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A Methodology for Community Mapping of Natural Resources

Forests and Revenue land in Bargarh District of Odisha

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Acknowledgements

This Working Paper is the first output from a research project supported by the RULNR unit of the Centre for Economic and Social Studies. It has examined the possibilities of combining community participation and modern information technology to map local uses of natural resources. This topic grew out of my PhD research into bauxite mining where it was realised that an important part of why tribal peoples are always losing out when mining is proposed is that their rights to land and forests have never been properly recognised. While strong land rights have existed for a long time without adequate implementation new hope has come in the form of the Forest Rights Act which allows traditionally forest-dwelling communities to claim individual and community reserves.

I was fortunate to meet Dr M. Gopinath Reddy in Hyderabad and find him interested in collaborating on this project, the support is hereby gratefully acknowledged. The project was also fortunate to have Prof. Desai of the RULNR Board attend the inception workshop in October 2011.

Fieldwork for the project was carried out in collaboration with Vasundhara, an NGO based in Bhubaneswar with extensive experience of environmental and forest research in Odisha. Initial project discussions and a scoping trip came into reality much due to the collaboration with Himansu Patra who later decided to look for employment opportunities elsewhere and therefore could not be part of the main fieldwork and later analysis. Throughout the project and as part of the scoping trip Madhu Sarin's vast experience of forests and forest livelihoods has been much appreciated. Thanks also to Y. Giri Rao for ensuring that the project and all its workers had the necessary project management support.

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A final thanks go to the villagers of Bargarh District who were able to take time from their everyday activities to discuss their lives with the project team and additionally helped to interpret maps and find the few remaining village boundaries in an area much neglected by its government.

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ABSTRACT

International experiences show significant opportunities in using GIS technologies and participatory methods to map community natural resource uses. In India, this has as far as is known only been done in a limited number of cases so far. In relation to mining and forests there are particular benefits of community mapping due to the Forest Rights Act, which promises to put forests in the hands of traditional forest-dwellers, and because of expanded mining which might remove the very same forest before it is returned to local communities.

This Working Paper presents a methodology for community mapping of natural resources based on a case study with an exploratory purpose at Gandhamardhan Hill in Bargarh District of Western Odisha. This is a hill which from time to time has been proposed for bauxite mining but which is also known for its forests and overall high biodiversity. The methodology has been designed with two purposes; to be possible to follow for local groups interested in claiming community forest rights, and to be good enough to convince bureaucratic expert committees in charge of deciding on environmental and similar approvals. Since the second purpose is more technically advanced and requires specialised skills and resources seen as being beyond local groups at present but can nevertheless fulfil a very important role in ensuring resource justice across rural India.

The methodology attempts to combine insights into technology and access to data resources, particularly maps prepared by the state government, with locally relevant ethnographic knowledge in order to provide an understanding about resource uses which are relevant in the particular social and legal context in which the study is embedded. While significant opportunities are identified the challenges, including security issues, which exist in carrying out participatory research in Western Odisha at present has worked to somewhat reduce the usefulness of the proposed methods.

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Glossary and abbreviations

Cadastral map	Map showing plots on revenue land. Also known as survey map
GIS	Geographical Information Systems
GPS	Global Positioning System; a navigation system which relies on US communication satellites to determine location
Khata	Plot
Khata Number	Unique serial number assigned to land owners at Village. Also known as survey number
Khatian/Khatiyani	An individual ROR
Mutation	Transfer of ownership
ROR	Record of Rights, also known as 'khatauni'. Records the names and classes of tenure of all occupants of land
Survey Number	Unique number assigned to each piece of land at Village Level
Trishumali	Point identifying the meeting point of three different revenue villages.

1. Introduction

Mapping of natural resource uses can serve many purposes beneficial to local livelihoods. It can provide detailed evidence of peoples' use of forests which can allow claims according to the Forest Rights Act. They can be used to settle revenue land in favour of local cultivators. And they can be used to convince expert committees and other planning bodies that mining plans has to be reconsidered given the risk of disrupting livelihoods, as well as be used in litigation. For these promises to be realised it is however crucial to have an active involvement of communities, or at the very least their representatives. If local participation is not part of the mapping exercise there is a likeliness that various elites will continue to own and use a disproportionate share of the natural resource base.

This Working Paper is part of an ongoing project which aims to map natural resource uses on and next to Gandhamardhan Hill in Bargarh District¹. Since the chosen project site was a hill known not only for its biodiversity but also for its large deposit of bauxite ore a second benefit could come out of the present project by clarifying the need for mining projects to involve local people and is not only a matter of conservation of forests versus industrialization. Developing maps showing community natural resource uses and spiritually important locations could become an important advocacy tool in the larger struggle for community rights in relation to mining.

This working paper details a methodology of resource-mapping which can be used to support future resource claims by mine-affected and other forest-dwelling communities based on possibilities afforded by the Forest Rights Act. This methodology needs to be as uncomplicated as possible and without expensive equipment to allow if not the communities themselves then at least local activists to carry them out. With a few additional tasks the Working Paper also indicates the possibilities for how professional maps can be produced based on the same mapping data collected for community forest rights claims.

¹ The project acknowledges support from the Research Unit for Livelihoods and Natural Resources (*Supported by Jamsetji Tata Trust*), unit of the Centre for Economic and Social Studies (CESS) in Hyderabad.

There are two aspects of the methodology presented in this working paper; data collection and map preparation. Since the aim here is both to prepare counter-maps of equal quality to those that tend to hide local resource uses, but also to come up with procedures which are possible to use by community groups without special training, the working paper will outline a basic and then an advanced methodological approach in each section. For any map to be valid the importance of an understanding of the social context of resource use and users is emphasised.

Background to project

The physical and social changes brought on by mining across central India have received increasing attention from civil society in recent years (Bhushan et al. 2008; Padel et al. 2010; Kalshian 2007; Oskarsson 2010). Social movements and activists have increasingly noted the threats posed by mining, and have been empowered by new legislation, especially the Forest Rights Act 2006, which allows for alternative resource claims to mineral extraction plans. But despite the struggle for pro-poor land rights as well as demands for recognition of community forest uses having a long history in central India with demands made both against the state and local elites, so far there has been very little research done to document spatially the many existing uses of land proposed for, and possibly at a later stage converted to, a mine. These changes are particularly interesting to document not only due to the private industry-lead expansion of mining but also given the new Forest Rights Act which allows previously excluded forest-dwellers to claim titles to land and forests officially classified as forest but used by the communities for generations. New possibilities afforded by modern information technology, specifically Geographical Information Systems (GIS), has the potential to produce maps of better quality than what was previously possible. These technologies can be used not only by expert geographers, but also by civil society actors in cooperation with affected communities themselves.

Bauxite mining can be a particularly useful form of mining to study not only since the ore bodies are all located in tribal areas and contain considerable biodiversity, but also for the many opposition movements which have objected to such projects including for example those in Kashipur and Niyamgiri in Odisha (formerly known as Orissa) and Jerrela and Araku in Andhra Pradesh in recent years (Supreme Court of India 2008; Amnesty International 2010; Reddy 2006; Oskarsson 2010). The need for support for local communities in their land and forest claims against a rapidly expanding mineral industry, and the new opportunities afforded by legislation (especially the Forest Rights

Act) and technology (known as Geographical Information Systems, GIS) indicate a great potential for social action research aimed at empowering marginalised communities.

Maps can support livelihoods directly by visualising the existing uses of natural resources by local people thereby helping to prevent their displacement by mining without their consent or compensation which is currently taking place when forest-dwellers are seen as 'encroachers' on forest land². The maps can also help communities claim recognition of their forest rights as well as counter the official mining plans which tend to hide local resource uses. Securing property rights via the formal recognition of land (and forest rights) titles is commonly seen as one of the best ways to improve the livelihoods of poor people (Besley et al. 2000).

With this background in mind the present project was started in late 2011 to look into the possibilities to use GIS techniques and participatory methods in a case study of resource uses at Gandhamardhan hill in Western Odisha³. A scoping visit and two fieldwork trips have been undertaken as part of the project which has included community interactions and measurement of locations using GPS devices. The research questions in the original project proposal were:

- a) How can evolving technologies in GIS help support local resource struggles via the creation of maps?
- b) In which ways might participatory mapping improve local knowledge of resources and resource use thereby strengthening rights claims? What are the technical, financial and other limitations to the usefulness of such maps at the moment?
- c) How can maps be put to use as part of challenges to large-scale mining plans, especially the different clearances, e.g. environmental clearance or forest clearance, and in different courts? Is it possible to create maps which adhere to regulatory requirements and are of equal or better technical quality compared to those currently used in official planning documents like EIAs and Mining Plans?

² The general risks of displacement have been documented in for example Fernandes (2009). For displacement risks and livelihood impact directly related to bauxite mining see Reddy et al. (2010) and Oskarsson (2010).

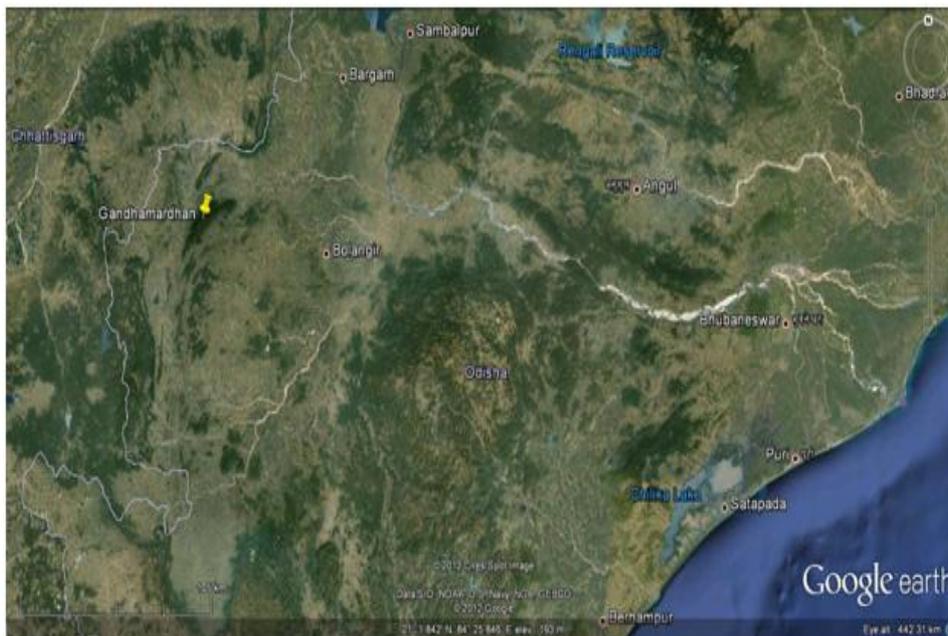
³ This fieldwork has been anchored by the NGO Vasundhara, based in Bhubaneswar, Odisha

This Working Paper aims to respond to a) above, that is how a process of mapping might be designed in order to provide not only useful results for the purposes mentioned above but also to be feasible for often resource-constrained community organisations.

Site description

Gandhamardhan in Bolangir District of Odisha is a hill which from time to time since the early 1980s has been proposed for bauxite mining. Mining plans have however proven very controversial due both to its famous biodiversity and the presence of tribal and other forest-dependent communities living on and close to the mountain. As far as is known there are no immediate plans to mine the mountain but Gandhamardhan continues to be linked to various mining companies ranging from Nalco, to Vedanta and the Canadian company Balaton Power (Gallo 2007). The many years of strong resistance to mining from the mid-1980s continues among local groups and movements however making Gandhamardhan a particularly suitable location for the proposed resource mapping.

Figure 1: Satellite image of Gandhamardhan and Western Odisha



Source: Google Earth

Gandhamardhan first came to prominence as a mining destination when then public sector Balco proposed a mine there⁴. Balco (Bharat Aluminium Corporation) was established in 1965 via a Hungarian-Indian government collaboration project in Korba in present-day Chhattisgarh West of Gandhamardhan. Technological problems however prevented the company from operating properly for many years and once it did the ore reserves were insufficient. It was in the search for new ore that the Indian bauxite industry's first encounter with protest movements occurred in the late 1980s when Balco came to Gandhamardhan in Western Odisha(Mishra 1987). The hill is known for its biodiversity but also as a Hindu pilgrimage location, and saw a significant opposition movement being established. In the end it was mainly livelihood concerns and local mobilisation which forced the company to leave at a time when across India a number of movements against displacement, especially from dams like the ones along the Narmada River, were increasingly making their voices heard. The difference between dam agitation and bauxite movements, such as the one at Gandhamardhan, has been lower direct displacement in the latter case, but enduring concerns about indirect loss of livelihoods when water and forests are disturbed from mining. In addition the proposed bauxite mining areas have often had great environmental values justifying conservation. These concerns remain largely unaddressed to date by the promoters of mining(Oskarsson 2010).

The entire Gandhamardhan Hill is officially settled as Reserve Forest to be managed by the Forest Department. While no villages exist within the boundaries of this forest many exist immediately outside of its boundaries and continue to depend on the forest for livelihoods as well as spiritual needs. The rich biodiversity of the hill is well-known and continues to support medicinal plant collectors, from near and far, as well as a wide range of other uses including NTFP (Non-Timber Forest Products) and firewood needs. And not only is the hill important for Hindus with two major temples connected by a pilgrimage path across the hill. Local deities are also worshipped by adivasi and other groups. As of now all these resource uses continue to exist based on traditional usage rather than any officially recognised rights leading to various forms of exploitation and a lack of control over natural resources which have been used by communities for generations.

⁴ Balco was controversially privatised and sold to Vedanta Resources in 2001.

The existence of Forest Rights and other forms of land titles at Gandhamardhan are not known in detail but statistics for the Districts of Bargarh and Bolangir are summarised in the table below. Since there have been no claims granted for Community rights in either of the two Districts it appears safe to say that a large part of the mountain remains settled as Reserved Forest despite the many existing uses of the land⁵.

Table 1: Current implementation of the Forest Rights Act in the Gandhamardhan area

District	Gram Sabha (acres)		District Committee Level (acres)		Titles distributed (acres)	
	Individual	Community	Individual	Community	Individual	Community
Bargarh	3,583	3.5	1,683	0	1,645	0
Bolangir	6,635	0	1,940	0	1,940	0

Source: Vasundhara (2011)

2 An adaptable framework for land use mapping

Internationally a lot of work has gone into designing manuals and other accessible, yet comprehensive, documents of how to carry out land use mapping in particular contexts, for example in relation to the lands of indigenous peoples in Canada (Tobias 2009; Tobias 2000), or in relation to particular kinds of activities. Common features for such mapping frameworks are firstly that they should include, and preferably be carried out, by the affected communities themselves in order to truly represent their interests. This is since traditionally mapping has tended to be carried out on behalf of the state or some other outside authority thereby inducing outcomes towards goals set by this organisation rather than those living on and making use of the land. Secondly, tools and techniques should be feasible. This means any methodology should not be overly complicated and require specialist knowledge or expensive equipment. This might imply a trade-off between precision, affordability and ease-of-use. Increasingly however the precision and affordability of commonly available tools ensures that maps of very good quality can be produced.

This section draws on the international literature on community mapping but attempts to situate it within a specific socio-legal setting to understand where and how the best combination of mapping techniques and community interactions can be achieved. The

⁵ A number of forests exist at Gandhamardhan including Harisankar, Bodharaja and Barpita Reserve Forests in Bolangir District and Gandhamardhan Reserve Forest in Bargarh District. In practice, however, these are administrative units whereas the forest is contiguous across the hill.

main criteria used here are map accuracy, community participation and social impact. The proposed framework is adaptable not only due to the need to adapt to specific social and environmental contexts but mainly given the varying capabilities in using GIS software and the difficulties to access official maps which both greatly affects the possibilities to create maps with good accuracy.

Land use mapping methodologies in an international perspective

In the struggle between mining promoters and local communities across central India over what is officially termed forest land, a clear understanding of local resource uses takes on crucial importance for the ability to counter mining plans and advocate in favour of local resource rights. A number of trends have contributed to the increased interest in participatory mapping as part of social movements aimed at securing local resources. The first is the noticed inclination of governments, companies and other 'experts' to favour large-scale mineral exploitation in favour of small-scale agriculture-based uses of land. Many of the currently used planning documents supposedly assessing the impact of mining tend to hide rather than make visible even the existence of habitations and villages on and close to the sites proposed for mining. If local people are to truly be heard it would thus seem like they, or organisations working close to the grassroots, must be able to use the best available tools to show on self-produced maps not only that they exist but also why certain resources belong to them and not to the government or private companies. In sum, maps can support local livelihoods directly by preventing displacement from mining by supporting local mobilisation as well as allowing complaints to be launched in various courts and in expert committees like those of the MoEF. Maps can further support local claims for the recognition of Forest Rights titles as well as visualise currently existing inequitable uses of resources thereby working in favour of a fairer distribution and utilisation.

New technologies, including low cost GPS (Global Positioning System) devices and the free online availability of detailed satellite images and geographical databases, are increasingly putting the ability to map resources and resource uses in the hands of communities around the world (Orlove 1991; Herlihy et al. 2003; Chapin et al. 2005). This has given rise to a wave of mapping exercises where previously excluded peoples have been creating counter-maps to the ones which show the officially allowed and sanctioned resource uses. Of importance for the impact of these counter-maps has been the ability to live up to existing legislative demands when for example bringing resource claims to court, as well as the possibility to match in technical detail the maps produced

by dominant groups including especially governments and companies (Chapin et al. 2005).

Internationally the possibilities for resource mapping have created a significant body of literature including the production of guidebooks to enable communities themselves to do mapmaking, and atlases of indigenous lands (Fox et al. 2005; Tobias 2000; Tobias 2009; Chapin et al. 2005). Depending on the scale of the mapping effort and the choice of technology efforts have had varying degrees of local participation at times relying more on remote sensing for data collection (Chapin et al. 2005). These examples of manuals on community mapping are mainly based in the West however and are likely to involve educational and technical requirements beyond the capacity of the average mining-affected community in rural Odisha. Mapping work in Odisha will thus not only have to take into account the resources and capabilities of local people but also of potential resource persons at NGO and with social movements who might have the ability to carry out the work.

In addition there is a need to understand legislative requirements to ensure that maps created are useful for the purpose of resource claims and resource protection. This knowledge not only determines where the most promising opportunities exist to use mapping techniques but also the quality and type of maps that need to be produced in order to be seen as legitimate. As far as is known resource mapping has not been attempted on a larger scale in India as of yet. In relation to mining and the possibilities for forest-dwellers to claim land or forest rights titles no similar attempts have been made to date.

Any methodology for community mapping in central India would find it very difficult to both be best in class and useful for community organisations due to skills, resource and map availability issues. Significant challenges also exist when trying to make the processes participatory. Therefore a two track methodology is proposed. One focuses on simplicity whereas the other one looks at professionalism by creating maps using GIS software. These two categories will be further explained below.

Accessing base mapping data

Unless some type of base map exists on which community resource uses can be added, any mapping project will face significant challenges. If not even general roads and village locations are available on maps with professional quality maps then a project might have to either create the entire map from start, thereby significantly adding time and

fieldwork efforts, or rely on satellite imagery. While in many countries basic maps are widely available this is unfortunately not the case in India where toposheet maps are generally difficult to access and not at all for sale in sensitive areas despite often not being very up to date. More specific maps like those of revenue land (which shows agricultural land holdings) and forests (which detail reserve and other types of forest) are even more difficult to access. Project experiences with accessing revenue maps in Odisha are detailed in the section 3.

In order to compare the present land use with what is the legal status of land holdings there is a need for accessing maps and land records. Such data is nominally available but pose serious challenges both in terms of access and in terms of interpretation. It is also well known that government archives tend to be in a very bad state meaning that records and maps can be difficult to at all interpret. And if available there is a likeliness that the information on them will be either inaccurate, due to poor information management skills, or simply since the details have not been updated for many decades. In Odisha the latest revenue land settlement took place in 1976-77. Subsequent maps which are used until this day were prepared based on this settlement and published in 1978.

Forest settlements happened in the 19th century across India during the colonial period. The exact year of settlement and the detailed rules for how forest was settled varied somewhat from one part of British India to another (Singh 1986). The official forest boundaries have remained rigid for decades while the actual picture on the ground has varied dramatically and might never have been particularly accurate even in the first place. While forest maps in theory should be possible to access for local organisations this will in practice often be very difficult. The experiences of the project, as detailed below, testify to this.

Understanding local specifics

When technological progress is swift with increasingly available and easy to use solutions it is fully possible to become captured by the technology and forget that individuals and societies do not change as quickly, if indeed at all, at the pace of technology. Furthermore there is an institutional inheritance with certain forms of governance which can not be readily ignored as these continue to affect resource uses. The approach taken here is that local ethnographic knowledge is important since it allows for a specific understanding of who the resource users are in particular locations and why and how they use various resources.

Without a proper understanding of social dynamics it is likely that many community claims to forests in reality will end up being dominated by local elites thereby not leading to the widespread reduction in poverty and improvement in resource security which they otherwise could have done under more democratic resource management. Social dynamics will also interplay with larger societal forces which are influenced by the socio-legal history of place. The modern legal framework of the state of Odisha continues to be influenced by the history of land tenure and forest settlement in the fieldwork area which was under princely rule and only integrated with the rest of the state at a relatively recent stage. It was first integrated into Sambalpur District and relatively recently divided into Bargarh District in 1993.

When trying to understand local specifics it is not only the immediate livelihood concerns which are important. Gandhamardhan is a well-known Hindu pilgrimage location with two large temples and a path across the hill connecting the two. But local peoples also have their separate religious uses of the hill. Some of these uses are well known locally and have become minor pilgrimage centres whereas others remain specific to a certain village. Various kinds of shrines and sacred groves thus continue to exist alongside mainstream Hindu temples since a long time in the forest. Since these are small sites it appears they can continue to be worshiped with little intervention by the Forest Department or other outsiders. But other uses of the forest have been denied, for example there are fruit orchards which are still claimed by villagers but not possible to cultivate inside the reserve forest.

Land relations

How land has been settled and who can make use of different resources which exists on it are key to the methodology outlined here. While each contains a wide variety of sub-categories this project has looked at forests and revenue land as two distinct categories.

Forests

The Forest Rights Act is especially important in the context of this project intent on mapping resource use on what is officially forest land. It has long been known that forests contain many resources that people depend upon for their livelihoods. The Forest Rights Act provides legal support for such recognition of rights building on a 'historical injustice' of depriving forest-dwelling communities of their resources.

It is well-known that actual claims of forest titles have been very slow since the enactment of the law, though with important variations across the country. Especially difficult has

been the community titles which would have enabled the most marginalised to reclaim forest management from the forest department.

Revenue land

Western Odisha inherited its land settlement and revenue system from the Central Provinces of British India. But large parts, including the study area, were under Princely States further confusing land administration. The study area according to local accounts has been settled for about three generations and were initially granted by the local ruler to specific favoured people and their families. While many laws have been framed since Independence to improve the access of poor people to land an unequal pattern of land use continues to this day with village heads having inherited land and possibilities to influence the rest of the village to this day.

Significant areas of forest exist also on revenue land. This land can not be claimed under the Forest Rights Act but continues to nevertheless be used for various purposes by villagers despite the lack of legal support. Lately the Forest Department has moved in to claim large parts of this land in the study area for Joint Forest Management (JFM). Various medicinal plants have been planted and are supposed to be sold via a local non-profit centre based in the Forest Department premises. But many in the villages were not at all aware of the purpose or even existence of the JFM groups which appeared to be managed by a few influential individuals in the villages.

Another problem is the poor update of land records. The most recent update was done in 1976-77 in the study area, or more than 35 years ago, meaning that actual land use was expected to be very different from the official picture today.

Low capacity and limited resources of local community organisations

If a methodology is to be used by any wider set of people beyond those with special skills residing in the larger cities, it will be necessary to reduce the need for special equipment, access to government maps as input, and the need for special GIS training and software in the creation of new maps. The NGOs and movements interacted with during fieldwork at Gandhamardhan, while appearing to be genuinely hard-working, could not be expected to carry out data analysis based on internationally acknowledged GIS principles. What they could do however would be to interact with groups in villages and collect data. Even across Odisha one would at present not expect more than a few organisations to have the knowledge and the resources required to be able to carry out all these activities.

Difficult field conditions

Controversies around mining, industry and land acquisition have become the norm rather than something unusual across Odisha especially in relation to bauxite and other large-scale industry. Gandhamardhan was specifically selected in this project since no mining project is on-going at present. It was believed that this would enable a more conducive atmosphere in which the project could be conducted. This turned out to be only partially true however since suspicions continue to linger that new mining projects will be proposed and outsiders are assumed to be working for mining companies. The scoping trip and the contacts made at this point in time could only partially compensate for the suspicions which exist against outsiders in the area. A history of contentious, displacement-causing industrial projects and outsider resource exploitation has made people suspicious of new ideas. Simply not speaking in a Sambalpuri Odiya accent can be enough reason to create distance in field interactions.

An even larger challenge was however the overall security of the area. It is well known that large parts of central India remain difficult to work in due to clashes between the police, including the well-armed special police forces and groups belonging to the CPI(Maoist), usually referred to as the Naxalites. While such clashes have been rare in Odisha in the past a significant increase in activity has been noted in the last few years as the situation for the Naxalites has become more difficult in the neighbouring States of Andhra Pradesh and Chhattisgarh. Despite heavy presence of the Odisha special police force with daily combing operations at Gandhamardhan it was possible to carry out the planned fieldwork, though with limitations in terms of forest access. This could additionally be accomplished a few months before the Odisha government restrictions on researchers and foreigners came into place due to security concerns and scandals involving tourists visiting adivasi groups in remote areas.

A third unexpected difficulty was the controversy around tourist groups visiting certain tribal areas. It was seen as the contact between foreign tourists and these groups would be particularly harmful. In the end the security conditions, including several tourists as well as local bureaucrats being kidnapped, led to several areas including most parts of Western Odisha, in which the present field site is located, to require special permission. While it was possible to conclude fieldwork there were still a number of unexpected events which continued to make it a challenge to plan for and carry out data collection. It is clear that Western Odisha at present is far from an ideal place for participatory research work.

3 Preparing for fieldwork

Many of the usual preparations in social science fieldwork is relevant for the methodology proposed here. A fieldwork area needs to be identified and there is a need to understand the benefits and drawbacks of specific locations within this area and which choices that needs to be made. Local partners have to be identified and a practically working fieldwork setting should be discussed.

Selection of study area

To select a study area which is not too large but still contains a good amount of variety in terms of social groups and their livelihoods was one of the most important tasks for the scoping trip and subsequent information-gathering activities. Local contacts were made during the scoping trip with the GSYP (Gandhamardhan Suraksha Yuva Parishad), a local movement which works to protect the hill and support livelihoods, and CCD, a Tamil Nadu NGO which is working on medicinal plants in the area. Local support was agreed on from both the organisations. CCD was able to provide one staff member to work on the project as a research assistant.

Available statistics and local interviews led the project team to consider a study close to Paikmal town in Bargarh District. When making the final selection of villages the following criteria were used:

- * Most villages are mixed in the area with ST, SC and OBC communities. There appears to be no one caste village.
- * There appears to be no forest villages (meaning that all villages are on revenue land) in the area but a good amount of forest as well as revenue land remains unsettled.
- * Biodiversity seems to be good all around the hill
- * There are plenty of streams of water, permanent and temporary, and smaller irrigation dams.
- * The bauxite area next to Paikmal is part of what is being claimed by the Canadian company Balaton Power (via its subsidiary Continental Resources) and gives us a good understanding of the bauxite deposit via a report published by the company.
- * The security situation is supposed to be good on the Bargarh side of the hill where Paikmal is located

Interactions also lead to the decision to locate the study area to a set of villages immediately east of Paikmal in Bargarh district. Paikmal town was excluded since it was seen as depending too heavily on visitors to the local temple to be really representative of how most people around Gandhamardhan depend on the hill. The below satellite image is a rough picture of the study area including five revenue villages. All the villages are located in Bargarh District on the northern side of the hill with close access to the forest.

Figure 2: Study area for the project



Note: Red is forest boundary from toposheet map, blue is District border, black is metalled road, yellow and dotted blue are gravel roads.

Accessing official maps

Increasingly, valuable government data is being made available on websites. There have for example been ongoing attempts to digitise land records across India since 1988 funded by the central government with significant progress in some states but less success elsewhere (Department of Land Resources, Ministry of Rural Development 2005). At present rate it is expected that full digitisation will take another 15-20 years to complete. Even if eventually completed there appears to be only limited coordination of efforts across the states to ensure uniform quality (Department of Land Resources, Ministry of Rural Development 2009). While digitisation efforts have resulted in some useful websites much of the details remain on paper however.

Officially land records are supposed to be updated every 20-25 years but at times this has been delayed. So called settlement camps are continuously working across Odisha but at a slow pace which has caused long delays in many locations. In certain cases land details have not been updated for as much as 50 years (Mearns et al. 1999). Similar experiences across India are also reflected in official Government of India reports where supposed updates of land records every 15 years frequently only occur every 30 or so years. Reasons for these delays include the low priority given to land records management with inadequate budgets but also a reliance upon outdated and complicated, time-consuming survey methodologies which do not take into account technological improvements in recent decades (Department of Land Resources, Ministry of Rural Development 2009). The maps of the research area were all made during the last land settlement in 1976-77 implying that many changes would have taken place subsequently. Nevertheless this is the best maps available and they do provide a good picture of land holdings at the village level including the common village forest and other forms of land.

Related to the digitisation and updating of land records is also the need to update village cadastral maps which in many states are more than 50 years old and were originally made by the British. "Over the years, they [the maps] have been subjected to the vagaries of the weather, continuous and improper handling, and unscientific methods of storage, rendering them fragile and tattered. The maps have also undergone shrinkage affecting their accuracy and their credibility (Department of Land Resources, Ministry of Rural Development 2009, 164)." It appears as if progress on digitising the actual maps has been very partial to date.

There are a large number of spatial databases under development at the moment. Examples include the Space Agency's (ISRO) Space based Information System for Decentralised Planning (SISDP) and the National GIS by the Planning Commission⁶. One of the best existing examples of a digital resource and land information system is the ORSAC website of the Odisha government. Via this website⁷ it is possible to get a good amount of detail related to land as well as statistical details reaching from the state-level down to individual revenue villages. While the statistical data is drawn from the Census of India and presented in a very accessible and useful manner on the site,

⁶ Thanks to an anonymous reviewer for this point.

the maps are however not detailed enough to allow the correct revenue and forest boundaries to be identified. For this one still has to turn to the original paper maps.

This section draws on fieldwork experiences of the project team while attempting to access official cadastral maps for the study area in Bargarh District. A key element in the mapping part of fieldwork was to access and use the existing revenue maps, known in Odisha as cadastral maps, as the basis for additional mapping. The cadastral maps contain details of the agricultural land, village forests, dams, ponds and other features of each revenue village. By combining the cadastral maps with detailed information from the Odisha government Bhulekh land information website⁸ it is additionally possible to map also the sub-divisions of each surveyed plot.

Accessing the cadastral maps is supposedly possible via local tehsildars in every district as well as via the survey and settlement offices across the state. Perhaps not surprisingly it turned out to be a significant challenge to find an office which not only had the maps but also the capacity to sell a copy of the maps we are interested in. For Bargarh district the maps were never made available locally. This is since it only became a district in 1993 which means that the cadastral maps remain with the Sambalpur Revenue Department to this day. Even when the maps are available it is common to find that there is only one copy available in the office which is not for sale since it is needed for official purposes. It can also not be photocopied since the government office does not have a Xerox machine.

For these reasons it was only possible to access the maps from the Odisha-wide 'Survey & Settlement Office, Maps and Publications' in Cuttack far away from the Bargarh field site. The next issue then became the timeliness of accessing maps. There are different versions of the same maps where the official map requires approval letters and a processing time of several months. Then there is the copy which can be acquired in 10-15 days. The actual timeliness of map delivery is seemingly quite variable based on the delays experienced for the project. A second issue related to access is the cost of 300 rupees per sheet which could potentially be a clear concern when many of the village maps have been made on two or three sheets. In practice it would thus seem like access to maps requires the ability to travel several times to the main office in Cuttack, thereby

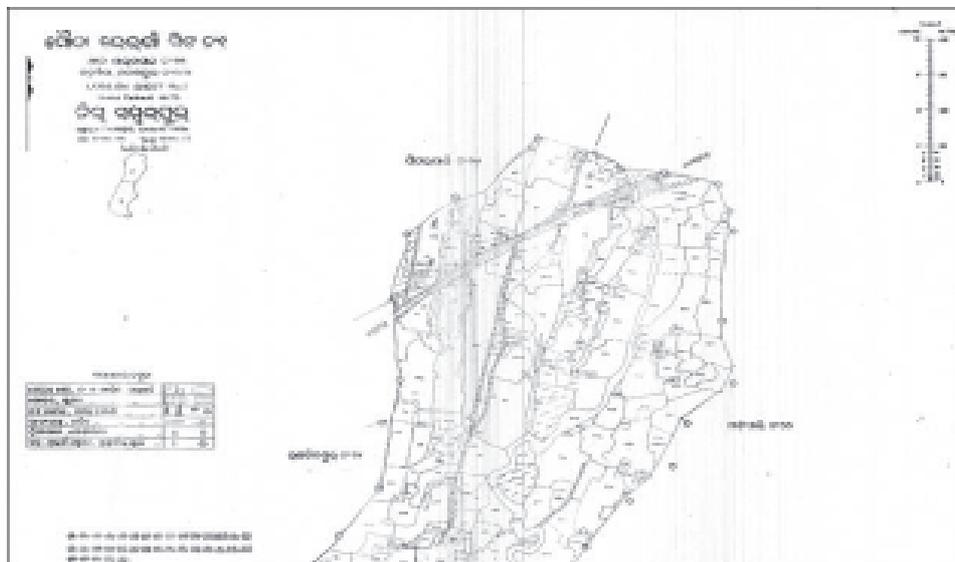
⁷ <http://www.orsac.org/odishasampad/>

⁸ <http://bhulekh.ori.nic.in/>

necessitating money to travel and pay for the prints. Poor people themselves would find this a clear challenge.

Once accessed the quality of the photocopied maps is, as can be seen below, not particularly good especially due to poor photocopying. When the maps are split across separate sheets this complicates the visibility of them. Further, houses and other easily identifiable structures are not part of the maps which only focus on plots of land but without any scale or other geographical referencing system. The design of the maps is just like the process of accessing them not user friendly.

Figure 3: Partial view of a revenue map for Lergan village



Source: Odisha Government 1978

Once copied the revenue maps can however be used as printed maps for fieldwork purposes as well as in mapping software when scanned (and combined). Since revenue maps come without coordinates a crucial part of fieldwork was to record the locations of points indicated on the maps and use these to geo-reference the scanned maps. The best points to use are the triangular-shaped boundary stones known as trishumalis, the points where three revenue villages meet. Other boundary markers are supposed to be present on the ground to indicate the borders between different kinds of land and between separate plots. In reality it was however found that most markers had been removed other than those between villages. Finding these remaining markers is not at all easy and is best done with the help of local people.

4 Data collection at the chosen site

The chosen location turned out to be more demanding than had initially been anticipated. Gandhamardhan was supposed to be removed from the mining conflicts that have been present in many other parts of Odisha. And so it is. But the problem is that Maoists, presumably originally moving in from nearby Chhattisgarh, had recently taken shelter in the forests and with them had come the Odisha Special Police. Frequent combing parties of the police prevented much of the forest-related fieldwork, though not completely.

A second important part of the chosen methodology was to use the already existing revenue maps, in Odisha known as cadastral maps, as the basis for further mapping of officially recognized agricultural land and the in Odisha commonly available village forests.

The seasonality of the work was seen as an important criteria from the start and fieldwork was thus planned for just after the monsoon, in the winter season at the time of harvest, and in the summer to capture how resource uses vary across the year.

Ethnographic methods

The goal of the ethnographic research was to identify different resource users within the chosen village(s) and to engage these for an understanding of how, when and why they use certain resources. A brief survey was carried out initially in order to get an overview of the households in the chosen village. It is known that both tribal and non-tribal households are likely to exist in the area. Expected types of resource use will apart from agriculture on formally settled land include, various forms of podu cultivation on a temporary or permanent basis without recognised land titles, land used for grazing, forest product collection (including important medicinal plants), fishing, and for community purposes including religious rituals and festivals. If all these land uses exist and yet there are no community reserves claimed under the Forest Rights Act as indicated in the table above, an important part of research will be to understand the difficulties in implementing rights. Existing literature was used to get an overview of the peoples and institutions that are most important in Western Odisha.

Institutional analysis

Understanding which formal and informal institutions exist is important when attempting to map how resources are governed and how rights to use them have been

distributed. It is clear that many of these tenure rights depend upon informal, historically influenced social patterns rather than the more modern official system of land rights promoted by the Odisha government.

Formal village-level institutions included:

- ▶ Gram Panchayats
- ▶ JFM groups/Forest protection committees
- ▶ Water management committees/Pond management committees
- ▶ Medicinal Plant Collection groups
- ▶ Women Self-help groups
- ▶ Gandhamardhan Suraksha Yuva Parishad
- ▶ Other (Pani Panchayat, Kala Bikash Kendra, Krushi Bikash Kendra)

Both Panchayat and JFM structures were found to be at best remote in the minds of most villagers. Panchayat leaders were not people that were generally contacted for services and JFM was dominated by a few village elites with others largely unaware of its activities. Other forms of committees appeared to work according to informal practices with no apparent leadership or apparent decision-making bodies. For example medicinal plant collection depended more on knowledge of where to go and how to extract certain plants rather than on any specific arrangements which guided the sustainable use of the plants. This might be since many others from the neighbouring villagers as well as roaming plant collectors and vaidhyas attached to for example the nearby temple could all enter the forest and search for plants. When it was not possible to control plant collection in a certain area it became what appeared to be a free-for-all kind of situation.

Of even greater importance, and more difficult to research, are the informal institutions which can inform much of resource use. Since this sort of institutional arrangement is highly context-specific fieldwork will need to read remain open to local shifts depending on historical dependencies and community-specific traditions.

Informal village institutions in available literature was described as:

- ▶ Traditional village leaders (Gauntia)/Council of Elders/Other influential people (Jhankar/Shankar, Chowkidar, Nariha)
- ▶ Caste/tribe associations (Kula Samaj)

► Religious groupings/Temple committees/Prahari committee

Gaunthias were found to be very influential in the villages although his (all Gaunthias were found to be men) influence varied significantly across the villages from at times not being very influential to sometimes taking on both material and spiritual roles when being both Gauntia and Shankar at the same time. A few people admitted to being part of Kula Samaj but stated these were not very important.

Questionnaire

A stratified random sample livelihoods questionnaire was carried out in all the study villages to get a better understanding of residents. Apart from understanding general livelihood concerns and conditions the questionnaire aimed to capture uses of common property resources related to the forest.

The sample size of 20% of village households resulted in approximately 150 questionnaires being completed with 473 individuals. Questionnaires are indispensable tools to understand how resource access and use varies between villagers. It informs the researchers about how resources are divided between groups in each village and allows for the identification of specific resource users which can be approached for personal interviews and focus group interactions.

Focus group discussions

Focus group discussions are especially useful when getting to know the villages and the people who live in them. Focus group discussions can be made to understand perceptions about what resources are particularly useful in the area for livelihoods, who uses and controls them etc. As the understanding of village dynamics improve specific groups can be brought together to discuss for example the collection of various forest products. Focus group discussions may also prove useful initially to get an understanding of the village history.

Different resource user groups were identified in village interactions:

1. NTFP collectors
2. Grazing
3. Medicinal plants
4. Firewood collection
5. Bamboo

Personal interviews

Personal interviews were carried out with local informants to get an overview of the area, its history and peoples. The strategy was to interview people holding influential positions such as Gaunthias or Panchayat seats, but also to identify major land owners or other particularly influential or knowledgeable people.

For all the villages interviews were made with:

1. Gaunthias (village heads and at times also village priests)
2. Shankars (chowkidars but at times also village priests)
3. Vaidhyas (traditional medicinal men)
4. VSS presidents and members

Capturing resource uses with GPS

Trishumalis needed to be identified so that the revenue maps could become part of a grid-based map. This process of digitisation of scanned maps is a very well-known function which is part of any GIS software. Finding the points in the terrain turned out to be not quite that easy however. Although in many places the original triangular-shaped stones were present there were several occasions when the stones would be missing completely or replaced by regular rocks or some other form of non-standardised identifier. There were also instances when reserve forest boundaries, which coincided with revenue boundaries, had to be relied on.

A truly detailed study would have used a digital GPS rather than the commercially available ones of this study. Such equipment can measure in much greater detail than a GPS but is not only legally restricted but also very expensive to purchase as well as difficult to move in rough terrain. For the purposes here the common GPS system with its up to 3 metres precision was found to be sufficiently accurate as is the case in the international literature on community mapping. An intermediate and more accurate option than the GPS relied on in this project would have been to acquire a 'survey grade' GPS which is available for 25,000 to 30,000 rupees⁹. The final decision on equipment to use will naturally have to depend on available funds as well as the skills to operate it.

Walking tours were found to be a very useful way of seeing the landscape and recording uses of different resources while also interacting with local people with experience of

the history of the area. It allows for ground verification of maps as well as the understanding of points not captured by the existing maps. Some individuals of the villages had been part of earlier land settlement exercises and understood the maps very well. They could also provide help in finding the often elusive thrishumali markers which are supposed to indicate the boundary between villages but was very often found missing or replaced by some other kind of marker stone not having the official triangular shape. The result of the walking tours was not only ground verification and recorded GPS points but also rich ethnographic knowledge.

Participation

Since community mapping has been an expressed element of the proposed research participation was deemed as important. This however was unfortunately not possible to realise to any greater extent during the project for a number of reasons. The main approach used for the project was to find suitable local organisations to work with during a scoping trip in October. Locally trusted people tend to make community interactions more straightforward and mutually beneficial across rural India. Fieldwork in Odisha not only conforms to this general statement but furthermore requires the support of fieldworkers from at least the same part of the state. Language and other aspects of state politics between the usually dominant coastal region and the field site of Sambalpur Odisha meant that the one fieldworker who spoke Sambalpur Odiya was very valuable to the project in terms of gaining local trust.

The main point related to participation is that intense poverty and low levels of education means that it is very difficult for villagers to take even a single day off in order to join work like ours which is for them very difficult to see the benefits of. The project relied to a great extent on the time of villagers in any case and could not have asked for full-time participation especially when it was found that there was no employable youth in the area which would be suitable for the project.

Despite the use of a scoping trip to get in touch with local organisations and to verify useful study locations it turned out to be difficult to get local involvement. One reason for this was that the project had an overreliance on a local movement which in the end proved not to be as well connected as had been anticipated on the scoping trip. This is not to put blame on the movement but simply to state that a movement which operates

⁹ Thanks for this final point goes to an anonymous reviewer.

completely based on volunteers will find it very difficult to have a presence across the area when at the same time having to earn their own living as farmers and shopkeepers in a very poor region. Simply put the movement did not have the resources to keep a presence in all villages and could only provide a few contacts, usually to more influential land owners in the villages, but did not have the solid trust which could have enabled better participation.

It is very possible that a study area close to Khaprakhol in Bolangir District on the South-Western side of Gandhamardhan would have been better from a participatory point of view. This is where the NGO CCD operates and its presence could potentially have allowed for more participation since the trust by working with locally known people could have improved the willingness of people to join the project. This idea had to be abandoned however when it became known that the special police force of the Odisha government had an active presence in the area with combing operations for the last few months.

Planning for a project which really wants to be inclusive and participatory will need to provide much more time for field engagement to build trust over many months. In the present case the poverty of the area, poor educational skills and the difficult security situation prevented any meaningful participation. The project also needs to acknowledge that its over-reliance on local contacts was a vulnerability which did not prove successful. The organisations of the area were either found to be not as influential as they had earlier claimed to be, not as resourceful, or perhaps not really seen as local.

An alternative to the approach attempted in this project would be to allocate project funds to hiring research assistants from the local area. But this form of participation with monetary ties, even if done to ensure proper representation of different groups, come with significant difficulties and will influence outcomes. The conclusion is therefore that there are no shortcuts to proper participation other than being able to find good local organisations or activists who have already worked in the area for a long time.

5 Map preparation

Two versions of map preparation based on the same set of data is presented here. The first one is a version which requires no special GIS software and also only basic computing skills. This version is referred to as the low skills version and is assumed to be sufficient for most struggle groups intent on showing the boundaries of a claim for community

reserves on a satellite image. The second version uses GIS software to produce professional maps which contain a much more detailed picture of land use. This is especially useful for maps of the revenue land where many small plots with survey numbers are part of the map.

Three different kinds of maps can be made based on the data collected during fieldwork.

1. Revenue village maps which detail official land use within each revenue village
2. Forest use maps for the five identified resource uses found to be common at Gandhamardhan during fieldwork (i.e. medicinal plants, grazing, NTFP, bamboo and firewood)
3. Land use change maps which show the actual land use

Below the low and high skills approaches to map preparation are discussed.

Google Earth: The low skills version

This kind of map is for making especially community but also individual forest rights claims. By recording points or make walking tours along the boundaries of a proposed community reserve and importing this data into Google Earth a simple, in fact even trivial, approach to making detailed maps exist. Once the boundaries exist in Google Earth these can be saved and emailed or printed to whoever needs to see the evidence. The only requirements in terms of equipment are a GPS and a computer with an internet connection.

Sample points and walking tours were used to record forest uses. Some of the forest uses, such as the existence of religious shrines, exist in very specific locations. Other forms of uses take place across certain areas but vary across the year, for example the collection of medicinal plants. A third type of resource is the firewood and bamboo collection which takes place in designated areas usually dependent on certain paths which lead to the areas in which the resource is available. For all these resources it was found important to combine walking tours with interviews and focus groups in order to understand actual uses by different local groups. As noted earlier, the difficult security situation prevented more than a few brief tours into the Reserve Forest not only for the researchers but also lately for nearby villagers who especially in the summer season depends on forest resources.

The possibility to utilise freely available resources including Google Earth and only require a GPS device for recording locations is the strength of this approach. It was realised during fieldwork that a further simplification of the process would be to use a mobile phone which has a built in GPS rather than a separate device such as those produced by Garmin. The chances of people being able to use a mobile phone are very good these days meaning that a smart phone with GPS software is a good investment at a similar price (10,000-15,000 rupees) to the Garmin device¹⁰.

For this project an HTC Wildfire phone was used to capture most of the points via the program Maverick. Maverick can save recorded points and tracks in a number of different formats including the kml file which is used by Google Earth. This means that the saved file on Maverick can be opened directly in Google Earth.

The quality of satellite imagery varies in Google Earth with less good quality in India than in for example the United States. Certainly rural areas are also less well-covered compared to the larger cities. Nevertheless high quality imagery is available across large parts of India including for Gandhamardhan where separate houses, agricultural fields, roads and walking paths can be identified. If better images than what Google Earth can provide are required then there is a possibility of purchasing high resolution images from the Indian Remote Sensing agency taken by the Cartosat I and II satellites¹¹.

Satellite imagery is additionally very useful for people who have never used regular maps before. People will be familiar with natural features of their surroundings and can understand a satellite image better than a map improving the possibilities for use and reducing the need for technical experts to explain a map.

The possibility to print or otherwise export satellite images from Google Earth is unfortunately somewhat restricted. A regular screen short can be saved but not higher resolution images unless you have a Google Earth Pro license which costs 350 USD per year (approximately 20,000 rupees). Despite this limitation Google Earth remains a fantastic free tool with great ease of use which should be adopted more widely.

¹⁰ When compared in the field it appeared as if the GPS of the HTC Wildfire phone was at least as accurate as the Garmin. And it was additionally much faster in finding its location, had longer battery life and could record more points due to its larger memory. A newer Garmin GPS might perform similarly to the HTC Wildfire but would still be expected to be more difficult to use.

¹¹ Antrix Corporation, owned by the Government of India, sells images internationally but at a high cost quoted in US dollars, http://www.antrix.gov.in/ps_pricelist.html [Accessed 10 November 2012].

ArcGIS: Producing professional maps

By combining GPS data with the official revenue maps discussed above it is possible to not only map common property use but also compare the official to the actual picture of land and forest use. In the above Google Earth example there is no possibility to transform official records based on paper maps into a map which can be updated and corrected based on local knowledge.

How to use GIS software such as ArcGIS is well-documented in many books and articles and is therefore not covered here. There are also special training courses for those interested in learning this very comprehensive piece of software which has come to be one of the most widely used programs for mapping. Buying the software and having trained people to create the maps remain significant challenges for resource-constrained civil society organisations however but might become easier in the future as computer-skills like GIS becomes more mainstream.

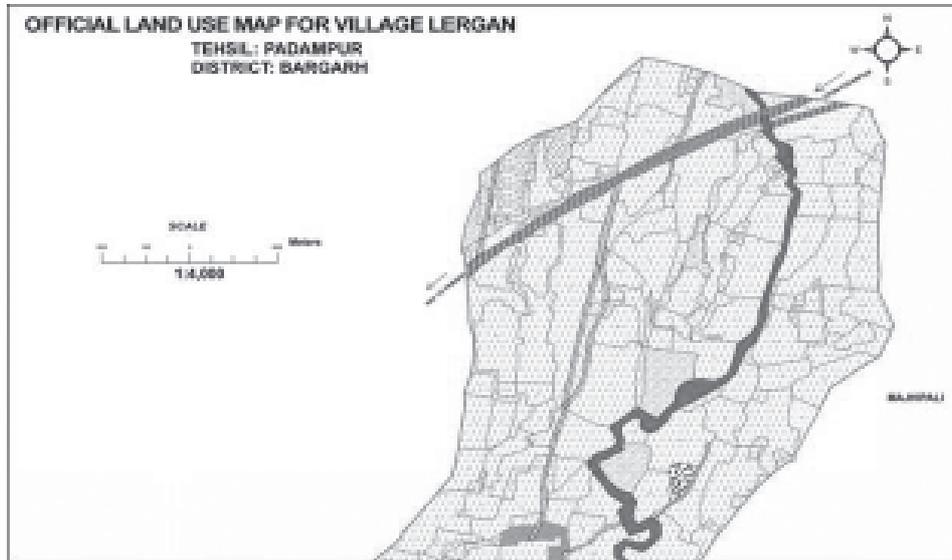
The main problem with ArcGIS is the cost of acquiring a license. Nowadays there are a number of free, open source alternative however. The main option to ArcGIS is Quantum GIS which has existed for a number of years and provide largely the same functionality as ArcGIS. A number of other programs, like GRASS, IDRISI, ILWIS, AGIS can also be useful.

Revenue maps

The first step in analysing the present land use within the revenue villages is to digitise the government maps acquired earlier. Any standard GIS software has a function in which scanned maps can be digitised by adding known locations. The challenge with the Odisha government maps however was that they come in several parts. For example Ranjitpur revenue village was depicted on three different sheets which had to be joined together before they could be digitised.

Once digitised an improved version of the revenue maps can be created (see figure below). The map contains survey numbers and type of land for the entire village and clearly displays the official picture of land holdings for the village in a format which can be printed on small as well as larger sized paper. For further improved maps it is possible to look up the ownership and land uses of the sub-survey numbers on the land register website run by the Odisha government.

Figure 4: Improved revenue map for Lergan village



Source: see Appendix for complete map of this Revenue village.

Once the official revenue map exists in a digital form a comparison can be made with the actual land use. This can be done by including measurements from the GPS and by using satellite imagery, either free images from Google Earth or more detailed ones fields in some of the villages.

Satellite images from Google Earth, while being of good quality, were still found to not be accurate enough to single-handedly decide whether agriculture was taking place. Google Earth satellite images can determine whether forest grows on a certain piece of land with great accuracy but on the ground verification is required to determine what the actual land use is. And only ethnographic methods will be able to tell the social views of the resources which exist on the land.

Revenue maps, while being the most accurate maps available, were nevertheless found to contain various internal inconsistencies. The most peculiar case for the study area was the Rasmunda village map which had a large area which was neither revenue nor forest land. Since all villages had been chosen since they were on the fringes of Gandhamardhan Reserve Forest it was expected that areas that were not marked as revenue on the maps would be reserve forest. But Rasmunda had land which was simply a white spot on the map. Villagers interviewed could not fully explain why this was the

case but had been frustrated for many years when their agricultural fields which were in the white spot could not be regularised since it was not known even by the authorities what kind of land this was and who it belonged to.

Forest use

Since it was not possible to acquire detailed forest maps the project was not able to improve significantly upon on what can be done with the low skills mapping of the previous section. What can be done however is to examine forest and revenue resource uses in combination on a joint map. This makes sense from a livelihoods point of view since significant areas of forest, officially settled as village forest, exists within the revenue boundaries which are used for similar purposes as that further away in the reserve forest.

A more thorough study of the forest, naturally only possible to undertake in a more secure research environment, would want to use a more approach for how to record land uses by spending more time with villagers as they go about their daily work and carry out various social and customary practices in the forest. Understanding each resource and its natural and social conditions take significant amounts of time and are not easily recorded other than in an overview type of manner as was the case for this project. Since the purpose was to explore mapping methods rather than to fully understand the complex natural and social setting of the fieldwork area this limitation makes sense for the project but should nevertheless be stated clearly.

Mapping land use change

By combining the professional map based on government data and prepared in ArcGIS with Google Earth satellite imagery it is possible to construct combined maps to indicate land use changes over large areas since the latest official map was created. Google Earth can here be used, although with some amount of care, to allow for visual identification of actual land use as opposed to that indicated on often outdated government maps. The problem with the method is that it depends on the accuracy of the images, but also that it requires a good knowledge of actual ground situations before statements about the type and quality of land use is made.

Comparing the low and high skills mapping approaches

Revenue village maps can usefully be prepared using the low or the high skills approach. The outer boundaries of each revenue village can usually be verified by recording the locations of the boundary stones on fieldwork. But the low skills version will find it

very difficult, if not outright impossible, to map all the survey numbers within each village. If this is to be done it will require a lot more fieldwork and still be considerably less precise than mapping based on existing government maps in the high skills approach. Since either mapping method is not going to be as precise as the maps prepared by the Revenue department, due to the limitations in the accuracy of the GPS devices, the main goal of the maps can be to point out the great inaccuracies in official maps and demand an update by the government.

The research project was not able to get hold of forest maps for Gandhamardhan. This meant that the high-skill maps even if produced using the best software available can not hope to provide much more detail than what can be seen on a satellite image. What can be attempted however is to rely on the less accurate toposheet maps for forests and revenue maps for the village areas of the fieldwork. In this way a quite accurate larger map of the fieldwork area could be produced on top of which the collection of GPS data could be added.

High skill maps can additionally be created for larger scale. Relying on Google Earth typically means that the screen resolution of the computer is the limit to how large the maps can be made. A license for high resolution images can be bought from Google but since this is very expensive at 399 US dollars per year it is likely that it would be better to invest in the software used for high skills map-making here instead.

Additional kinds of maps can be used to visualise particular resource, for example the spiritual sites of the hill. There is also a great opportunity to create temporal maps which show resource use across time to include the often significant variations between seasons. Certain activities, the collection of certain medicinal plants or NTFP, will only take place at specific times of the year. Other activities, such as grazing, is carried out throughout the year but varies spatially for example by utilising the agricultural fields just after harvest.

6 Conclusion

This Working Paper has detailed a process of community mapping of natural resources which combines technical GIS tools with ethnographic methods to create maps based on local resource uses. There are great benefits to this approach since officially recognised maps by various governments tend not only to be outdated but also largely supportive of elite rather than community interests in the ways that resource uses have been settled.

It is believed that the methods discussed could help provide detailed evidence in support of community natural resource uses over those preferred by private companies, for example mining, or those preferred by governments, for example national parks, in areas usually described as empty of people but in reality often supporting some very poor and vulnerable groups.

A number of significant opportunities exist in terms of creating maps in favour of pro-poor concerns. On revenue land maps using data collected by the project can show that the official land register is not correct and needs to be updated to include many new agricultural areas. If this does not happen then villagers will continue to face fines and various forms of harassment in the future. In the reserve forest opportunities are even greater due to the Forest Rights Act. Here forest-fringe villagers, and to some extent villagers further away from the hill, need to get together and decide how to demarcate community areas. The project, despite security concerns, has been able to record a wide range of community uses of the reserve forest ranging from the collection of medicinal plants, bamboo and firewood to spiritually important sites including some very close to the bauxite-bearing top of the hill. It is clear that people depend upon large parts of the hills for their various needs and should make use of the right to make community claims. Finally, in case mining is proposed at some point in the future, EIA reports and similar official planning documents could be countered by maps which show that local people live in the area and depend on the forest which in the future may be proposed for mining.

The methodology described uses one low and one high skills option to enable a wider adoption of the tools and processes. It is believed that some of the basic, but also most relevant for Forest Rights, mapping can be done using the low skills version at a very low cost by community organisations. This would involve a GPS device and access to a computer with the free Google Earth software on it. The low skills mapping methods combined with a knowledge of the regulations that are part of the Forest Rights Act would enable communities to make claims for titles with much better detail, less ambiguity and based on community rather than official perceptions on which land should be claimed than what is presently the case. The combination of Google Earth and GPS for community claims is a simple, yet very precise, tool. It is in fact simple to the point of being trivial to use particularly in the case of a GPS built into a mobile phone which a large part of especially the rural youth would be able to handle.

Before the high skills methodology explored in this working paper is taken further there is however a number of challenges before widespread community mapping can become a reality. Compared to the Western countries on which most of the existing community mapping literature is based it is very difficult to get hold of quality maps to use as foundation mapmaking. Also for this project which contained relatively experienced and well-resourced project members it proved not only expensive but also a time-consuming and challenging experience which took several months to complete. And once the maps are in hand it quickly becomes clear that these are not up to date nor of very good quality and needs to be combined with additional data in order to understand the detailed official picture. Only a handful of civil society organisations across India could be expected to be able to replicate this feat at present. Additionally actual map-making will of course require further skills as well as resources in terms of computers and GIS software. As GIS knowledge becomes more widespread it is nevertheless believed that the techniques outlined in the high skills approach will lead to additional benefits suitable for justice claims on revenue land not possible to realise using the low skills version.

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