas that cultivation is a more clear signal of property and boundaries to outsiders than communal forest, in both physical and legal senses.[28]

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[28] Showing evidence of cultivation is one of the ways to prove Native Customary Rights in Sarawak under the Land Code of 1958.

Defining boundaries at least partially as a response to external pressures on land could be seen in several examples given by the informants.

> ...by the time a community has decided that they want to do some mapping it's often because they are feeling like their land is threatened...by taking a big group of people and walking the boundary as part of the mapping process, it's like an affirmation. And sometimes they take that opportunity to actually mark the boundary as well, using plaques...or blazing trees...the mapping becomes an excuse to go out and do that symbolic act of affirmation. (Int. #3, 15)

Challenges in boundary determination

In discussing how boundaries are determined, many accuracy challenges become evident. In essence it appears that mapping a boundary is not a straightforward act of documenting, as accurately as possible, a concept of boundary that has been in existence for a long time and has an immediate physical counterpart. It may also involve indicating recently fixed boundaries, concretised in various ways as a response to outside pressures. This is not to suggest that the recently concretised boundaries are not reflective of traditional domains, but that their exact location and definition may involve a specific claim that has contemporary, as well as historical relevance. This is more clearly discussed in projects that include boundary negotiations between communities (Int. #5,#9) or long discussions of land use overlap between communities as a key part of the mapping process. (Int. #6).

One informant, (Int. #4, 11) suggested that it is important to be aware of the different natures of boundaries. He suggested that in community mapping it is important to 'look for the territory, not just the settlement area':

> It is not good to only ask 'where are the swidden fields? Where are the lowland rice plots?' although these may appear to be more permanent features. There are also other areas within the territory, such as protected forests, spirit forests, and open access forests. There will be different kinds of land use on different parts of the map. (Int. #4, 11)

Thus it is likely that different kinds of land use may have a strong influence on the determination of boundaries.

Another kind of 'boundary' discussion that emerged was the notion of 'administrative' boundaries. In this case, some informants had seen some differences of opinion *within* the village about the location of boundaries. Some of the younger generation had understood a '*desa*' boundary, which is the 'official government assigned village designation' in Kalimantan (Int. #3, 21), and some had understood a *customary* boundary which was spatially and conceptually quite different. The informant interviewed felt it was more 'accurate' to map the customary land boundary.

The definition of the boundary may also depend on the expectations and goals of the mapping project. For example, some community members may be more interested in

mapping their individual plots rather than entire communal territories. But this activity has many more concerns than just 'accuracy', as individualizing land previously under communal tenure can have many unforeseen impacts:

> ...there are some members of the community that want to recognize both the customary plots and the customary communal land...and then there would be another half of the community that is frightened about the security of their land and they would rather just forget about the communal land and get title on their...family plots (Int #3, 23)

Other community mapping consultants shared some reservations about mapping private entitlements to land, as it could unduly influence customary systems of resource entitlement:

> I think the ideal is to demarcate outer boundaries meant to delineate interactions with the state, but within that, communities can continue their internal system which may not include hard boundaries. Maybe the Native Americans did that. Some adopted private property systems, but they do have the right to continue in their customary ways if they choose (Int. #4, 20)

This point is of importance when considered how communities might respond to initiatives such as the *Konsep Baru* in Sarawak, which although recognizing communally based NCR claims, seeks to identify these areas based on individually cultivated plots. (Ngidang, 2000; see also Cooke, 2003)

There are also cognitive aspects to recollecting boundaries, however they are placed. One respondent likens the exercise of mapping a boundary to remembering a route taken from place to place. Some points, or landmarks, are clearly remembered, while other parts of the route, while known topologically and experientially, are more difficult to describe specifically, in an abstract and removed sense. (Int #3, 24).

> They have certain landmarks that are really clear...and then other parts ...that they would have to walk and figure out how to describe because they've never had to describe it, they just have a picture of it in their mind. ...So those parts of the boundary would be particularly vulnerable if the landscape is changed by logging roads.(Int. #3, 24)

In determining where to map the boundary, responses from informants reinforced my initial idea that although boundaries can look 'linear and straightforward' on a map, they are often not this clear on the ground. Local perceptions of boundaries can be multiple and combinatory, as was evidenced by these responses. In addition, these perceptions are not necessarily static, but may change depending on wider socio-economic contexts.

> It could be a very broad ridge (Int. #3, 26)

> ...you can get into all kinds of technical arguments about it and it's completely irrelevant, ...because they haven't defined the boundary that

> precisely anyway...It hasn't been necessary...but now, when they are wanting to present maps in court, or negotiate...it becomes important. (Int #3, 26)

> If it is a new boundary, then yes, it can be linear. But if not, there can be several place names and traditions involved in one area. Hard boundaries in that case can be problematic. (Int. #4, 10)

> ...the forest is the boundary between them, but who knows exactly where the line is? It's just that forest area...It is common that boundary won't be clear, unless it is a ridge or a watershed. (Int#5, 8)

In many cases, the name and location of rivers were strongly related to definitions of boundaries. For example, with reference to the settled or semi-Nomadic Penan of Sarawak:

> *at the village level, do you remember people talking to you and...describing the boundaries of their territory?*

> No.

> *no?*

> No, when you ask them about that they will always...give you the names of the rivers. They'll just give you the names of the rivers...I think they think in terms of whole watersheds. It's a pretty clear natural division. (Int. #1, 11)

In terms of 'challenges to boundary determination' the most interesting thing discovered was the range of opinions about the importance of mapping accuracy and boundaries that were expressed by the informants. Some informants seemed to view the map as a 'work in progress' in which boundaries could be sketched in, and later modified based on new information or negotiations. In the words of one informant 'it's not like if you get the boundary 6 feet wrong, you will die!' (Int. #5). Others viewed boundary determination as a contemporary act involving serious levels of negotiations before mapping. (Int. #9). Finally, as mentioned, some informants found the act of boundary mapping to be so potentially volatile that they removed it from their community mapping repertoires entirely.

Still other challenges that were discussed were that large scale changes to the local environment that have occurred because of logging or other forms of environmental degradation can impact local knowledge and/or agreement about the nature and location of boundaries.

> ...at the same time (if) they are not using (the communal forest) very much...there can even be confusion about where the boundary is...like when a logging company comes and builds roads and alters the landscape to such an extent that there starts to be an argument about where the traditional boundary was, in fact. (Int #3, 24).

In addition, there may often be overlapping boundaries or use areas between villages (Int. #1, #3, #5, #6). In interview #9 I was referred to the work of Anau et. al (2002) , who

identified that the level and nature of participation in mapping exercises and related boundary negotiations were key factors in the agreement, documentation and stability of boundaries mapped between villages.

Given these many aspects of boundary definition, I also directly questioned the informants about how the issue of accuracy was addressed; that is, once a boundary is delimited on a map, how is its position verified and legitimated? Interestingly, many communities respond to this issue by ultimately referring to the *land*, and not the *map*.

How is boundary accuracy verified?

Most of the informants suggested that once the boundary was mapped, it would be returned to the community for verification, a procedure that is discussed in Phase Two. Verification is also done at the field mapping stage to address issues discussed above. It was suggested that the preference is often to verify the boundary *in situ* rather than, or in addition to, assessing its location as represented on the map. This is particularly true if there is a situation of dispute with a neighbouring community. The preference seemed to be that people wanted to 'see it on the ground and walk it on the ground', rather than trusting a 'line on a map'. (Int. #3) So, at least for very important features, it appears that the community verification process often includes 'ground truthing' and not just abstracted discussions around a map.

As for specifics of how boundaries are verified in the field, the informants suggested that both community participation and field work are very important. In this case, it appears that 'the community' is not considered a homogenous entity, but consisting of diverse opinions and knowledge about the landscape:

> I would tend to want to go with a group of people and allow discussion to emerge on the boundary...and allow disagreements to come out. If you never get to discuss it out there, it would be hard to identify why that person said it was here and the other person said it was twenty meters over to the other side. There might be a reason for it, there might not....I would tend to recommend a participatory process. (Int. #3, 25)

Specific aspects of verification can involve 'place names, stories about land use, past and potential conflicts, and other community based data'. (Int. #4, 2) This was reflected in other interviews, in which it was suggested that assessing the accuracy of field data had both technical and cultural aspects (Int. #5, 7). The mapping facilitators were sometimes seen as responsible for the technical aspects, whereas the community members were seen as the leaders of the boundary survey (Int. #5, 7) and ultimate purveyors and protectors of the mapped information. It was considered important to *triangulate* oral testimony, and verify the connection between oral and positional information (Int. #4). This suggested to me that although the maps are called 'community maps', specific information should be documented

regarding the individuals who act as sources of data for the map, so this can be traced and triangulated clearly after the field work and map are completed.[29]

6.2.4 Conclusion to phase one

Boundary determination, then, certainly seems to involve more than simply traversing a clear line on the ground and documenting the latitude and longitude of a number of points. In order to assess the accuracy of the boundary that is mapped, the historical, social and physical aspects of it should also be documented. By the experiences of these informants, it can be seen that 'boundaries' can be defined and located in various ways, depending on the terrain, and also how the boundary is 'seen' and enacted, both historically and culturally. The terrain may provide an obvious division, such as a mountain ridge or river, or may allow for transition zones defined by use and movement.

In this small group of informants, there was a spectrum of approaches to boundary mapping and accuracy assessment. Some considered a boundary, while often problematic, to be an existing and mappable entity, while others considered it inappropriate to approach community mapping in this way and chose to focus only on land use and occupancy without explicitly delimiting 'boundaries'.

Also of interest was discussion over how boundaries are determined. In some cases, the informants felt that boundaries could be mapped by individual communities, (Int. #3, #5), while others felt that this was a feature that could only be determined through negotiation *between* neighbouring communities. (Int. #2, #9). As mentioned, others felt that boundaries should not be mapped at all. (Int. #4,, #6). This returns to my question about whether boundaries are concrete 'things' that exist in the custom of a single community, or if they are malleable concepts in which their cartographic expression depends as much on adaptive and contemporary, and sometimes temporary, agreements on their location and meaning. These questions, in order to have a definitive approach to 'accuracy' would probably have to be addressed on a project by project basis.

6.2. Phase Two: Mapped Representations

6.2.1 Introduction

This section revolves around the completed maps that were produced in phase one. Questions were asked such as 'what is an accurate map?' I was also interested to know how local people respond to and critique the final drafts of the mapped product, and if accuracy reports were produced. Finally, I examine material examples of community maps from the

[29] This approach can be seen in Tobias' (2001) account of traditional land use and occupancy mapping in Canada, in which map interviews are first done with individuals and only later collated onto a community style map. These interviews are often audio and videotaped, to provide a permanent record of the data collection so that the final map draft can be checked and verified.

region and describe how they also provide insights into the social and technical aspects of accuracy in boundary mapping.

6.2.2 What is an accurate map?

The general response to this question was that the accuracy of the map should fit with the objectives of the project.

> The appropriate level of accuracy depends on the project. If the project is about tenure rights and claims to land, then a high level of accuracy should be achieved. The state takes it more seriously then, so it should be fairly rigorous. (Int. #4, 14)

Some informants, while distancing the production and application of the maps, still suggested that 'accuracy' levels were tied to the maps 'standing up to scrutiny' by outside actors.

> The uses of the map are their business, not ours. Sometimes, if a map is not all that accurate, it is still very useful. We'd like to get as close to reality, and as much detail, as possible. Indigenous people are usually fighting a battle with the maps. So if they are inaccurate, they will be criticized. The maps have to stand up to scrutiny or they are not useful. And often, they are judged as better than the government maps, and this has given them a great deal of credibility. (Int. #6, 14)

'Getting it right' was identified as important not only so the maps could stand up to critique, but also so they would represent local perceptions adequately.

> It is important to get the names in the right place, and to get the associated stories right. The stories are an important way of seeing land through local perspectives. (Int. #4, 15).

During phase two, the most prevalent definition of an accurate map was one that had been assessed and validated by the community. 'Community' validation was seen as different from the map representing every individual perception:

> ...consensus within the community is enough to call that map accurate,... perceptions of the land, they're all different, but if it's *community* mapping, then if there's *community* consensus on the representation, then that's accurate. (Int. #3, 32)

6.2.3 How do local people respond to and critique the maps?

Most respondents said that responses to the maps were positive.

> ..villagers coming around afterwards to look at the maps. And some get really excited, especially seeing the local names on things, suddenly it starts to make sense. A topographic map doesn't mean anything to them, but when they see their own network, their own grid, native grid, drawn on the map with all the rivers and footpaths, with local names on them, it all starts to make sense (Int. #3, 11).

> Usually they are thrilled. They use them in schools, they display them widely. They are used for gaining title to lands. The response has been overwhelmingly positive. (Int. #6, 13).

One respondent who had worked in East Kalimantan, however, was not certain that the maps meant anything at all to the local people who had been involved in a participatory mapping process. He suggests that the social dynamics beyond documenting boundaries on a map are more important:

> For instance, say the Bupati would want them to create, or BPN would want to create accurate boundaries whereas the community themselves might think 'sod that, why do we need to make maps at all, period? Because in fact what is more important is that we have some sort of verbal or legal recognition of where the boundary is, and we'll stick to that because we know where it is'. Like the map's not going to prove that. We had all these maps which were produced using community mapping methods, but you show them to half of the people in the communities and they couldn't read them, didn't know what the hell it meant. You know, it's just like lots of pretty colours on a piece of paper, and in fact it would be much better if you just cut them to pieces and rolled cigarettes with them. (Int. #2, 14)

Another respondent who had worked in Sarawak suggested that the maps could also engender distrust amongst community members and their neighbours. (Int. #5, 8)

An interesting point that came up was that not only was Phase Two important for validation of the maps made in Phase One, but also that viewing an initial set of maps, could engender more interest and trust in the project, which in turn would often mean that much more information was supplied to be put on the maps than during the initial phases. This particular respondent incorporated this experience into the approach of community mapping, in which there were at least two rounds of field mapping.

> ...in the first stages a lot of information was not shared. But by the time of the second field work, the suspicions dissolved and then information just poured out. (Int. 6,10)

Viewing the maps also predicated a sense of ownership:

> The response from the villagers was 'these are OUR maps, OUR information...we control access to them and their use requires our permission'. (Int. #4, 13)

Overall, in some cases the step of community validation was incorporated with an explicit methodological approach into the mapping process, for example exhaustively examining and verifying every feature (Int. #6). In other cases, it was more a case of displaying the maps during a community meeting and allowing conversation to flow in order to identify areas or locations that needed to be ground truthed or discussed further (Int. #3, #4, #5).

Another question about 'phase 2' of community mapping processes was 'are accuracy reports produced'. The answer to this question varied, but overall it seems that accuracy reports initially were not paid much attention to, and now are seen as more important (e.g. Int. #4). It was suggested that these reports should include documentation of all sources of information used, for example the names of informants, so that testimony can be triangulated (Int. #4), the sources of spatial information used (Int. #6) and the methods used to collect the data.

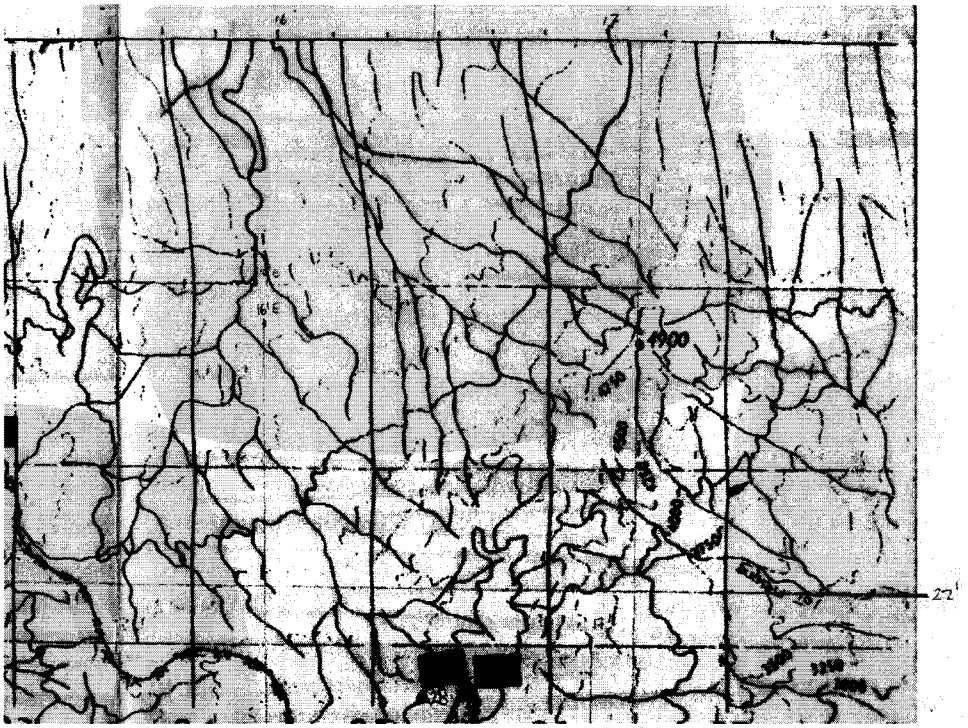
It is my opinion, judging from what was learned about community mapping through the interviews and readings, and also through my own experience in the field, that although community mapping is considered a 'participatory' and 'community' process, information should be documented such as the names of individuals who provide information for the 'community map'. In this way, the source of the information shown on the map can be traced and levels of participation can be verified.

6.2.4 Examples

Some community made maps, at various stages of completion, were examined. I was curious to see what the maps themselves could say about accuracy and boundary issues in community mapping. The findings are neither conclusive nor representative, but are useful for discussion purposes. For example, Figures 5 and 6 (below) show sections of a community made map from Sarawak, Malaysia. This map can be considered a 'working map' that was part of the map compilation process for three villages in Sarawak. The method of production was to photocopy maps from a 1967, 1:50,000 topographic series published by the Department of Surveys, U.K. Four topographic maps were used to obtain coverage for the entire area. This area was then expanded to 1:20,000 using photocopying techniques. The photocopied 'base map' was then used to plot information that had been gathered using techniques such as sketch mapping, map interview, and GPS collection. Field data were recorded in notebooks, and supplementary information, such as stories about place names, were recorded and referenced on the map using a numbering system. This map was selected for use as example because it is suggestive of certain challenges that can be involved in acquiring good base maps. The size of the original map was large: (91 cm by 110 cm, or 'table top size') The photocopy indicates where the map has been taped together from multiple base maps. In the first image, the east (rh) side of the map is particularly poor quality, particularly near the top where it is evident that the map moved while being photocopied as the features are distorted and faint. The second image shows the seam where two of the topographic maps were joined in an obviously less that perfect fit. Note also the faintness of the contour lines and the re-drawn lines for rivers. Much of this distortion (shrinking/stretching) can be accounted for by the age of the source materials and by the fact that the sheets were enlarged by photocopier. The upper right hand side of map shows distortion of the grid and faintness of features. It is also evident that someone has tried to

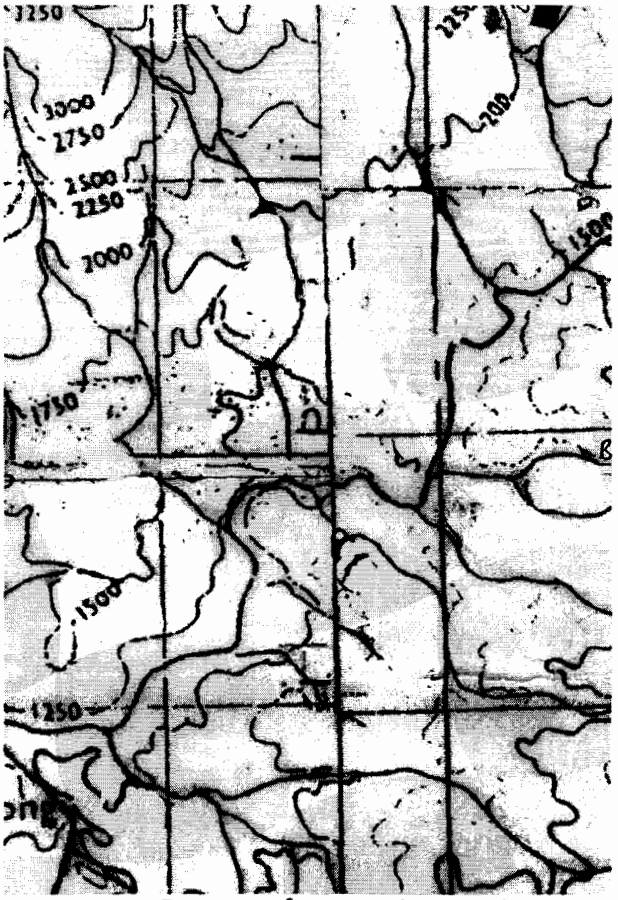
draw in a contour line more clearly, and that they have manually added latitude/longitude reference points:

Figure 5: Section of community map from Sarawak



Courtesy of community mapping group

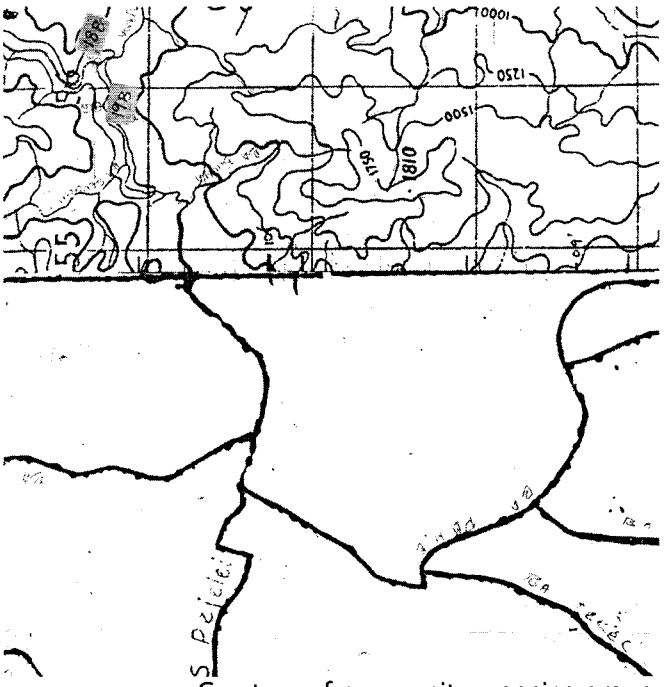
Figure 6: Section of community map from Sarawak (2)



Courtesy of community mapping group

Figure 7 shows what can also be considered a 'working map' that was part of the compilation process for another village in the same area of Sarawak as the previous examples. The method of production was similar to figures 5 and 6. Photocopied maps at a scale of 1:50,000 were used for the northern section. Notable here is that the southern half of the map is created from a topographic map with a scale of 1:250,000. In these examples, several technical issues emerge concerning accuracy, although there is not much elucidation about the social processes of accuracy beyond the evident difficulty of finding good quality base maps.

Figure 7: Part of a base map from Sarawak created from combined data sources



Courtesy of community mapping group

6.3 Conclusions and Discussion

It was found that there are both social and technical dimensions to the accuracy question that emerged during phase one and phase two. The most important technical issues appeared to be the acquisition of good quality data for the construction of base maps, accuracy considerations in combining base map data from multiple sources, and challenges in traversing difficult terrain during field mapping.

Several boundary demarcation methods were discussed, for example topographic map interviews and sketch mapping, ground survey with GPS and/or compass and tape, 'the head man approach', and finally de-emphasis on boundaries as 'lines' with preference to mapping use and occupancy.

Boundaries, however they were mapped, had multiple definitions. In some cases, land use extent was the operative definition for the mapping of the boundary. In others, points such as major land marks were identified, and the rest of the boundary was interpolated between these points based on watershed divisions. In some cases, boundaries were mapped by individual communities, in others it was deemed necessary to include with boundary mapping a process of boundary negotiation between neighbouring communities. Challenges arose from disagreements between individuals about the location and nature of boundaries, and impacts of large scale changes on memory and wayfinding concerned with boundaries.

The results for Phase Two suggest that accuracy can be thought of in two directions. The maps should reflect local perceptions, but they should also be sufficiently accurate for their intended purposes. The presumed link between the necessary accuracy and the purpose of the map was clearly evident in the interviews, which supports what I expected based on my reading of manuals and reports. Also interesting is that a presentation of maps back to the village does not imply that the process is complete and only needs to be checked and verified. According to one respondent, viewing the maps engendered more trust and interest in the project, and thus the flow of much more information.

In terms of accuracy reports, most respondents suggested that 'accuracy' should be thought of in both technical and social terms. That is, there are ethnographic data that should be triangulated, and there are spatial data that should also be verified. In returning to the findings about how boundaries are defined, it is clear that these are not mutually distinct, but that clarity regarding social meanings of boundaries should be obtained before the spatial information can be assessed for its accuracy.

The following chapter discusses 'phase three' of community mapping, and examines the link between required accuracy levels and actual *applications* of mapping.

Chapter 7: Phase Three-Accuracy Issues In Applications Of Community Mapping

7.1 Introduction

This section concerns how outsiders viewing the maps evaluated or critiqued their accuracy. Findings from phase one and two suggested that the purpose of the map will influence the level of accuracy required, but also that the methods used, time and resources available and local perceptions will influence the level and types of accuracy attained.

The key informants were asked how the maps they had helped to make were actually used, and whether they ultimately were considered 'accurate' for their purposes. As expected the maps were made for several purposes, which are discussed below. Responses to the maps recounted by the informants were interesting in sometimes unexpected ways. There was not much response from the key informants about how 'accuracy' is evaluated by outside viewers, apart from the general opinion that usually the maps were effective in their applications. Some also felt that format and presentation were equally as important to the ultimate effectiveness of the maps, regardless of accuracy issues.

In addition, the judgement of the Rumah Nor case, in which community maps were introduced as evidence of a customary land claim in Sarawak, was examined. These findings are discussed in section 6.3. Analysing this landmark case provides a sense of how boundaries on community maps may be critiqued in terms of their accuracy in formal, legal contexts.

7.2 Applications of Community Maps

The informants were asked to relate some instances where the maps had been used, whether 'successfully' or 'unsuccessfully' in their opinions, and how they were received by viewers from outside of the communities.

In general, the maps had been used for several purposes, such as: promoting local land management (Int. #3); community boundary determination, negotiation and delimitation (Int. #3,#9); providing tools to negotiate with government and large companies operating on or near their land (Int. #3); fostering local awareness and cultural identity (Int. #4); documentation for legal purposes such as land claims (Int. #3); and producing base maps for further participatory research, such as local resource inventories (Int#8).

In Sarawak, the maps had been used for protesting large scale developments on customary land, for example as evidence in legal proceedings:

> ...an Iban community that was protesting the development of an oil palm plantation. They said 'this is our land', the oil palm company said 'we have a license'. An NGO helped them to map their land and the oil palm plantation started to take them more seriously. They showed the police the map, and took the case to court and got an injunction. The map demonstrated and communicated their claims. It was compelling enough for the judge to say 'work it out'. (Int. #5,5)

The same respondent suggested that mapping can also 'help to level the playing field' (Int. #5) in direct negotiations between companies and communities.

> ...they still don't have the same power as the companies or the government but maps help to improve the ability to discuss and clearly argue their position. (Int.#5, 5)

The maps also had unforeseen uses in some cases. One informant speculated that community maps may have played a role in the reduction of arrests on logging road blockades in rural Sarawak (Int. #5, 5). In this informant's opinion, the presentation format of the maps is an important factor:

> It's especially true for impressive looking GIS maps, the police might think 'my God, they must be official'...GIS seems also to add a certain validity that hand drawn maps don't have...(Int.#5,5)

Here it is evident that perceived 'accuracy' may have as much to do with the format and presentation of the maps as with the social and technical elements discussed in previous chapters. This is also suggested in another example from Sarawak, where hand drawn maps made at the community level were ridiculed by local authorities. This reception encouraged a local community member to adopt cartographic methods that would be respected by the authorities:

> For example M. who is from an Iban community drew a map with his community to the best of their abilities. But when they brought the map to the D.O. the company guys scoffed at it 'you call that a map?'. M. was humiliated, and this was his inspiration to learn cartography. In truth it probably was a good map that they made. Now he is making a very detailed map of his community. Every rice field, and rubber plantation is on there, with numbered with information about the person's name.... It's very thorough. The government had done some mapping there too, and now M. is like 'theirs is crap'. Mapping has really changed people's lives there. (Int. #5, 5) (*note, 'D.O.' means 'District Officer')

In terms of perceived accuracy, it was the opinion of one informant that legal applications had the most stringent demands:

> So in Sarawak that's the main place where the accuracy has become an issue and I think there is still a lot of debate about legally what the accuracy requirements are. (Int # 3, 30)

Other applications of community mapping were less specific, in which the informants suggested that mapping could play a role in developing sustainable resource management and in fostering local institutions and awareness.

> The mapping was used to bring the community together and to protect the watershed. (Int. #5, 6)

In these cases the mapping played a dual role. On an immediate level, it was useful for planning local resource management projects. However, mapping was also used to document information on cultivation for future land claims. This was considered strategically important because 'idle' lands 'are not recognized as valid to claim in Sarawak' (Int. #5, 6) but cultivated areas can be recognized. Many respondents suggested that the exercise of mapping could itself be considered an application, as it served the function of bringing people together in discussion. (Int. #3, #5) Other projects used several community maps to promote the inclusion of local communities into regional scale land use planning. (Int. #3) In this case the mapping served to help raise the profile of the local people with government authorities.

One thing I was curious about was whether the maps were used in ways that were different from their original intention. My reason for asking about this was to explore the presumed link between accuracy requirements and intended use. One project, for example, was meant to show how much community land would be submerged under a proposed dam development in preparation for compensation claims. (Int. #3) In the end, however, the dam did not go ahead. The maps ultimately were used by the villagers to negotiate with the managers of a neighbouring national park which they had been barred from using for their swidden rotation and non-timber forest product collection.

Some respondents suggested that evaluating how the maps are used and assessed for accuracy within these applications, is something that still needs to be examined in community mapping. While the maps may be useful in empowering communities they may also be vulnerable to misuse, such as presenting a vision of the land as a commodity. One international consultant suggested that while previously he was not around for the application part of community mapping processes, he was becoming more interested in developing assessments for these projects. He was interested to know if community mapping really 'empowered' anyone, as some mixed results had occurred:

> Key issues surrounding potential empowerment are access to resources, reinvigorating cultural identities, and developing use and management of resources. ...But there are negative uses as well. For example, in Indonesia, some maps have been used to sell off lands to logging interests. (Int. #4, 15)

He also suggested that maps could help improve 'informal' rather than 'formal' recognition of people's claim and rights to land, because formal and explicit negotiations could 'become complicated'. (Int #4, 6) It appears also that with increasingly formal

applications, 'accuracy' emerges as a much more critical issue, as do other concerns such as participation levels in the production and ownership of the maps.

Thus the maps can be used for a wide variety of purposes, sometimes foreseen and planned for, and sometimes quite incidental to the original purpose for mapping. Although the general opinion was that the more formal the applications of the map, the more stringent the accuracy requirements, the informants were uncertain how maps might be *specifically* evaluated in terms of their accuracy. I suggest that the recent Rumah Nor case in Sarawak provides some crucial insights into how the accuracy of community made maps might be specifically evaluated in legal cases.

7.3 Discussions of Community Mapping and Accuracy in the Rumah Nor Decision

7.3.1 Introduction

In the Rumah Nor (2001) case in Sarawak, community made maps were used for legal purposes in order to support arguments of native customary rights to land in Sarawak (Nor, 2001; Hooker, 2002). The 'perceived accuracy' of the maps used in the Nor case, with particular reference to the existence and location of customary boundaries, was related to how the maps were made, who made them, and also to how well they were perceived to represent local (and 'ethnographically verifiable') traditions of boundaries and territory, encapsulated by Iban *adat* terms such as *pemekai menoa*, *temuda* and *pulau*.[30]

In this case is there are clear descriptions of field methods used to map the community's boundaries. Essentially, an NGO staff member named 'Samy', frequently described in the ruling as 'the unqualified surveyor', followed the representatives from Rumah Nor community and documented where they showed him 'the boundary'. In this case, there was a specific boundary that was discussed, and it related to land use, such as areas with planted trees, and natural features such as rivers and other landmarks. The maps are attacked by the counsel of the Defence as being 'inaccurate', and they cite examples when testimony from the Iban community members does not coincide with the information shown on the map. Given this challenge from the defence, how did the judge decide whether to accept the maps as 'accurate' or not? It must be emphasized that this evaluation was not only based on how well the map was made by Samy and the Rumah Nor villagers, but also on how the law of Sarawak 'sees' native customary territory and boundaries. In order to decide

[30] *Pemekai menoa* was defined by the court as 'the territorial domain of a longhouse'; *pulau* as 'forest used for gathering produce'; and *temuda* as land for cropping. (Hooker, 2002,94) These definitions were developed by the judge based on 'standard ethnographic and administrative texts', more recent anthropological work on Iban culture and society, historical documents from the Brooke's era *and* oral testimony from the Iban plaintiffs. (Hooker, 2002, 94) What is important to note is that the extent of the territorial domain of the Iban Plaintiffs is defined *partially* by their testimony, but not *exclusively.*

where and how the Rumah Nor boundaries should be *defined*,[31] the judge interprets relevant laws and considers the ethnographic evidence from community members, and other sources such as historical material written during the Brooke's era and later, that describe Iban land use and boundary making. He also employs his own logic to determine where the boundaries of the community would likely be, by suggesting that it seemed to make sense that the traditional *pemakai menoa*, or communal territory, would extend to at least a half day's walk from the longhouse. Using this evidence to adduce a likely definition of the community's boundaries, he then decides that the maps are as accurate as could be expected given the resources available to the community mapping team, and ultimately rules in favour of the Rumah Nor community. Two things become evident. First, the judge does not apply a stringent definition of cartographic accuracy, and accepts the methods used by the community mappers. Secondly, a fixed idea about where the boundaries should be, even through a legal perspective, does not appear to exist in his judgement. Instead, the *likely* locations of where the boundary should be, based on a number of factors and sources of evidence, are assessed by the judge.

Some Nomadic Penan groups have also decided to try community mapping in order to support their legal arguments to NCR. But it remains in question where and how 'boundaries' should be mapped for these projects. In the following section I will discuss in more detail the insights from the *Rumah Nor* case from the perspective of how *adat* rights are interpreted in the Sarawak courts. In chapter 7, I will draw on some of these points to further discuss the issue of boundary mapping accuracy in the Nomadic Penan territories.

7.3.2 Review of relevant points from Rumah Nor

In the Rumah Nor case, the community produced maps and their depiction of boundaries was discussed in a legal judgement that addressed three aspects of Sarawak land law-state legislation, residual colonial laws and *adat*. In the Nor judgement, principles are accepted from *Mabo* (1992) and *Adong* (1997) rulings in which the pre-existence of native customary rights are considered valid under common law (Hooker, 2002).

In *Nor*, the land in question was not held in title by the Iban plaintiffs, meaning that they had no official documentation of rights to occupation or use. On the basis of their *adat* laws, they claimed traditional rights of occupation and use to a specifically defined area which they presented with oral testimony and accompanying maps. Iban *adat* terms, such as *pemakai menoa, pulau,* and *temuda* were presented by the plaintiffs to argue the extent and

[31] Here I use the term 'defined' in a similar way as the question in Phase One: 'How are the boundaries defined'. The difference here is that in Phase One, I was concerned only with how the community themselves defined their boundaries (e.g. perceived and enacted) and whether mapping methods could accurately represent this. In this case, the judge is looking at two things. He too is interested in how the community themselves see their boundaries. He is also interested in how the law sees their boundaries, and his assessment of the boundary map made by the community members and Samy is clearly a balance between these two perspectives.

nature of the area claimed. The judge relied on ethnographic evidence, for example scholarly works on Iban culture and society, government documents from Brooke's and British eras, and also accepted oral evidence from Iban witnesses. The ethnographic work was used to 'confirm the existence of such customs' (*Nor*, cited in Hooker, 2002) that reflected the nature of customary rights to land and resources. Like many communities, the Iban land had never been surveyed, so demonstrating rights through occupation and use necessarily involved using various sources of information, in a sense creating an ethnographic reconstruction and interpretation of the specific area of occupation and use.

One of the key points about Nor was that the territorial domain of the longhouse (*pemekai menoa)* was accepted as a basis of a native right to land. Further, that genealogies could be used to trace historical movements of the longhouse community, in order to assess that the ancestors of the plaintiffs had actually been in the area of dispute for a length of time. The judge also uses historical works about native customary rights and their relationship to land administration in Sarawak (e.g. Porter, 1967) to assess the validity of the claim that the rights the plaintiffs were arguing for were indeed ancestral. (Hooker, 2002).

To identify the land area in this case, the judge accepted evidence of 'long established farming practise' (Hooker, 2002, 96) and the presence of old fruit trees as supporting a claim to occupancy and use. However Hooker (2002) suggests that this alone will not answer the question of boundaries and territory, and this is where the conjuncture between the community map and Iban *adat* views of land use and territory becomes important. Ultimately, the defendants' critique of the map, and their argument that the boundaries presented were not accurate was not accepted by the judge. That is, the boundaries that were shown on the map produced with GPS by Samy, referred to in the judgement as the 'unqualified surveyor' and the Iban community members were accepted by the judge because they reflected, 'on a balance of probabilities' the areal extent of the community's *adat* territory of use and occupancy. The judge defined boundaries in local, as well as cadastral terms (Hooker, 2002) and the legal recognition of these 'local terms' was key to accepting the accuracy of a map that was produced, in essence, by an 'unqualified person' in an 'unofficial capacity'. (my quotes)

This judgement shows how particular issues related to the methods used and resources available to community mappers may relate to how the accuracy of maps may be questioned in this context. But there is also a more complex legal backdrop that needs to be addressed, in which the judicial interpretation of customary 'rights' and 'territory' plays an important role.

Turning the conversation towards the mapping efforts of the Nomadic Penan, this case, as well as a reading of how Sarawak land administration might recognize customary tenure, presents several important questions. An underlying concern is whether 'accuracy' in community mapping is bound to *reflect* dominant legal and political paradigms of property

entitlement, or whether it has the capacity to *challenge* these paradigms based on the specific aspirations and realities of these communities, and also based on recent calls for land policy reform in this region. Although *Nor* has presented a landmark decision that may support this kind of policy reform, the case of the Nomadic Penan presents several differences that were not addressed here, and have not yet been addressed in the courts of Sarawak. These differences demonstrate that 'boundary accuracy' in community mapping applications should consider both local and state views of property entitlement.

Chapter 8: The Case Of The Nomadic Penan

8.1 Introduction

In this chapter, I return to the specific case of the Nomadic Penan, who hope to use community made maps in legal applications. This case is illustrative of my approach to understanding 'accuracy' in community boundary maps, as both local realities and external expectations must be considered. A discussion of accuracy in this case would need to incorporate 'on the ground', or social understandings of boundaries, as discussed in Phases One and Two, and aspects of Phase Three that consider how maps may be scrutinized by outside viewers.

8.2 Using Community Mapping as Evidence for NCR Claims-The Nomadic Penan Case

8.2.1 Introduction

The question about community mapping here is how might the Nomadic Penan use this tool to accurately represent their claims to customary land? Again, the concept of 'accuracy' can be considered from two directions. First, in the *depiction* of local features, in both spatial and conceptual terms, and second, in how the maps might be *challenged* in terms of their perceived accuracy and legitimacy *vis a vis* existing legislative and political structures that are implicated in the recognition of indigenous land entitlements.

This discussion must also be placed in the context of recent discussions regarding the complexities of native title law in Sarawak. Legal scholars and NGO activists (e.g. Hooker, 2002; IDEAL, 2000) have suggested that since the adoption of *Mabo* as precedent in Malaysia, there is a need for land policy reforms and greater clarity in how the courts define native title rights. This call was foreseen earlier by Hong (1987) and Brosius (1986) who suggested that Sarawak development policies could benefit from a widened understanding and recognition of Penan land and resource use[32]

Community mapping efforts might have a potential role in informing and urging on these policy reforms, rather than merely attempting to fit in to existing frameworks-an approach which could be described, borrowing from Lindsay's (1998) description of modern title and traditional societies in Indonesia, as fitting 'square pegs into round holes'. If community mapping efforts could be seen as potential vehicles to promote policy reform, what implications might this have for these mapping strategies and associated views of

[32] In this work Brosius was specifically referring to the Penan Gang communities of the Upper Belaga but I have considered his insights and critique valuable for this discussion as well.

'accuracy'? Can community mapping help to square the holes or round the pegs, so to speak?

The Nomadic Penan case brings all of these issues out dramatically. On the one hand, as recounted in interview #1 of this research, some Nomadic Penan communities have expressly asked for assistance in mapping their lands so they can attempt to secure native customary rights to their traditional territories. On the other, their manner of using, living on, and knowing about the land is not expressly recognized in legislative frameworks governing entitlement to native customary lands. In this case then, there is a need to consider not *only* how to be spatially and conceptually accurate in the depiction of land use and occupancy, but also to consider how and if mapping projects can help to develop a rhetorical argument that supports the legitimacy of these claims.

The key here, in my opinion, is to question not only *where* claims to land and resources occur, and how to map them appropriately, but also to question *how* concepts of property and entitlement are defined and enacted within the social and physical landscape of the Penan. The Nomadic Penan have presented us with a *legal* problem that requires a thorough understanding of *their* concepts of 'property', its specific cultural and historical connotations, and its manifestations on the landscape, and how it relates, or often times *doesn't* relate, with wider state paradigms governing property entitlement.

They have also presented us with a *mapping* problem, in which we can question how the Penan might creatively and constructively use community mapping techniques as a way to communicate their claims to property and territory in a way that honours their traditional conceptions of space, (cf. Fox, 2001) and is also considered accurate enough to argue 'legitimate entitlement' in wider milieux such as courts of law.

Sarawak land law suggests a pre-existing 'template' which defines how property rights may be created. The Land Code, however, does not explicitly recognize paradigms of use and entitlement operative in Nomadic Penan society, but is based on the modes of land use and occupancy of agrarian communities that are more sedentary in nature. For example, the methods to acquire Native Customary Rights stipulated in the Land Code include felling of virgin jungle and the occupation of the land thereby cleared; planting of land with trees; occupation or cultivation of land; use of land for a burial ground or shrine; and use of land of any class for rights of way. (Hong, 1988) Inherent in these stipulations are certain ideas about the meaning of property and how it may be created. As mentioned in the previous chapter, however, some of these ideas have been challenged in recent court victories in which rights to communal forest areas were recognized based on historical use and occupancy.

Legislation surrounding land rights in Sarawak involved 'a steady erosion of native customary rights by the state government and its patrons' (IDEAL, 1999,17; see also Hong, 1988). Further, Native Customary Lands, or NCL, are defined as 'land in which native

customary rights, whether communal or otherwise, have lawfully been created prior to the 1st of January, 1958 (Hong, 1988, 48). The implementation of the Sarawak Land Code of 1958, and its amendments, is probably the most crucial law to understand, in that new clearings or other activity post 1958 do not entail rights to native customary claims. Although the 1958 Land Code does have a category for Native Customary Land (also Mixed Zone Land, Reserved Land, and Interior Land), it is restrictive in that it removes the opportunity for further claims to native customary rights, and it also is limited in how these are defined.

In my reading of the Rumah Nor decision, however, it seems that there *is* space in the Land Code to claim rights to communal forests used for subsistence purposes. Thus the key challenge for the Penan would be to *prove* that they had established rights to the communal forest, and also that they had established these rights prior to 1958. It can also be shown through historical and ethnographic evidence that the communal forest of the Nomadic Penan was not simply used for subsistence purposes, but also as a source of items for trade and sale to neighbouring groups. (for example, see Sellato, 1994)

Spatially and ethnographically, the Nomadic Penan's claims to territory and resources can be explored through what Brosius (1986) described as a 'culturally dense landscape'. 'Boundaries' per se may or may not be an operative concept, but territory, resources, and place names certainly are. (Int. #1; Brosius, 1986)

What needs to be explored is the meaning of 'property' as it is applied by the state, and as it is understood by the local people. For example, although cultivation is a particularly powerful statement of the creation of individual property rights creation under the Land Code, the precedent of Rumah Nor now suggests that communal rights to forest areas can also be argued if they are within a certain proximity to habitation sites. In addition, demonstrating area specific use and conservation of resources such as sago may also support a claim to communal property in land.

The Nomadic Penan do not necessarily leave strong visual evidence of property through cultivation and habitation, as I will discuss below. The question then is how would a mapping project be approached that could accurately reflect Nomadic Penan land use and occupancy? How should the ethnographic data be collected, recorded and presented? And also, how might the accuracy these maps be challenged in their intended applications?

8.2.2 *'Accurately'* depicting the Nomadic Penan landscape with maps: four key issues

It is suggested in the literature and from some of the key informant interviews of this study that the Nomadic Penan may not leave the same kind of 'evidence' of their claims to property as that recognized by the state legal system. Specifically, we can examine this issue by discussing four issues that are outlined as means to proof of native tenure in the Sarawak Land Code: cultivation history, graveyards, boundaries, and settlement/movement patterns.

According to two of the respondents, (Int. #1 and Int. #5) documenting and georeferencing Penan oral history would be the obvious method to create maps that reflected the locations and meanings of Penan land features.

In order to accomplish acceptable levels of accuracy this would have to be conducted in a manner that had currency with the existing legal apparatus that evaluates native customary rights to land. The difficulty, it seems, is in the *visibility* of the Penan claims, not only to the physical eyes of outsiders, such as bulldozer operators mowing down Penan gravesites, sago clumps and hunting forests, but also to the 'eyes' of state law, which 'see' property claims through physical evidence of cultivation and habitation. There are echoes of this in the North American experience, recounted by Rose (1994) in her discussion of the common law doctrine of 'first possession'. Here, native peoples' 'alleged indifference to well-defined property lines in land was part and parcel of what seemed to be their relatively unproductive use of earth' (Rose, 1994,19), and justified the culturally myopic view that personal acts on the part of the natives, sufficient to create property rights, had not been undertaken. [33]

The Penan are at even more of a disadvantage than longhouse communities such as the Iban, Kenyah and Kayan, who can visibly demonstrate 'a well defined, visible stretch of secondary forest, groves of fruit trees, and prominent burial grounds in asserting their claims to land' (Brosius, 1986). Also, longhouse communities often have had their land boundaries documented, and can attain these documents from District Offices. (Brosius, 1986)

Mapping and other forms of documentation of Penan land use and occupancy may help the Penan to make their claims more visible, but it is also important to revisit Brosius' (1986) question regarding the extent to which the state land law recognizes Penan land use principles, given that they lack the two prerequisites of *well defined land boundaries*, and clearly demarcated areas of secondary growth land. Brosius suggests that what is needed is:

> the recognition of an alternate set of principles which explicitly recognizes Penan land use practices as a basis for the recognition of land claims, and which takes into account the central importance of stewardship. (Brosius, 1986,180)

For the purposes of this study, I was interested in how this notion of 'Penan stewardship as property' could be communicated on community maps in such a manner that

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[33] Also see Rose's (1994) discussion of 'seeing the property of strangers' pp. 294-297: '...European settlers moved into North American and Australian lands, and many justified their moves by what they said was the emptiness of the land. Their answer to any charge of tresspass was that this land had not belonged to anyone; the natives had done nothing to signify their proprietary claims according to what was straight-facedly called 'the law of nature' The chief exceptions in North America were the agricultural plots of the Native American women, which did indeed signify property to Europeans, because their cultivation visibly marked the land in an enterprise familiar to European conceptions of property'(295)

both the Penan and the Government would assess the maps as accurate. To address this, we should first discuss the major requirements of the Sarawak Land Code for 'proving' property claims via native customary rights arguments, and evaluate whether Penan claims can be 'seen' through this lens, and whether maps might help to improve their visibility and yet continue to honour local perceptions of space. The major requirements of the Land Code for proving NCR are showing locations of cultivation, graveyards, boundaries and settlement sites. I will now discuss each of these in the Penan context, and explain the issues involved in mapping them accurately.

Issue #1: Cultivation as claim to property

In Nomadic Penan territory, land isn't cultivated, and trees are not planted. Instead, natural resources are used and known about, often named with very specific detail. (Int. #1) Indeed, the landscape is named, known, and talked about to a degree that has astounded external observers (Int #1; Sellato, 1994).

The difference is that land is not cleared in order to cultivate species, instead, resources such as the sago palm are harvested for a while, and then left to regenerate while the human population dependent on it moves to other known locations of this resource. Documenting the relationship between the Penan and sago in spatial terms may provide explanations of movement and territory, as well as claims to a 'propertied landscape'. There may be some room in the Land Code to recognize sago, as well as other wild species that are of importance to the Penan, to the same extent as cultivated species such as fruit trees in longhouse communities. For example, during the Brooke era exclusive rights to wild trees could be created in the forest if they were marked 'upon discovery'. (Hong, 1977, citing Richards, 1971) This principle thus has 'legal and customary precedent in Sarawak as applied to longhouse communities, and could be extended to Penan communities'. (Brosius, 1986)

The importance of the sago palm to the Penan is described by Sellato (1994). Sago flour is produced from the tree by a process of pounding and straining the pith until it is a floury substance. The heart of the tree is also edible directly (Brosius, 1986) and resembles the inner part of an artichoke in taste and texture. Earlier writers have suggested that one trunk of the *Eugeissona* palm can provide approximately four kilograms of flour, which is enough to feed an individual for one week. (Kedit, 1982, cited in Sellato, 1994). Sellato (1994, 121) used this information to calculate that a group of fifteen to twenty Penan would need fifteen or twenty of these trees per week, or between 800 and 1,000 per year. Looking at the size of individual palm groves, it can be estimated how long a group could use the grove, (perhaps a week or two, according to Sellato) before they would need to move on. Of interest here is that according to Brosius (1986) and Sellato (1994) a group of Penan will return to the same groves after a suitable amount of time has elapsed in which the grove can regenerate. According to Sellato (1994) it is possible to estimate the number of sago groves a

group of Penan would require to have available within their territory. Areas of territories may vary though, as the density of groves is variable over the region.

But it is evident that the Penan can map out where the sago clumps grow, and can supply ethnographic documentation about how they harvest and process this resource and how they are custodians of the species' regeneration. Similar to gardening and other forms of land cultivation, reliance on and custodianship of a particularly key resource could be argued as a form of property ownership. Is clearing land such an issue when a crop can be cultivated without large scale clearances of other species? I do not personally see how this distinction could equate to a negation of rights to property or resources, except through the peculiar bigotry of law, ideology and power. In essence, it seems logical that in the case of subsistence use of resources, 'cultivation' and 'custodianship' should have similar weight in terms of supporting claims to land and resources of an area.

Following this, in addressing the fact that the Nomadic Penan do not clear land to establish claim to it, some advocates have presented the notion that 'ownership' can be better expressed through the Penan terms of *tana pengurip* and *molong*. *Tana pengurip* is the 'concept whereby Penan claim customary land', and defines areas claimed by each community which are mutually recognized, whereas *molong* refers to 'the practise whereby a community or individual can claim a particular resource', a practise which can also confer intergenerational rights (IDEAL, 2000,1;Brosius, 1986).[34] Thus I would argue that the mapping of sago clumps and *molong* resources may help to present a legible form of propertied landscape.

Issue #2: Graveyards

Another aspect of Sarawak land law is that proving the existence and age of grave sites can support a claim to native customary rights to land. (Int. #1; Brosius, 1986) The Nomadic Penan may be at a disadvantage here, as grave sites are not highly visible on the landscape. Because grave sites do not physically last very long in the rainforest, although memory of them does, georeferenced oral testimony would be the primary, and perhaps only way to document the location and information about particular grave sites in Nomadic Penan territory:

> They'd have to bring somebody up to it and say 'this is my father's grave' and somebody take a GPS reading...In terms of establishing any of their traditional land, it is all testimony, there is no other way of doing it (Int. #1, 10)

Locational information about the resting place of ancestors may also be related by a reference to the name of the river near where the person died. (Brosius,1986) Ancestral

[34] Brosius (1999) has, however, taken issue with writers who imply that *molong* is a universal concept amongst all Penan, suggesting that it is far more operative in Western Penan than Eastern Penan groups.

memories by this device can go back six generations, according to Brosius (1986), with the result that

> ...the landscape itself serves as an idiom for the maintenance of historical and genealogical information. This idiom... is an important mnemonic device for the maintenance of social relationships...At the same time it serves to establish the rights of the Penan communities to exploit the resources of a given area. The rivers in which the ancestors are buried are the source of livelihood for their living descendants'. (Brosius, 1986,175)

Since burial sites can be accepted as proof of occupancy and the basis of tenure recognition for other communities such as Kayan and Kenyah, the Penan could be afforded the same recognition. (Brosius, 1986) 'Visibility' may be an issue, but the locations of burial sites, as well as the geneologies contained in place names, can also be determined through ethnographic research with Penan informants and accompanying GPS georeferencing.

Issue #3: Boundaries

In terms of boundary mapping specifically, it is questionable whether the mapping of boundaries is sufficient in presenting legal arguments regarding the ownership of land for the Nomadic Penan who may not have presented their boundaries in this way on previous occasions. We have a cartographic backdrop to this question. Land that the Penan live on was mapped already, by state agencies seeking to apportion and entitle land to logging interests. In addition to presenting mapped boundaries the Penan need to argue, in the language of law and entitlement, why and where the land belongs to them.

Some of the respondents of this research agreed with this (Int. #1, 3) and suggested that the way to make the Penan landscape visible to outsiders is to map the current and historical use of resources, the naming of places and the local history of occupancy.

But boundaries are not moot to documenting site specific oral histories persuasively. Mapping the boundary lines of Penan customary land, based on watershed boundaries of extensively named river networks, and other local landmarks, may create an overview, or 'container' for claims based on other sources of information.

> The importance of rivers to the Penan can scarcely be underestimated. In an environment where visibility seldom exceeds 200 feet, these rivers and streams form the skeleton around which environmental knowledge is organised. (Brosius, 1986,174)

It may also provide the most logical tenurial unit for the recognition of these claims, as the occurrence of individual sago and rattan clumps, fruit trees, encampment sites and burial areas are generally dispersed throughout the territory.

A discussion of concepts of territory in Nomadic Penan culture is useful here. Sellato (1994) suggests that there is a spatial 'grid for historical and genealogical information' and

that concepts of 'ethnic territory' emerge in the oral literature of the group. This, he suggests 'provides a firm foundation for ethnic identity, indeed for modern territorial claims'(Sellato, 1994,135).

In order to ascertain 'where the boundaries are' for the Nomadic Penan, an effort should be made to support boundary delineations on the map with documentation about the locations of all important resources, as well as the place names which contain the genealogical information about the history and land use of the community.

Documenting the history and geography of the Penan struggle against logging may also serve to support this notion of a bounded and claimed territory. We can see in the testimonies of several settled and semi-nomadic Penan communities regarding their activities of protest against logging that a notion of 'boundary' is employed to communicate where they feel the logging companies are trespassing:

> Back in August 1992, when the logging operation was about three miles from the boundary of this communal forest, a group of villagers, led by the village headman, went to the logging camp of Samling at Camp Kelesa, to tell them of the boundary and warned them that they should first consult with the whole village community before they thought of entering and logging.
>
> When the villagers reached the site, it was almost dark and the timber workers had returned to their camp. The villagers then walked up the road to the boundary and tied a rattan across the road and put up a sign to point out the boundary. The purpose of putting up this sign was to inform the timber company and workers of the boundary so that they could not plead ignorance of it.
>
> The villagers insisted that the meeting be held where the boundary is so that both sides are clear where the boundary is. The community also insisted that all must take part in the meeting, instead of sending a few representatives... (Testimony of Penan villagers, IDEAL, 2000, 8-9)

Figure 8: 'Blockade in Sarawak'

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However, the settled Penan may have an advantage in that in some cases they can prove the boundaries have historical precedence:

> In 1972, the District Officer, Edwin Dundang, visited the locals in Long Spigen and gave them permission to stay permanently in Long Spigen. He also agreed on the boundary of their land and communal forest. (IDEAL, 2000,13)

The Nomadic Penan have used maps to talk with outsiders before, that local NGO's have helped them make, without much success:

> ...and they've shown them to the logging companies...little maps showing their claimed area. Of course the response has just been that 'this paper has no authority' ... I mean in some cases...I think they have delayed logging. They've made it especially awkward for the loggers so that they've gone somewhere else, at least temporarily, but it certainly hasn't stopped logging in any sense. (Int. #1, 3)

Another issue that the Nomadic Penan may have to deal with is their historical relationships with other groups in the area, and how this might influence contemporary claims to land and territory. The notion of 'boundaries' emerges yet again as something problematic that needs to be contended with in its modern incarnation:

> But it's clear that the boundaries...there were no boundaries, there were just these kind of fluid, kind of fuzzy interfaces both geographically and socially. (Int. #1, 12)

From the previous chapter, in particular the interview questions that asked about how boundaries were expressed using watershed areas, we can see that watershed boundaries and territorial boundaries are often synonymous in community mapping in Sarawak (although this is area and context specific). I asked the ethnographer/linguist how this particular approach to mapping territories may be applied in Nomadic Penan territories, and whether it would be appropriate or not. I was interested in finding out whether there are other operative concepts that may influence the identification and demarcation of boundaries in these territories. What emerged from this interview was that there may be many other ways to document land use and occupancy, but watersheds are the most convenient way to indicate boundaries. This may be, according to this ethnographer/linguist, more due to the over abundance of other kinds of data, rather than lack of it:

> The whole point is that they are exploiting a natural environment that they are not altering, and they are exploiting every part of it, and how to remember or define all of the places where that exploitation occurred...there's no way of doing it except by saying that it is in this watershed. That's the only natural boundary...a watershed, if they testify that the watershed is theirs and they've always hunted there. That may be the best they can do.(Int. #1, 13)

When asked how to actually get down to mapping this territory, the ethnographer/linguist suggests that technical mapping methods can be combined with ethnographic data about the environment:

> Well they've got to get someone to go in there who knows how to use a GPS, and will be escorted around by them. Someone, a Malaysian. And just walk out, walk around the boundary of the territory they want to claim, and take GPS readings at any...place or site of importance, (and then this) will be entered into the court record as testimony. (Int. #1,15).

Issue #4: Settlement/Movement Patterns

It became clear in the Nor case that proving the existence and location of settlement sites was an important element in arguing entitlement to a specific territory. For the Nomadic Penan, this is more difficult to do as the closest equivalent to a 'settlement site', or longhouse, is that of a temporary 'encampment' as described in interview #1. The difficulty in proving 'encampment' sites is that they are not permanent dwellings, but are meant to function in a temporary sense. Documentation of these sites would often depend on recording oral testimony, as physical evidence of sites does not last very long.

It is pretty clear that sago palm is a key resource, upon which local movement, encampment locations, and claims to territory are at least partially based. But sago is not the sole determinant. Social and cultural factors also influence the decisions of the Penan to move throughout their territory and to use local resources. The ethnographer/linguist interviewed,

(Int. #1) (see also Sellato, 1994; Brosius, 1986) discusses the role of sago in the livelihoods and movements of the Nomadic Penan:

> ...they know where all the sago is, they know how fast it grows, and they'll go back to an area where new shoots have grown...but they would move for other reasons too...So it's not some kind of a clockwork pattern that they move around. (Int #1, 18)

Another interesting aspect of the Penan case is the issue of proving the existence and location of habitation sites (see Figure 9):

Figure 9: Nomadic Penan Dwelling

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> ...you've got to really understand what is possible and what isn't...You're not dealing with settlements, you are dealing with nomadic encampments. You're not dealing with any activity that actually leaves a mark on the land, basically your evidence is just people's testimony. These are nomadic hunter gatherers...It's very different from the other peoples...And the kind of claim, or the kind of evidence that you can adduce, is very different and in conventional legal terms, much weaker in fact. (Int. #1, 21/22)

On the other hand, if Penan habitation sites can be proven as legitimate, in legal terms, it may prove, based on the principles established in the *Nor* ruling, to be actually advantageous to their case:

> One of the interesting things about the...Iban case ...basically he wanted to define a boundary around the longhouse based on how far you could travel in a day. So as far as he was concerned if you could get up in the morning and walk out to the boundary and kind of get back home again, the distance that you could travel, that would define a boundary around the long house. ... for the Penan that would be just fine. Because, of course the point is, that they have had their...encampments within a days walk of pretty well every part of the territory. (Int. #1, 17)

If the Penan were able to clarify a strategy about this, perhaps, given the precedent set by *Nor*, mapping the locations of former dwellings would provide a strong demonstration of the extent of their territory, and sense of its boundaries, if not their explicit location.

Summary

Ultimately, what are the potential challenges to mapping Penan territories, and resource/property claims? It may have something to do with pre-existing notions of property and territory, that may be latent in legal, social and cultural paradigms, even those operative in the agendas of some community mapping facilitators:

> ...even for example Martin*, he kept asking about where is the settlement and we were talking about the nomads and he was using the 'settlement' you know. (Int. #1, 21)*pseudonym-Sarawakian community mapping facilitator

This made me wonder about the possibilities of advancing the Nomadic Penan mapping project-the particular types of data that are evident, and their potential currency in contemporary land claims cases. The question is how to document, cartographically, the evidence of land use and occupancy that the Nomadic Penan are presenting in the hopes of securing their claims to land and territory. The ethnographer/linguist had some insights about this- the overwhelming theme was that the Nomadic Penan tend to use and claim everything within a particular territorial area:

> And so really you have to fall back on natural boundaries and identifying marks, and in a rain forest really the only natural boundaries are rivers and heights of land. You can't see anything, you can't see more than 50 yards. (Int. #1, 22)

Penan traditions of naming the land and features on it may be a way to put forward a convincing argument of land use and occupancy, and it seems the way to document this is primarily through documenting oral history in respect to specific places:

> I once followed a young Penan man in the forest and just asked him (while) the two of us were together and were just kind of walking leisurely, 'can you please tell me every time you come to anything that has a name, just stop and tell me the name', and he did. And I was just blown away. Every tree, every rock, every...these are specific names...these are specific landmarks...I mean, they live there, they have to have a name for everything, that's how they find their way around, that's how they tell people where they went, you know. (Int. #1, 23)

> ...the more specific site names and site information within those boundaries that you can find, it seems to me the stronger the case is. Even if much of that ...is well away from the boundaries. It's still within that watershed , it still establishes that they've lived in this watershed...and so you're basically asking, you're inviting the judge to simply draw a boundary where there already is a natural boundary. (Int. #1, 23)

8.3 Conclusion

In conclusion, a mapping project that seeks to learn about and reflect the spatial extent and meaning of Nomadic Penan territory will have to consider and incorporate all of these aspects, and probably many more that I have not mentioned. It may be advisable for mapping facilitators to ask not only about 'where are your 'boundaries'' but also to document location, names and meanings of land use and occupancy features, and compare the resultant 'boundaries' from each. Legal definitions of how property is created and signalled also need to be revisited in terms of their applicability to local cultures. Specifically, legal traditions of seeing property claims to land through cultivation can be examined for the possibility of widening this 'vision' to including in the definition of 'cultivation' extensive resource use without associated large scale clearances of other species. Brosius (1986) suggests that it is important to challenge the dominant notion that the Penan do not have a sense of place, and presented his research that explored the relationship of the Penan with their environment. In this relationship, the naming of natural and human-made features is key. In the naming of places, there is 'ecological and genealogical information'. Names also tell about the ownership of fruit trees and sago clumps, and trace the history of occupancy on the land. Brosius (1986,179) suggests that this, taken altogether, adds up to 'a dense, intricate network of economically and culturally significant places, linking past, present and future generations'.

Community mapping facilitators then are presented with a dual challenge. First to apply the limited medium of mapping to accurately represent the worldview of the Penan. Second, to apply this mode of representation to argue the currency of the Penan position in respect to state laws of native entitlement to land and resources. Different understandings and perspectives of land and property between 'the state' and the Penan can perhaps begin to be clarified by the use of maps. However, care should be taken that local perspectives are adequately considered and represented. The next chapter discusses the overall conclusions that were drawn from this research.

Chapter 9: Discussion And Conclusions

9.1 'Technical' and 'Social' Accuracy

The results of this research supported the idea that issues concerning boundary accuracy that emerged during the three phases of community mapping would have both technical and social aspects. I attempted to understand and present this problem from the perspective of community mapping practitioners, because I believe that they need to simultaneously address *both* aspects in their concern about mapping accuracy, and they also need to recognize the overlaps, or the heuristical aspects of this division between 'social' and 'technical' issues.

The specific information that was discovered in this project ranged from mundane topics like the challenge of finding or creating good base maps, to deeper concerns about whether western style maps can, within the limitations of their conventions and social history, 'accurately' convey the complex ideas and enactments that exist in local places regarding the locations and meaning of boundaries. In this chapter I will summarize and discuss these findings.

9.1.1 Phase one: field data collection

Technical aspects of boundary accuracy issues:

In Phase One, it became apparent that during field research and field mapping, there are many technical challenges. These include finding good base maps, using field techniques to correct faulty topographic maps, and combining multiple sources of spatial information.

The conclusion is that 'finding good base data' is an important element of producing accurate boundary maps. A challenge to this is that government issued topographic maps in this region are often unavailable to community mappers. In many senses, this 'technical' issue also has social elements, in that access to good spatial data is limited by financial resources, and also by social power. In Sarawak, for example, good topographic maps may exist, but their availability is controlled by the government who can decide whether or not citizens may have access to them. When they are available, they are not always 'accurate' in the experience of community mappers, but contain errors in place names and feature locations which are often only discovered during the field work phases of community mapping.

Further research into the availability and evaluation of base data would be useful to community mapping projects in this region, including the option of using geomatics and remote sensing. Lower priced and better quality GPS units, remote sensing imagery and GIS

software presents the opportunity for community mappers to produce their own base maps where none are available. However, research should be done regarding whether this option will ultimately be acceptably accurate for intended *applications*. In addition, the pitfalls of more technical approaches should be considered, such as whether they serve to alienate local communities from the mapping process and product.

Although community mapping manuals suggest that methods and materials used in the field data collection phase should be suited to the goals and aims of the project, the findings of this study suggest that it is often likely that the methods and materials used will also be influenced by their availability and also by resources available to the project.

This was evidenced in responses that several sources of spatial data are often combined in order to 'piece together' adequate coverage of the area being mapped, and again combined with interview and field data to create the final product. I agree that this approach can be valid and useful. It is my opinion, however, that various data sources, as well as the manner in which they are combined, should be carefully documented. The scale and precision of the combined data should be considered in order to avoid presenting some data as more precise and 'accurate' than they actually are. Also, given that GPS data are collected as 'points', the nature of this symbolization should be considered with the qualitative nature of what is being mapped. Thus 'triangulation' and harmonization of both feature location and meaning should be conducted between sources of data.

My initial supposition about community mapping was that it also has strong advantages in terms of accuracy, in that local informants have good data in terms of the locations and meanings of local features. This advantage can be used, in my opinion, to ameliorate deficiencies in other forms of spatial data that are used. This would require a shift in mindset from 'fitting in' locally provided data onto conventional maps, and instead, at least initially, emphasize the documentation of the topological relationships in local understandings of space, for example through sketch mapping and narratives. This information can later be transferred onto topographic maps, and georeferenced with GPS if necessary. However, rather than considering sketch maps as preliminary data that are *bound* to be translated onto topographic maps, I suggest that it may be very useful to maintain the sketch maps and narratives as part of the final product.

This is illustrated in the boundary mapping example in which GPS points collected in the field were different from the boundary that was interpreted from the topographic map. In this case, it would be important to assess the combination of data by documenting similar concerns as were addressed in this study:

Table 2: Concerns addressed

Question	Answer (example)	Considerations
What method is used to map the boundaries?	Map interview with topo map GPS field data collection	Limitations of topo map Limitations of GPS instrument/user error
How are the boundaries determined?	Watershed boundary Named rivers	Are there other ways of determining boundaries? E.g. margins of landuse
What are the sources of the base map?	1:50,000 enlarged photocopy	Spatial distortion; incorrectly placed/named features
What are the sources of the community data?	sketch maps map interviews	Maintenance of topological nature of local information Clarity of transferral accuracy

Thus in assessing the accuracy issues of using combinations of data sources, it is important to document the quality and characteristics of each source, and to assess the implications of combining these sources. In addition, the final map product need not be several forms of maps (performance maps, mental maps, sketch maps, etc) 'squeezed in' to one final format of a single map. Other formats can be added to document more explicitly the various views and data sources.

Social Aspects of boundary accuracy issues

What were termed 'social' aspects of boundary accuracy also emerged in this discussion. Judging from the responses in the interviews, local definitions and enactments of 'boundaries' did not often reflect a unified and widely agreed upon 'line on the ground' that correlated in a straightforward way with the resultant 'line on the map'. Instead, 'boundaries' could mean many things, such as the margins of land use, a combination of well known points joined by interpolated line segments along ridges, watershed boundaries based on named (and claimed) river basins, and estimations of locations based on previously shared forest areas.

There were often multiple opinions on the locations and nature of community boundaries, based on different individuals' knowledge and opinions, 'traditional' versus 'administrative' ideas of boundary locations, and whether the boundaries implied private or communal property holdings.

Often, the delineation of strictly linear boundaries was a response to outside pressures, so it can be argued that the location and symbolization of boundaries sometimes incorporates the need to 'signal' territory to outsiders as much as accurately reflect local perceptions.

Physical change on the landscape is also implicated in the perception and delineation of boundaries. For example impacts from activities such as logging have sometimes destroyed specific landmarks, and the general landscape, and have made parts of the territory 'illegible' even to local people. In these cases, boundary mapping becomes an endeavour to record knowledge previously held on the landscape before it is lost permanently. Alternatively,

some groups produced 'boundaries' by activities such as clearing forest for agriculture as a method of signalling property ownership to outsiders through the powerful message of cultivation. Accurately mapping these boundaries would need to consider that these features reflect contemporary, as well as customary, notions of land use and ownership.

Drawing boundaries on maps was considered by some to be too contentious, so was avoided altogether. In these cases, use and occupancy were recorded using other methods and symbols. In other cases, boundary mapping was not considered to be a straightforward exercise of delineation, but more a long and difficult process of discussion and negotiation with mixed results.

All of these examples show that 'accurately' portraying the social nature of boundaries on maps is a complex exercise. Given the diversity of experiences surrounding the question of boundary definition, it is my conclusion that no single prescribed definition of, or approach to, 'accuracy' can be proposed. In terms of community mapping methodology, however, there are some ideas that may be useful, that this research has explored. Given that within communities there can be a diversity of opinions regarding boundary definition, it would be useful to promote documentation methods that include wider discussions of the social meanings and physical features and locations of boundaries. These may include not only the production of a 'community map', but also the maintenance of individual or small group discussions or map interviews about this subject, using supplementary documentation of audiotapes, videotapes, and field notes. In this way, a record could be kept of the nature and source of information provided, which could be re-visited in the future if necessary. As with technical aspects, my key finding about social aspects of accuracy is that all sources and types of contributing information should be documented carefully rather than be subsumed into a final mapped product. In essence, this re-presents the 'community map' as something that is both a reflection of many perspectives, and also something that is always in process, rather than a 'finished product' such as that implied by a specific map.

9.1.2 Phase two: mapped representations

Phase Two revolved around the completed maps that were produced during Phase One. I was interested in how community mapping facilitators define what an accurate map is, and also to explore how local people respond to the maps that were produced in their community mapping exercise, and how they critique them for accuracy. In addition, I examined some examples of community maps to see what they might reveal about boundary accuracy issues.

The general response to 'what is an accurate map' is that the accuracy of the map should fit with the objectives of the project. It was suggested that the greater the formality of the intended application, the more stringent the accuracy requirements should be. In my

opinion, this is of key concern when maps are used in applications for which they were not originally intended, or if the accuracy requirements of particular applications are not clearly determined before the project is undertaken. Put otherwise, 'accuracy' should not be considered an iterative process that can be gradually improved, but rather standards and goals should be clearly determined at the earliest possible stage.

It is relevant that some respondents thought that an accurate map should not only be useful for its purposes, but also should adequately reflect local perceptions and knowledge. This may be self-evident on the surface, but judging from what was learned from phase one, it is not as straightforward to implement. It is first necessary to explore and document local perceptions and knowledge, and to discuss with local people how well these are represented cartographically.

There were three interesting elements to the respondents' recollections of how local people respond to maps. First, there were many suggestions that the responses were overwhelmingly positive, and that the addition of local names and land use, for example, began to add local meaning to a conventional topographic map that was previously less meaningful to local people. This implied to me that the insertion of local toponymies onto state rendered depictions of space can re-characterize these spaces as being known and claimed by local people, and that this re-characterization can be explicitly *for* the benefit of local people. In other words, the activity of community mapping can make 'state rendered spaces' more legible to local people. It can more clearly define areas of occupancy and of overlap with other interests than other forms of communication, which is a strong argument in itself for the continued use of community mapping. This is especially true when we consider the insights of critical cartography, which suggest that state produced maps are not neutral, but often have underlying agendas in their particular depictions of space.

Alternatively, some responses suggested that the final map products meant little to many local people who reviewed them, possibly because they had not been meaningfully included in the initial phases of mapping. This suggested to me that high participation levels in community mapping 'phase one' are important to achieve if meaningful local evaluations of the maps that are produced can be conducted. In order to produce 'accurate' community maps, the processes of mapping should be transparent and accessible to community members. If this is not the case, accuracy evaluation in the second phase can be limited to either 'rejection' or 'signing off', neither of which suggest an appropriate level of community participation.

The third interesting element was that many informants suggested that initial community reviews of the maps not only involve *correction*, but can stimulate much more interest and flow of information. This is important because not only mapped features should be addressed for accuracy, but also areas that are initially represented as 'empty'. If they are not meant to be so, these empty spaces must be considered as errors. Therefore 'phase two'

can and probably should involve repeated exercises of reviewing, revising and adding to the maps. As mentioned in chapter 5, the consideration of community mapping accuracy as a participatory process should include documentation not only of individuals who attended, but also the nature of their participation and provision of data for the map.

The second question was what can the maps *themselves* tell us about boundary and accuracy issues? One community map from Sarawak revealed that watershed boundaries were the clear definition of community boundaries, as the boundary line followed the height of land between watersheds, and that the placement of named rivers and landmarks was the basis of this definition. In another map, from East Kalimantan, this definition was not as clear, as it appeared that some parts of the boundary were defined by rivers, and some by specific points that had been interpolated to produce 'a boundary'. This was supported in one of the interviews, in which the informant who had worked in this village suggested that in this particular case, boundaries are sometimes clear, for example when they follow a river, and sometimes less than clear, for example when they refer to the extent of historical land use.

The conclusion is that different communities have different ways of defining their boundaries. Assuming that there is a clear boundary line of unambiguous meaning and location on the landscape that merely needs to be found and documented can lead to over-simplification, which I suggest is a form of inaccuracy. Thus accurately representing boundaries, in a community mapping project, should begin with detailed discussions with community members regarding how boundaries are perceived, enacted, and manifested on the landscape. Both field work and map symbolization should attempt to reflect these discussions, rather than attempt to reduce 'fuzzy' areas to a strict line on the map. In my opinion, easing up on the boundary metaphor may well provide more space for dynamic consultation between interested parties, and may reduce the risk of boundary maps creating future conflict.

The previous discussion regarding field data collection (phase one) both legitimates and problematizes this finding. In an earlier rendition of my research question, I simply asked 'are 'on the ground' perceptions of boundaries accurately reflected in their 'on the map' representations?'. I proposed that all that needed to be done was simply to go back to the field with local informants and assess the accuracy of the boundary that was initially produced, by discussing the social meanings, the physical manifestations, and the geographic locations of this feature. Having taken a different approach to this research, it became evident that discussions and mappings of 'boundary' may serve to actually *produce* this feature, as much as reflect it. 'On the ground' and 'on the map' boundaries are ultimately, in my opinion, a troublesome and dynamic composite of many technical, social and historical processes.

The maps that were examined also exemplified some key technical issues. Again, the main issue seems to be the availability of reliable spatial data from which to produce 'base

maps'. The maps selected clearly showed distortions and inaccuracies which, when combined with other data such as locally collected GPS locations, must be considered. The conclusion here was more of a question. Although the topographical data that are used as the basis of community mapping can sometimes be considered questionable, or 'sub-standard' by conventional mapping standards, they provide a useful starting point for community mapping. In addition, the reality for community mappers is that they are often the best and only spatial data available. However, it must be proposed that the 'topological accuracy' provided by the ethnographic data sources of community mapping projects can improve and legitimate the accuracy of the final product.

This can be illustrated by example. Given that available topographic maps are often photocopied and enlarged, this implies some distortion and related accuracy issues, which, when referring to the findings of Phase One and Two, can be quite considerable. Following this, if GPS coordinates are recorded on these maps, we need to consider the accuracy of both the original map and the GPS unit, as well as the operators of the GPS unit, and the error that may be introduced. In combination, the GPS point plotted on the base map may not record the exact location of the feature represented. It may, however, be close to that feature. If the *topological* elements of the feature mapped can be considered, it may be possible to determine the significance and location of that mapped feature to a sufficiently accurate level.

9.1.3 Phase three: applications

In the 'applications' section of this research, key informants were asked how community maps have been used in specific contexts, and how they have been assessed in terms of their perceived accuracy by external actors. In addition, I examined how community made maps were evaluated in the judgement of a court case in Sarawak, which garnered a more subtle and complicated picture of accuracy requirements than expected. It also suggested to me that there is a relationship to consider between legal understandings of property entitlement and notions of accuracy in the mapping of these ideas.

In the interviews, there were a few insights regarding how maps are evaluated in applications. However, many informants agreed that this was an area that had not been concentrated on as much as the production of maps at the village level. Some have suggested that a critical and rigorous examination of the applications and implications of community mapping, including closer attention to accuracy issues, is becoming increasingly important, as more and more communities are deciding to make maps of their territories. There was also the suggestion that legal, or other more formal applications of community maps will probably have the most stringent demands. However, there remains a great deal of debate about the nature and level of accuracy requirements in this context, which is something that I hoped to contribute to with this research.

It was also suggested that format plays an important role in the perception of maps as being 'valid' or not, for example in the case where hand drawn maps were considered less effective than GIS maps even if they displayed similar data.

Finally, many examples were cited in which boundary mapping had transformative impacts on the communities, both negative and positive. The issue of the potentially transformative impact of boundary mapping is something that will require much more research and attention in the future. For the purposes of this research, I am recounting these examples because they underscore my point that 'accuracy' is a multi-faceted issue in community mapping. In some cases, drawing boundaries explicitly on maps helped local communities to communicate the location of local tenure rights to outsiders. In other cases, the maps and mapping had some negative impacts, for example generating mistrust between neighbours or being used by individuals to sell off communal forest land for private gain. These observations underscore the necessity to address the issue of 'accuracy' from angles other than merely technical concerns of the locational accuracy of features.

In order to get a different perspective on how outsiders may evaluate the accuracy of community maps, the depiction of boundaries in particular, I reviewed a court case in which community maps were entered as evidence. As expected, the counsel for the defence attacked the maps as being invalid and inaccurate. Two key aspects the defence counsel emphasized were that the maps were 'amateur', that is, produced by 'the unqualified surveyor, Samy'; and that some specific pieces of information shown on the maps did not coincide accurately with the testimony of the Iban plaintiffs. The lessons here for community mappers are somewhat self evident. The first issue is the use of relatively informal methods and relatively untrained, or at least unaccredited, facilitators to produce maps for the context of highly formal applications such as legal land disputes. The conclusion to be drawn is that regardless of the actual accuracy of the maps, however this is measured, *perceived* accuracy will be influenced by external perceptions of how the maps are made, and who made them. NGO's may need to examine the possibility of hiring accredited land surveyors for boundary mapping rather than relying on methods such as GPS collection by staff members. The role of community mapping in this scenario could be to empower the community to be able to check the work of state qualified surveyors, rather than attempt to replace them. Alternatively, resources could be targeted to training NGO staff so they themselves can be considered 'professional surveyors' who can produce credible and accurate maps.

The second issue, regarding the identified disparities between the produced map and the Iban plaintiff's testimony can be addressed by considering what I have called 'phase one' and 'phase two' of community mapping, and developing rigorous approaches to ensuring the connection between local testimony and mapped representation. However, the old adage that 'the map is not the territory' should also be remembered. A specific piece of advice about this

issue was offered by Neil Sterritt.[35] He suggested that in settings such as legal cases where this situation occurs, the cartographer's role is to educate the court about the nature of making maps of community lands with multiple community informants. The map, he suggests, is never 'finished', and in cases where new information from community informants comes to light, it is the responsibility of the cartographer to both acknowledge the error of the map, and to acquiesce to the new information provided by the local informant. In addition, he suggests, 'Neither I nor any cartographer should accept information at face value. Any new information would need to be checked for accuracy before accepting it for mapping purposes, or before dealing with it in some other fashion' (Neil Sterrit, pers. com, August 14, 2004)

Beyond these two issues is the manner in which the judge assessed the accuracy of the maps submitted as evidence for the Rumah Nor case. Quite surprisingly, he did not appear overly concerned with the technical rigour of the maps that were produced, nor with the social processes involved in their production. Rather, he assessed the accuracy of the maps based on whether the boundary locations shown 'made sense' based on other evidence, including oral testimony, historical and anthropological records, and physical evidence on the landscape such as current and former longhouse sites. The maps were deemed sufficiently accurate primarily because they seemed 'reasonable' given other information supplied to the courts. In addition, the *adat* land claim that the boundary maps represented was legible vis a vis Sarawak land law, and could be demonstrated both spatially and historically with the assistance of maps.

This might be more difficult in other mapping projects, where the requisite commonality between *adat* and state views of property is not as evident. As a final aspect of this project I discussed the land issues of the Nomadic Penan, and how mapping their boundaries 'accurately' must address differences in how property and territory are conceived by this local population and by state laws. Questions such as this should be explored and clarified at the field data collection level of mapping projects. If the goal is to 'fit in' with existing legal structures governing customary property entitlement, notions of boundary accuracy might be different than if the goal is to *challenge* these legal structures and create spaces for dialogue and reform.

9.2 'Critical Community-based Cartography'

Returning to the insights gained from the critical cartography literature, this research provided an opportunity to ask if these concerns had some bearing on the 'accuracy' of community made maps. Community maps can challenge the 'selectivity of content' that Harley and others suggest puts mapping into the realm of powerful members of society. As

[35] Researcher and cartographer with Gitksan and Wet'suweten elders regarding place names and boundaries from 1975 to present; Director of Land Claims for the Gitksan-Wet'suwet'en Tribal Council from 1977 to 1981 and President of the Gitksan-Wet'suwet'en Tribal Council from 1981 to 1987.

recounted by the key informants and other sources of data for this study, democratising the availability of mapping tools and techniques can provide an opportunity to represent local toponomies and other local information. However it can be misleading to present tidy dichotomies such as 'powerful' and 'not powerful', or 'local' and 'state', and to suggest that these inequities can be easily bridged by providing opportunities for communities to make maps.

In terms of what I have termed 'accuracies of content', the process of data collection and representation at the community level must also consider that communities are not necessarily homogenous entities, but have their own relationships of power and privilege. If a 'community map' is to accurately represent community perceptions of land, resources and boundaries, for example, the processes by which this information is ascertained and collected should be transparent and participatory, and should also be able to incorporate the many voices and experiences that exist at the local level.

This research was also concerned with the notion that cartography has a *pre-existing set of signs and symbols* which may privilege certain perceptions of space over others in less immediately evident ways. Looking at 'boundaries' in particular, the apparent unity of this map symbol may serve to mask or simplify what might be multiple meanings and relationships on the ground. This was certainly borne out in the responses of the key informants, who suggested that 'boundaries' could be defined and enacted in several different ways, not all of which are easily shown using the symbolic metaphor of a linear boundary. An alternate approach to drawing boundaries as 'lines' onto maps is mapping land use and occupancy, and documenting the boundaries that 'emerge' from this information.

Even if maps use western conventions, their 'indexicality' (cf: Turnbull, 1989) can remain subjective when meaning does not easily transmit from knowledgeable to non-knowledgeable people. There still appears to be a need for explanation, and a role for 'narratives' remains within the ostensibly 'objective' and 'transparent' framework of western cartography. Two key examples of this are the Penan place name maps and the boundary discussions revealed in interviews. In both of these cases, 'the map' was not enough to transmit the required information to the relevant parties concerned, but had to remain connected with the explanations and experiences of its authors.

Given this, I suggest that greater attention to encompassing 'the narrative' elements of community mapping can help the maps to 'say what they mean' and 'mean what they say'. Many possibilities exist for exploring this requirement, for example multimedia mapping, greater concern with keeping the map rooted and connected with its authors, and keeping the map within the context of its production and use.

9.3 Summing up

The 'community map' is something very different from the 'state map'. In order to be considered 'accurate' by both local and external observers, it needs to maintain, and also communicate, the connections between the three phases of community mapping. In my opinion, the community map must be considered a 'work in progress' as it cannot be given 'meaning' without the verbal explanations of its authors. Also, its authorship is always under question. Who provided this data, and does this 'who' equate to 'community'?

The community map may not even be meaningful unless the landscape that it represents is available for consultation, which in the era of massive environmental change due to development in this region can be tenuous. Also, it cannot be considered something greater, or more complete, than the multiplicity of voices that engendered, or were overlooked in the engendering, of its production. If local narratives of property and landscape are not incorporated and also given further audience, the community map can become something abstract and its original meaning unintelligible. This is reflected in the experiences of the Delgamuukw trials, where the maps that were painstakingly compiled by the ethno-cartographer Neil Sterrit still had to be secondary and accountable to the oral testimony of Gitksan and Wetsuwe'etan elders in terms of their 'accuracy'.

This small insight from community mapping in rural Borneo may indeed provide insights into the role of mapping in any society. If we assume that maps are objective depictions of space, we need to ask about the multiplicity of local knowledges and experiences that might be lost in that assumption.

To sum up, the last word should come from some of the communities impacted by 'conflicting land use' on their territories, who have decided that mapping may help create for them a more level playing field in land use conflicts, and who for me have both problematized and prioritized the notion of 'mapped boundaries':

> Until today, the company did not pay any compensation for the land destroyed. The manager has also refused to meet and have dialogue with us. We did not negotiate for compensation because we want to save our land. We do not want to sell our land to the company. We want to find the means to stop the logging operation here to preserve our forest. From here, we get our supply of rattan, medicine and wild boars. This is important to us. [36]

> People from around here say we've no rights but the names of the rivers and mountains were given by our ancestors. We can relate their history and the history of their coming here, but when we ask them to tell about our history they cannot do so. That's the evidence that we've been here a long time. Another thing-making farms. Of course we only started recently to make

[36] Testimony from Lg. Sepigen resident, (IDEAL,1995, p.14).

> farms but we've always been here. If they want us to tell the names of the rivers and mountains, we know them all because we've always been here. [37]

These words are also descriptions of boundaries. More specifically, they are descriptions of boundaries transgressed. It might be difficult to locate them as specific and accurate lines on maps, but it is impossible to argue that they don't exist. Community mapping can help to reveal and explain the meanings of these boundaries, and can help to support the struggle of local communities to preserve their livelihoods which exist within them. The task remaining is to determine how to do this both respectfully and effectively, and this includes careful attention to the multi-faceted and problematic issue of accuracy.

[37] Testimony from Lg. Kerong resident (IDEAL,1995, p.25)

Appendix One-Schedule Of Interviews

Schedule of Interviews

Interview number and length of transcription	Location and mode of interview	Date of Interview	Description of Informant
Interview #1 25 pages	Vancouver B.C., in person.	27 September, 2002	Ethnographer and linguist who is fluent in Penan and has lived with Nomadic and Settled Penan communities. Published author.
Interview #2 14 pages	Victoria, B.C., in person	16 November, 2002	Researcher who has been involved in village based field studies in the West Kutai region of East Kalimantan involving community based mapping. Published author.
Interview #3 40 pages	Kootenays, B.C., in person.	December 14, 2002	Community mapping specialist-ran workshops in various parts of Indonesia, Malaysia, and elsewhere in SE Asia. Published author.
Interview #4 24 pages	Vancouver, B.C., by preliminary discussion and review of questions by email/telephone interview	8 May, 2003	Community mapping specialist-has worked throughout Indonesia and SE Asia. Published author.
Interview #5 9 pages	Vancouver, B.C, by telephone	June 20, 2003	Community mapping specialist-involved in organization that trains indigenous mapping instructors in Borneo and provides financial and technical mapping support.
Interview #6 4 pages (June 2) 14 pages (June 9)	Vancouver B.C., by telephone	June 2, 2003 June 9, 2003	Anthropologist/Community mapping specialist. Published author.
Interview #7 7 pages	Sarawak, Malaysia, in person	May 6, 2002	Community Mapping specialist.
Interview #8 26 pages	Victoria, B.C., in person.	May 31, 2003	Participatory Methods Specialist, has worked throughout Indonesia particularly East Kalimantan. Published author.
Interview #9 12 pages	Vancouver, B.C./East Kalimantan, by email	22 June, 2003	Community forestry/community mapping specialist, Indonesia. Published author.

Interview number and length of transcription	Location and mode of interview	Date of Interview	Description of Informant
Interview number and length of transcription	**Location and mode of interview**	**Date of Interview**	**Description of Informant**
Interview #10 10 pages	Vancouver B.C./East Kalimantan, by email	23 June, 2003	Community mapping specialist, Indonesia
Interview #11 1 page	Vancouver B.C./Germany, by email.	not recorded	Community mapping specialist, Indonesia.
Interview #12 3 pages	Sarawak, Malaysia, in person	April, 2002	Village Leader, Sarawak.
Interview #13 2 pages	Vancouver, B.C./Indonesia, by email	January, 2004	Community mapping specialist, Indonesia. Published author.

Appendix Two-Interview Questions

Informed Consent Document Sample

The University and those conducting this project subscribe to the ethical conduct of research and to the protection at all times of the interests, comfort and safety of subjects. This research is being conducted under permission of the Simon Fraser Research Ethics Board. The chief concern of the Board is for the health, safety and psychological well-being of research participants.

Should you wish to obtain information about your rights as a participant in research, or about the responsibilities of researchers, or if you have any questions, concerns or complaints about the manner in which you were treated in this study, please contact the Director, Office of Research Ethics by e-mail at hweinber@sfu.ca or phone at 604-268-6593.

Your signature on this form will signify that you have received a document which describes the procedures, possible risks, and benefits of this research project, that you have received an adequate opportunity to consider the information in the documents describing the project or experiment, and that you voluntarily agree to participate in the project or experiment.

Any information that is obtained during this study will be kept confidential to the full extent permitted by the law. Knowledge of your identity is not required. You will not be required to write your name on any other identifying information on research materials. Materials will be maintained in a secure location.

Name of Experiment: Community Mapping in Borneo-Issues of Accuracy in Traditional Boundary Delineation. Investigator Name: Lorraine Margaret Gibson Investigator Department: Department of Geography, Simon Fraser University

Having been asked to participate in this research project, I certify that I have read the procedures specified in the Information Document, describing the project or experiment. I understand that the procedures to be used in this experiment and the personal risks, and benefits to me in taking part in the project or experiment, as stated below:

Risks and Benefits

Risks: Subject's responses to the interview questions will be transcribed and analysed using qualitative techniques. It is possible that the subject will not agree with the interpretations of the researcher of the subject's responses.

Benefits: The topic of the research project may be interesting and thought provoking to the interview subject, and may present useful insights about the practise of community mapping that can be incorporated into future projects.

A complete transcript of the interview will be returned to the respondent with invitations to send critiques and comments back to the research, which will be duly considered and incorporated into the final data. The subjects will also be informed of where they can access the final thesis project if they would like to read it.

I understand that I may withdraw my participation at any time. I also understand that I may register any complaint with the Director of the Office of Research Ethics or the researcher named above or with the Chair of the Department as shown below.

Chair of Department of Geography, Simon Fraser University: Dr. Alex Clapp Director of Research Ethics: H. Weinberg 8888 University Way, Simon Fraser University, Burnaby, British Columbia, V5A-1S6, Canada

I may obtain copies of the results of this study, upon its completion, by contacting:

Lorraine Gibson MA Candidate c/o Department of Geography Simon Fraser University, Burnaby, British Columbia V5A-1S6 Canada

I understand that the research will be confidential to the full extent permitted by the law.

What the subject is required to do:

The subject is asked to respond to a series of open-ended questions regarding his or her personal experiences and theoretical knowledge about community mapping in Borneo. This interview is approximately seven pages long, and will be administered either in person, or via e-mail or telephone. The interview will take approximately two to three hours, depending on the responses. Participation is voluntary, and the respondent may decline to answer any questions that they do not wish to, for any reason. Also, they may feel free to add comments or insights that were not covered by the structured questions. They may also feel free to critique the content or structure of the interview.

The subject and witness shall fill in this box: (please print legibly) Subject last name: Subject first name: Subject contact information: Subject Signature: Witness: Date: (mm/dd/yyyy)

*In the case of interviews conducted by email or telephone, this form will be sent by mail to the respondent. Interview will be conducted upon subject completion and return of form.
Interview sample-In-depth, open ended interview

Interview questions: Community mapping consultants or other key-informants identified by researcher as important sources of information regarding the research topic (e.g. anthropologists, linguists, or local informants)

note: 'open-ended' format-questions can be omitted if already answered
italics - notes for interviewer (unspoken)
geneva font – thematic notes for interviewer

Preamble

(if person-to-person) 'Do you mind if I tape this interview?'.

Thank-you for agreeing to do this interview with me. I am doing these interviews as part of my research for an MA thesis in the department of Geography at SFU. This thesis is concerned with community mapping projects in Borneo, and their social and political contexts. I am particularly interested in examining the methods used by community mappers, and how 'accuracy' emerges as an important and complex issue in these projects.

Discussion of informed consent.

Informed consent form: ensure that they have had time to review and sign the form.

Do you have any questions about the informed consent form?

Your participation in this interview is voluntary and confidential. If there are any questions you do not wish to answer, please let me know. The tapes of the interviews and their transcripts will be stored in a secure place, and will not be identified with your name. After the completion of this project the tapes will be destroyed.

I will also send you a copy of the transcript of this interview. Please feel free to contact me at [telephone], or at my email <email address> if you have any comments regarding the transcript. I would like to present to you the opportunity to comment on the transcript before it is incorporated into the research analysis, so that any errors that may have occured in the transcription process can be rectified, and also to give you the opportunity to think more about the questions and add supplementary information that you think is important.

Questions

Part One: Background

1. What is your experience with community mapping?

2. Why did you become interested in community mapping?

3. What is your educational/professional background?

4. Where have you worked on community mapping projects?

5. As a 'community mapping trainer', what is your role in the community mapping project? -Does your role vary?

6. Have you worked with NGO's?

7. Have you worked exclusively with villagers? (ie without NGO presence?)

Part Two: Methods

1. Can you briefly describe how a community map is made?

2. What kinds of materials and tools/instruments are used?

3. What training is involved?

4. Who does what, in terms of data collection, sketch mapping, field work, etc?

5. What do you think is meant by the term '*participatory* mapping'? Is it different from '*community* mapping?'

5b. Have you heard of this term 'counter-mapping'? (*If yes*) Is it the same or different than community mapping

6. What are some questions that have been asked by local people about mapping procedures?

7. Can you recall any examples of interesting or unexpected issues that have come up during training or field data collection with local communities? What did you do?

Part Three: Boundaries and Territory

Methods used to delineate boundaries:

It has been suggested in the literature about community mapping with forest dwelling peoples that the identification and definition of boundaries of customary forest tenure is important in order to understand 'indigenous ways of organizing and allocating space'

1. In general, what is the method used for mapping these customary forest tenure boundaries?

2. Sirait et al. mention the importance of finding both the 'location and *nature*' of customary forest tenure boundaries.

-Do you think it is important to determine the *nature* as well as the location of boundaries? (Why? What is meant by the expression '*nature of boundaries*'?)

3. Sirait et al. suggest in their paper that ... 'there have been 'a few instances where (*community forest tenure*) boundaries have been surveyed and recorded on cadastral maps'

-Have you heard about these instances?
-(if yes) Can you tell me more about this? What were these cadastral maps used for?

4. Sirait et al. suggest that customary tenure boundaries 'define the limits of area to which any tenurial right, duty, privilege, or disability applies'
-As far as you know, how is this specific area decided upon and maintained at the village level?
-Does it change over time?

5. In the Long Uli pilot project of community mapping in East Kalimantan, it was noted that the boundary was too large to map entirely on foot with GPS units. The method employed was that some points were located, and a topographic map was used to interpolate the boundary from these points. Do you have any comments about this process?

6. Does the method employed for mapping boundaries vary between from place to place?

7. Do you ever find that one approach works well in one village, but not in another?

-(If yes) Can you give examples of different approaches?
-(If yes) Why do you think one way worked better than the other?

8. Are there any times when boundaries are not discussed, but kind of 'emerge' via other mappings? What are these? *(e.g. landuse, land marks, watersheds, etc*

Boundary accuracy

1. How is the accuracy of the boundaries determined? Verified?

2. What are the criteria employed to check the accuracy of the mapped boundary?

3. In general, who provides the information about the boundary?

4. Do you recall any times when different members of the community had different ideas about where the boundaries were?

5. Can you recollect any stories about boundaries that villagers told you?

6. Have you ever worked in a community that has physically indicated boundaries on the territory? If so, how did they do it? (*signs, flagging tape, fences, etc.*)

7. Have you ever worked in a community that didn't know where their boundaries were? Did mapping the boundaries help to actually determine their location?

8. Have you ever worked in a community that had what you would describe as a different impression about boundaries than you or I might have?

9. If specific 'boundaries' are not known, or perhaps not spoken about in that form, how is the boundary for the map determined? (*e.g. extent of land use, location of landmarks, rivers, forest area, etc...*)

10. Have you ever worked in a village that had a very strong description of territory that easily transferred to the map? What was this description?

11. What is the relation between 'territory' and 'boundary' in community mapping?

12. What role do you think mapping has in reflecting boundaries?

13. Do you think that mapping has a role in *determining* boundaries? If yes, how so? If no, why not?

Part Four: Context and application of Community maps

1. How are the completed maps used by the villagers? (*General examples and/or specific examples*)

2. What is your idea of a 'successful' community map? ...'unsuccessful'?

3. Any specific projects you could describe as 'successes'? Any.. 'non-successes'?

4. Have you ever had the experience of explaining community maps to government representatives, industry representatives, or other interests 'outside' of the community?

5. If yes, how were the maps received? What were some of the questions, comments and concerns voiced by these people?

6. Do you recall any instances where community maps were challenged in terms of their accuracy?

Part Five I: Field work and community mapping[38]
Perceptions of land-use/occupancy and the process of recording it on maps:

1. In your experience, are some kinds of community information harder to record than others?
   -What might these be?
   -Why do you think they are more difficult to map?

2. How do the non-trained villagers, the ones providing information rather than documenting it on maps or field notebooks, comment on the process?

3. What kinds of challenges arise when doing this kind of field work?

4. *I have been told by other community mapping consultants who have worked in Borneo that one way of mapping boundaries is simply to follow the local people, (apparently sometimes the whole village comes along, even if it takes a week or more), along the boundaries and simply document the locations along the boundary using GPS or compass triangulation methods. But I am curious about how the idea of the boundary is constructed by the local people, and how this translates itself during a field mapping procedure.*

Have you ever followed along on one of these boundary mapping exercises?

   -(*If yes*), Can you describe to me what happened during this process?

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[38] Note: By field work I mean that point where the community mappers have been trained to use GPS, map and compass, field interview techniques, topographic map interpretation, etc. , and are now at the stage of actually using these techniques to document local land-use, history, boundaries, etc. I am interested in what we might term as the first point of contact between mapping and community knowledge. That point where community members, local NGO staff or international consultants with mapping expertise assist other community members in documenting their knowledge of land-use, history and boundaries into the form of maps.

-How do the consultants and community prepare for this exercise?

-What do you talk about with the local people, vis a vis 'the boundary', before mapping it?

-Did the villagers express to you why they were interested in doing this?

-Apart from location, what other information is recorded?

-Does this process take place only once, or more than once?

- What happens after the boundary survey has been completed?

(If no), have you heard about employing this method? What do you think of it?

6. Anything else to add about interesting field experiences mapping boundaries or other features? (*Anything goes...*)

Part Five-II-Community mapping training workshops

1. You have provided training in workshop format as well as in specific villages to be mapped. Is that correct?

2. What kind of skills were taught in this workshop?

3. How long was spent on training overall?

4. What skills do you think were imparted to the participants?

5. As a community mapping trainer, how do you discuss this issue of accuracy?

6. As a workshop facilitator, are you ever involved in discussions of boundaries and how they are defined?

7. What advice or suggestions would you give to community mappers, in a workshop setting, about how to go about mapping their boundaries?

8. What advice might you give them in order to ensure mapping accuracy and legitimacy?

9. What are your opinions, having worked in both field and workshop settings, about the differences between the two?

-Which are more effective, if either? Which do you prefer?

Part Six: Accuracy
materials, skill sets, technology and information available to community mappers.

1. What materials are generally available to community mappers?

2. What quality of basemaps are available to community mappers?

3. What other kind of technology is used?

4. Are there limitations to the availability of these factors? *(If yes)* What are these?

5. Do you think that the availability of materials, skill sets and technology affects the accuracy of the community maps? Why/Why not?

6. Do you think that community mapping has unique advantages or disadvantages in terms of accuracy? If so, what might these be?

8. As a community mapping trainer, how do you define 'accuracy'?

9. Does greater technical precision equal greater accuracy? Why or why not?

10. *Here's a picture of a local person in a village in Indonesian Borneo, explaining why 'western mapping' is hard to apply to local paradigms of property and land use management. His comments were that land use and resource ownership tends to move around spatially.*

-Do you have any ideas of how community mapping techniques could be able to recognize and incorporate this person's concerns?

Part Eight: Conclusion

1. Looking at the practise of community mapping in this region generally, and the reasons why it is conducted, do you hope that more communities start using it as a tool?

2. If this happens, do you think the methods, practises and available tools could be developed further? If yes, how?

2. What kind of role do you see yourself having in the future?

3. Those are then end of my questions, is there anything you would like to add about anything we've talked about?

Thank-you for your participation and insights.
End of interview

Bibliography

ABBOT, J. ET. AL., 1998. Participatory GIS-Opportunity or oxymoron? *PLA Notes,* 33, 27-33.

ABERLEY, D., ED., 1993.*Boundaries of Home: Mapping for Local Empowerment.* Gabriola Island, B.C.: New Society Publishers.

ADAM, F.J., 1998. Native customary rights over land in Sarawak. *Journal of Malaysian and Comparative Law,* 25, 218-231.

ALCORN, J., 2000. Keys to unleash mapping's good magic. *PLA Notes,* 39, 10-13.

ALCORN, J., 2000b. An Introduction to the Linkages between Ecological Resilience and Governance. *In*: Alcorn and Royo, eds. *Indigenous Social Movements and Ecological Resilience:Lessons from the Dayak of Indonesia.* Washington D.C.: Biodiversity Support Program-Peoples, Forests and Reefs (PeFoR) Program Discussion Paper Series.

ALCORN, J.B., 2000c. *Borders, Rules and Governance: mapping to catalyze changes in policy and management.* Gatekeeper Series No. 91. London: IIED.

ALCORN AND ROYO, EDS., 2000. *Indigenous Social Movements and Ecological Resilience: Lessons from the Dayak of Indonesia.* Washington, D.C.: Biodiversity Support Program-Peoples, Forests and Reefs (PeFoR) Program Discussion Paper Series.

ANAU ET. AL., 2002. Negotiating More than Boundaries: Conflict, Power and Agreement Building in the Demarcation of Village Borders in Malinau. *In*: *Technical Report: ITTO PROJECT PD 12/97 REV.1 (F) Forest, Science and Sustainability: The Bulungan Model Forest.* Jakarta: CIFOR, 131-156.

APPELL, G.N., 1996. The history of research on traditional land tenure and tree ownership in Borneo. *Borneo Research Bulletin,* 28: 82-108.

BABBIE, E.,1992. The Practice of Social Research. 6th Edition. California: Wadsworth.

BARTLETT, L., 2002. New 'White Rajah' rumoured in rainforest following new blockades. *Malaysiakini,* April 29th, 2002. www.malaysiakini.com/news. Accessed May 31, 2002.

BLOMLEY, N.K.B., 1994. *Law, Space, and the Geographies of Power.* New York and London: The Guilford Press.

THE BORNEO PROJECT. 2002a. *The Story of Ubra and the People of Uma Bawang.* [on-line]. Available from: http://www.earthisland.org/borneo/news/articles/UBRAstory.html. [Accessed June 20, 2004].

THE BORNEO PROJECT. 2002b. *Blockades.* [on-line]. Available from: http://www.earthisland.org/borneo/borneo/sarawak5.html/http://www.earthisland.org/borneo/news_blockades.html. [Accessed August 5, 2004].

THE BORNEO PROJECT 2002c. *A History of the Penan Struggle in Sarawak, Malaysia.* [on-line]. Available from:

http://www.earthisland.org/borneo/news/articles/010403article.html. [Accessed August 5, 2004].

BREALEY, K,.1995. Mapping Them 'Out': Euro-Canadian Cartography and the Appropriation of the Nuxalk and Ts'ilhqot'in First Nations Territories. *The Canadian Geographer,*. 39(2), 140-156.

BRIMAS (Borneo Resources Institute of Malaysia). 2001. *Judge: Iban NCR had 'survived'- Rights not affected by any Order or Legislation.* [on-line]. Available from: http://brimas.www1.50megs.com/UK-July01-Nor-4.htm. [Accessed August 5, 2004].

BROSIUS, J.P., 1986. River, Forest and mountain: The Penan Gang Landscape'. *Sarawak Museum Journal*, 57, 173-184

BROSIUS, J.P., 1992. Foraging in tropical rainforests: The case of the Penan of Sarawak, East Malaysia (Borneo). *Human Ecology* , 19 (2), 123-150.

BROSIUS, J.P., 1997. Prior Transcripts, Divergent Paths: Resistance and Acquiescence to Logging in Sarawak, East Malaysia. *Comparative Studies in Society and History*, 39 (3), 468-510.

BROSIUS, J.P. ET.AL., 1998. Representing Communities: Histories and Politics of Community-based Natural Resource Management. *Society and Natural Resources*, 11 (2), 157-168.

BROSIUS, J.P., 1999. Green Dots, Pink Hearts: Displacing Politics from the Malaysian Rain Forest. *American Anthropologist*, 101 (1), 36-57.

CARTER ET. AL., 1995. Local people's participation in forest resource assessment: an analysis of recent experience, with case studies from Indonesia and Mexico. *Commonwealth Forestry Review*, 74 (4), 333-341.

CHAPIN, M. and THRELKELD, B., 2001. *Indigenous Landscapes: A Study in Ethnocartography*. Washington, D.C.: Center for the Support of Native Lands.

CHAPIN, M., pers. comm. Dec. 1, 2003.

CHING, Y.M. 2002. Improve our lives: Penan demand state government to stop destruction of forest. *Malaysiakini* June 6, 2002

COLCHESTER, M., 1992. *Pirates, Squatters and Poachers-The Political Ecology of Dispossession of the Native Peoples of Sarawak.* London: Survival International and Selangor: INSAN (Institute of Social Analysis).

COLFER, C.J.P., 1981. Women, Men and Time in the Forests of East Kalimantan. *Borneo Research Bulletin*, 13 (2), 75-85.

COOKE, F.M. 2003. Maps and Counter-Maps: Globalised Imaginings and Local Realities of Sarawak's Plantation Agriculture. *Journal of Southeast Asian Studies*, 34 (2), 265-284.

CORBETT, Jon. 2003. *Empowering communities by improving the communication of their information.* Thesis (PhD). University of Victoria.

DAES, Erica-Irene A. 2001. *Prevention of Discrimination and Protection of Indigenous Peoples and Minorities-Indigenous peoples and their relationship to land.* Final working paper #GE.01-14179(E), UN Commission on Human Rights/UN Economic and Social Council.

DAVIS, W., 1993. Death of a people: logging in the Penan homeland. *Cultural Survival Quarterly*, 17 (3), 15-20

DAVIS, W. ET. AL., 1995. *Nomads of the Dawn-The Penan of the Borneo Rainforest.* California: Pomegranate Artbooks.

DELGAMUUKW *v.* British Columbia [1997] 3 S.C.R. http://www.lexum.umontreal.ca/cscscc/en/pub/1997/vol3/html/1997scr3_1010.htm Last accessed July 10, 2004.

DOWN TO EARTH (DTE), 2002. *Forests, People and Rights, Down to Earth Special Report, June 2002.* [on-line] Available from: http://dte.gn.apc.org/srf2.htm. [Accessed: August 2, 2004].

ELIAS, P.D., 1989. *Rights and Research: The Role of the Social Sciences in the Legal and Political Resolution of Land Claims and Questions of Aboriginal Rights.* Canadian Native Law Reporter, 1989, 1-43.

ESRI term search for 'rubber sheeting'. www.esri.com. Last accessed August 1, 2004.

FLAVELLE, A., 1996. *Community Mapping Handbook-A Guide to Making Your Own Maps of Communities and Traditional Lands.* Edmonton: Quon Editions.

FOOTE, K. and HUEBNER, D., 2000. *Error, Accuracy and Precision.* http://www.colorado.edu/geography/gcraft/notes/error/error.html

FOX, J., 2002. Siam Mapped and Mapping in Cambodia: Boundaries, Sovereignty, and Indigenous Conceptions of Space. *Society and Natural Resources*, 15, 65-78.

FOX, J. ET. AL., 2003. *Spatial Information Technology and Society: Ethics, Values, and Practice.* www2.eastwestcenter.org/environment/ethics/main1.htm

HARLEY, J.B. 1989. Deconstructing the Map. *Cartographica*, 26 (2), 1-20.

HARLEY, J.B. 1988. Maps, Knowledge and Power. *In:* D. COSGROVE and S. DANIELS, eds. *The Iconography of Landscape.* Cambridge: Cambridge University Press, 277-312.

HARRIS T. AND WEINER, D. 1998. Community-Integrated GIS for Land Reform in Mpumalanga Province, South Africa. *Cartography and Geographic Information Systems.* 25(2): 67-76.

HESS, C. 2002. *Digital Library of the Commons.* [on-line] International Association for the Study of Common Property (IASCP). Available from: http://dlc.dlib.indiana.edu/cprdef.html. [Accessed August 1, 2004].

HOLLIS, C. 2001. Landmark Judgment Rules in Favour of Sarawak Natives. *Malaysiakini*, May 12, 2001.

HONG, E., 1987. *Natives of Sarawak. Survival in Borneo's Vanishing Forests.* Penang: Institut Masyarakat.

HOOKER, M.B., 1978. *Adat Law in Modern Indonesia.* Oxford: Oxford University Press.

HOOKER, M.B., 2001. Native Title in Malaysia Continued – Nor's Case. *Asian Law*, 4, 92-105.

HOROWITZ, L.S., 1998. Integrating Indigenous Resource Management with Wildlife Conservation: A Case Study of Batang Ai National Park, Sarawak, Malaysia. *Human Ecology*, 26 (3), 371-403.

IAPD. How to transfer Peoples' Knowledge to a GIS. [online]. Available at: www.iapd.org/p3dm/step_04.htm. [Accessed June 23, 2004]

IDEAL (Institute for Development and Alternative Lifestyle), 2000. *Not Development but Theft-The testimony of Penan communities in Sarawak.* Sibu; Ideal Time Sdn Bhd.

IDEAL (Institute for Development and Alternative Lifestyle), 1999. *Tanah Penghidup Kitai.* Sibu: IDEAL TIME Sdn Bhd.

JKPP, 1994. Pemetaan Kampung. (Technical report and manual from 1994 Community Mapping Workshop in Maluku Tenggara)

JORDAN, G. 1999. Public Participation and GIS: Report Back. *PLA Notes.* 34, 16-17.

KAIN, Roger J. and BAIGENT, E., 1992. *The Cadastral Map in the Service of the State-A History of Property Mapping.* Chicago: University of Chicago Press.

KEDIT, P.M. 1982. An Ecological Survey of the Penan. *Sarawak Museum Journal.* 30(51), 225-279

KING, V., 1978, ED. *Essays on Borneo Societies.* Oxford: Oxford University Press.

KING, V., 1993. *The Peoples of Borneo.* Oxford: Blackwell.

KONSORSIUM Sistem Hutan Kerakyatan Kalimantan Timur. 1996. Pelatihan Pemetaan Partisipatif dan Sistem Informasi Geografis. (Technical report of community mapping/GIS training session in East Kalimantan).

KONSORSIUM Sistem Hutan Kerakyatan Kalimantan Timur. 1997. Laporan Pemetaan Tana Adat Desa Tepulang. (Report on Mapping Traditional Territory in Tepulang Village).

LANGUB, J. 1989. Some aspects of the life of the Penan. *Sarawak Museum Journal.* 39, 169-184.

LANGUB, J., 1996. Penan Response to Change and Development. *In:* PADOCH, C. and PELUSO, N. eds. *Borneo in Transition: People, Forests, and Conservation.* NewYork: Oxford University Press, 103-120.

LINDSEY, T., 1998. Square Pegs and Round Holes: Fitting Modern Title into Traditional Societies in Indonesia. *Pacific Rim Law and Policy Journal,* 7 (3), 699-719.

LOFFLER, U., 1996. *Land Tenure Developments in Indonesia.* Eschborn, Germany: Deutsche Gesellschaft fur Technische (GTZ).

MACKINNON, K. and SUMARDJA, E., 1996. Forests for the Future: Conservation in Kalimantan. *In:* PADOCH, C. and PELUSO, N. eds. *Borneo in Transition: People, Forests, and Conservation.* NewYork: Oxford University Press, 59-75.

MACKENZIE, I. 2001. (unpublished). Explanatory-Combinatorial Dictionary of Eastern Penan.

MARCHAK, 1995. *Logging the Globe.* Montreal and Kingston: McGill-Queen's University Press.

MCKAY, B.J. and FORTMANN, L. 1996. Voices from the Commons: Evolving Relations of Property and Management. *Cultural Survival Quarterly*, 20 (1), 1-2.

MOMBERG, F., ET. AL., 1996. *Drawing on Local Knowledge: A Community Mapping Training Manual-Case Studies from Indonesia*. Jakarta: Ford Foundation, Yayasan Pancur Kasih, and WWF Indonesia Programme.

MONIAGA, 1993. Towards community-based forestry and recognition of *adat* property rights in the Outer Islands of Indonesia. In *Legal frameworks for forest management in Asia: Case studies of community/state relations*, edited by J. Fox. Program on Environment Occasional Paper no. 16, Honolulu: East-West Cente

MONMONIER, M. 1991. *How to Lie With Maps*. Chicago: University of Chicago Press.

MULIASTRA, Yohanes I Ketut Deddy. 2003 (unpublished) Community Mapping, Tenurial Rights and Conflict Resolution in Kalimantan, Indonesia.

NATALIA, I., 2000. Protecting and Regaining Dayak Lands through Community Mapping. *In:* J. ALCORN and A. ROYO, eds. *Indigenous Social Movements and Ecological Resilience: Lessons from the Dayak of Indonesia*. People, Forests and Reefs (PeFoR) Program Discussion Paper Series, Washington, D.C.: Biodiversity Support Program (BSP)

NEWMAN, D. and PAASI, A., 1998. Fences and neighbours in the postmodern world: boundary narratives in political geography. *Progress in Human Geography*, 22 (2), 186-207.

NGIDANG, 2000. A Clash Between Culture and Market Forces: Problems and Prospects for Native Customary Rights Land Development in Sarawak. Leigh, M., ed. *Borneo 2000-Sixth Biennial Meeting of the Borneo Research Council, Kuching, Sarawak, July 10-14, 2000*. 237-249.

NGO, T.H.G. 1996. A New Perspective on Property Rights: Examples from the Kayan of Kalimantan. In Padoch and Peluso, eds. *Borneo in Transition: People, Forests, Conservation and Development*. New York: Oxford University Press, 137-147.

NOR Anak Nyawai & Others v Borneo Pulp Plantation Sdn Bhd, Borneo Pulp and Paper Sdn Bhd and Superintendent of Lands and Surveys, Bintulu (2001) Reasons for Judgement: Suit no. 22-28-99-I, High Court in Sabah and Sarawak at Kuching, Malaysia.

ORLOVE, B., 1993. The Ethnography of Maps: The Cultural and Social Contexts of Cartographic Representation in Peru. *Cartographica*, 30 (1), 29-45.

PADOCH, C. and PELUSO, N. 1996. Changing Resource Rights in Managed Forests of West Kalimantan. In Padoch and Peluso, eds. *Borneo in Transition: People, Forests, Conservation and Development*. New York: Oxford University Press, 121-136.

PANCOAST, W. and THOMPSON, H., 1998. Borneo's Native Lands at Risk. *Earth Island Journal*, Winter, 3.

PELUSO, N., 1995. Whose Woods Are These? Counter-mapping Forest Territories in Kalimantan, Indonesia. *Antipode*, 27 (4), 383-406.

PELUSO, N. and VANDERGEEST, P., 2001. Geneologies of the political forest and customary rights in Indonesia, Malaysia, and Thailand. *The Journal of Asian Studies*, 60 (3), 761-812.

PHOA, J. 1996. The Dayaks and Orang Ulu of Sarawak. *In:* C. NICHOLAS and R. SINGH, eds. *Indigenous Peoples of Asia-Many Peoples, One Struggle.* Bangkok: Asia Indigenous Peoples Pact.

POOLE, P. 1995. *Indigenous Peoples, Mapping and Biodiversity Conservation-An Analysis of Current Activities and Opportunities for Applying Geomatics Technologies.* Peoples and Forest Program Discussion Paper. Washington, D.C.: Biodiversity Support Program (BSP).

PORTER, A.F., 1967. *Land Administration in Sarawak-An Account of the Development of Land Administration in Sarawak from the Rule of Rajah James Brooke to the Present Time (1841-1967).* Kuching: Land and Survey Department.

PRIYANA, ED. 1996. Sebuah upaya penguatan Masyarakat Adat.- Laporan Pelatihan Pemetaan Masyarakat Adat Dayak Benuaq Ohoong Mancong, 27-30 Januari 1996.

RAMBALDI, G. and CALLOSA-TAR, J., 2002. *Participatory 3-D Modelling: Guiding Principles and Applications.* Los Baños, Philippines: ASEAN Regional Centre for Biodiversity Conservation.

RAMBALDI, G. ET. AL, 2000. Adding the fourth dimension to Participatory 3-D modelling. *PLA Notes*, 39, 19-24.

RANDHAWA, Sonia. 2002. Keeping our forests alive for our use. *Malaysiakini* September 5, 2002.

RHEE, 2002. Community management of natural resources in a *de facto* decentralizing Indonesia: A Case Study from East Kalimantan. *Tropical Resources: The Bulletin of the Yale Tropical Resources Institute.* Spring, 25-30.

ROBINSON, A. et. al. 1995. *Elements of Cartography.* Sixth Edition. New York: John Wiley and Sons.

ROOS, E. (1999) *A report on the situation of the indigenous peoples of Peninsular Sarawak and Sabah.* Amsterdam: Netherlands Centre for Indigenous Peoples

ROSE, C.M. 1994. *Property and Persuasion.* Boulder: Westview Press.

RUNDSTROM, R. A., 1990. A Cultural Interpretation of Inuit Map Accuracy. *Geographical Review*, 80 (2), 154-168.

RUNDSTROM, R. A., 1991. Mapping, Postmodernism, Indigenous People and the Changing Direction of North American Cartography. *Cartographica,* 28 (2), 1-12

SAHABAT ALAM MALAYSIA, 2002. Penan Representatives Meet Sarawak State Planning Unit. *Utusan Konsumer*, September 9, 2002. [on-line]. www.rengah.c2o.org/news [Accessed January 20, 2004].

SARAWAK ON-LINE http://www.sarawak.gov.my/contents/economy/economy-a-land.shtml. [Accessed January 20, 2004].

SARAWAK PENAN ASSOCIATION, 2002. The Long Sayan Declaration 2002. *Malaysiakini*, June 26,2002. [on-line]. www.rengah.c20.org/news. [Accessed January 20, 2004].

SCOTT, C. 1998. *Seeing Like a State-How Certain Schemes to Improve the Human Condition Have Failed.* New Haven: Yale University Press.

SELLATO, B., 1994. *Nomads of the Borneo Rainforest-The Economics, Politics, and Ideology of Settling Down.* Honolulu: University of Hawaii Press.

SILVERMAN, D. 2000. *Doing Qualitative Research-A Practical Handbook.* London: Sage.

SIM, S. (year unknown). Sarawak-An essay written for the Borneo Project. [on-line]. http://www.earthisland.org/borneo/borneo/sarawak1.html. [Accessed March 21, 2004].

SING, C. C., 2001. "Speech by Chiew Chin Sing DAP Deputy Chairman and Member of the Sarawak State Legislative Council of N53 Kidurong on the debate on The Land Surveyor's Bill, 2001 on 31st October, 2001 in the Sarawak State Legislative Council, Kuching, Sarawak'. Posted Saturday, Januray 5, 2002. to DAP Sarawak Homepage. [on-line]. http://www.dapsarawak.comSin [Accessed January 20, 2004].

SIRAIT, M. ET. AL., 1994. Mapping Customary Land in East Kalimantan, Indonesia: A Tool for Forest Management. *Ambio*, 23 (7), 411-417.

SOCHACQEWSKI , P.S., 2002. *Borneo Native Group Scores Land Claim Victory: Special report written for the Borneo Project*, Berkeley: April 17, 2002. [on-line]. http://www.earthisland.org/borneo/news/articles/020304article.htm. [Accessed March 21, 2004].

STERRIT, N. pers. comm. March 14, 2004 and July 10, 2004.

STRANG, V. 2000. Showing and Telling: Australian Land Rights and Material Moralities. *Journal of Material Culture*, 5 (3), 275-299

SUHAKAM, 2002. Annual Report. Kuala Lumpur, Malaysia.

SZCAEPANSKI, K., 2002. Land Policy and Adat Law in Indonesia's Forests. *Pacific Rim Law and Policy Journal*, 11 (1), 231-255.

TEO SEW-ENG, D., 1990. Indigenous Peoples' Struggle, Sarawak. *International Review of Mission*, 79 (July), 301-304

THIEN, T., 2001. Natives Jubilant over court decision affirming land rights. *Malaysiakini*, May 14, 2001.

THOMSON, H., 2001. Landmark Ruling Secures Native Land Rights-Surprise verdict could protect forests and communities around the world. *Berkeley Borneo Project* [on-line]. www.earthisland.org/borneo/news/articles/010509article.html. [Accessed March 24, 2004].

TOBIAS, T., 2000. *Chief Kerry's Moose.* Vancouver: Ecotrust Canada

TURNBULL, D. 1989. Maps are Territories, Science is an Atlas. Victoria, Australia and Chicago: University of Chicago Press.

UTUSAN KONSUMER, 1999. Extinguishing Native Land Rights. *Utusan Konsumer*, December 1999

UTUSAN KONSUMER, 2002a. Baram's Penan Community-Hungry, Poor and Sick. *Utusan Konsumer*, May, 2002. [on-line].

http://www.earthisland.org/borneo/news/articles/020518article.html [Accessed March 21, 2004].

UTUSAN KONSUMER, 2002b. Set Aside Some Forest for Us. *Utusan Konsumer*, May 2002. [on-line]. http://www.earthisland.org/borneo/news/articles/020519article.html. [Accessed March 21, 2004].

UTUSAN KONSUMER, 2002c. Hierarchical Interests: Why the Penan Problem has Never Been Solved. *Utusan Konsumer*, June 2002. [on-line]. http://www.earthisland.org/borneo/news/articles/020601article.html. [Accessed March 21, 2004].

UTUSAN KONSUMER, 2001. Historic Victory for Sarawak Natives. *Utusan Konsumer,* July, 2001. [on-line]. http://www.earthisland.org/borneo/news/articles/010720article.html. [Accessed March 21, 2004].

VANDERGEEST, P. and PELUSO, N., 2001. Territorialization and State Power in Thailand. *In:* N.BLOMLEY ET. AL., eds. *The Legal Geographies Reader*, Oxford and New York: Blackwell.

VOEKS, R.A. AND SERCOMBE, P. 2000. The Scope of Hunter-Gatherer Ethnomedicine. *Social Science and Medicine.* 51, 679-690.

WEINER, D., ET. AL. 2001. Community Participation and Geographic Information Systems. *In: ESF-NSF Workshop on Access to Geographic Information and Participatory Approaches Using Geographic Information, Spoleto, 6-8 December, 2001.*

WINICHAKUL, T., 1996. Siam Mapped: The Making of Thai nationhood. *The Ecologist*, 26 (5), 215-230.

WOLLENBERG, Eva-Lini. Report of Workshop "Building an Agenda Together" *(Bangun rencana bersama)* and Mapping Training (*Pelatihan Pengenalan Pemetaan*) Long Loreh, East Kalimantan 20-24 November, 1999. 10 December 1999 http://www.cifor.cgiar.org/acm/methods/pm.html

WONG, M.C. 2002. Prospecting Sarawak Indigenous People's rights. *Rengah Sarawak,* Oct 11, 2002. [on-line]. www.rengah.c2o.org/news. [Accessed March 21, 2004].

WONG, M.C. 2000. Sarawak Land Code Amendment Bill 2000 Does Not Recognise Indigenous Rights Over Customary Land. Rengah Sarawak. *Rengah Sarawak,* May 24, 2000.[on-line]. www.rengah.c2o.org/news. [Accessed March 21, 2004].

WOODWARD, D and MALCOLM LEWIS G., eds., 1998. *The History of Cartography, Volume 2, Book 3: Cartography in the Traditional African, American, Arctic, Australian, and Pacific Societies.* Chicago: University of Chicago Press

WORLD RAINFOREST MOVEMENT AND FORESTS MONITOR. 1998. *High Stakes: The Need to Control Trans-national Logging Companies: A Malaysian Case Study.* United Kingdom: IUCN.

ZERNER, C., 1990. *Community rights, customary law and the law of timber concessions in Indonesia's forests: legal options and alternatives in designing the commons.* Jakarta: FAO Forestry Studies TF/INS/065.

ZERNER, C., ed., 2003. *Culture and the question of rights : forests, coasts, and seas in Southeast Asia.* Durham : Duke University Press, 2003