

PARTICIPATORY MAPPING FOR LOCAL MANAGEMENT OF NATURAL RESOURCES IN VILLAGES OF THE RUFJI DISTRICT (TANZANIA)

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ABSTRACT

Tanzania has introduced legislation that allows communities to locally manage their natural resources. From 1998 to 2003, the Rufiji Environmental Management Project (REMP) promoted such a transfer of authority, from the central government to 4 pilot villages of the Rufiji District in southern Tanzania, mainly for forest resources. These communities developed Village Environmental Management Plans (VEMP). Land-use maps have been produced by multi-institutional teams using Landsat images, aerial photographs, detailed landscape analysis, ground-truthing and incorporation of the results in to a GIS.

Cartography and Environmental Management, carried out in a participatory way, were shown to be effective tools for the improvement of communication and information sharing between local populations, government institutions and researchers. The mapping of land use in the Rufiji District can potentially clarify a fuzzy land-tenure situation, especially in the floodplain. This area, considered as under-utilised by the local authorities, is in fact extensively cultivated by the Warufiji populations who have abandoned the *Ujamaa* village scheme. The mapping of the 4 areas, by the villagers themselves, equipped with GPS, was instrumental in their official recognition as Village Forest Reserves. Mechanisms still need to be put in place for the resolution of land-use conflicts between villages and for the mediating role that local government should play.

For improved planning, this participatory mapping exercise has to be complemented by a detailed analysis of the economic and spiritual values of the different landscape components, and by a description of the local rules of resource sharing. The drive towards increased local management of natural resources still needs to be supported by a strong Government with the will to empower and to secure the local benefits of the decentralisation process.

INTRODUCTION

Common property regimes (Schlager & Ostrom 1992), which have largely been ignored or supplanted by nation states, have returned to the forefront in natural resource management, often carried-out in collaboration with the government (Borrini-Feyerabend *et al.* 2004). The new Tanzanian legislation on decentralisation allows communities to locally manage their natural resources (Mniwasa & Shauri 2001). From 1998 to 2003, the Rufiji Environmental Management Project (REMP), implemented by the District Government with financial support from the Dutch government, and technical assistance from IUCN (The World Conservation Union), promoted such a transfer of authority, from the central government to 4 pilot villages of the Rufiji District in Southern Tanzania, mostly for forest resources. This was only one aspect of a much wider process of capacity building for environmental management in the District Government.

For historical reasons, the land tenure situation in the Rufiji floodplain is complex: a resettlement scheme moved people from the floodplain to the terraces during *Ujamaa* in the 1970s and a return movement to the floodplains occurred in the 1980s. Therefore, knowledge of the present land use pattern is today limited; there are no accurate maps of the land in use by the local communities and the land tenure situation is precarious. The transfer of authority of natural resources management needs to be built on a thorough understanding of current land-use practices and linked to zoning into agro-ecological units and thereafter consolidated through the production of maps. As part of the wider process of Village Environmental Management Planning, one of the aims of the participatory mapping exercise was to improve communication and information sharing between managers, villagers and researchers and to reach a consensus on the current land tenure situation. Participatory GIS was thus considered as a tool that could contribute to such a process (McCall 2003) although here too, like elsewhere, its impact on the empowerment of the communities still needs to be better documented.

Due to insufficient public knowledge of the previous uses of the floodplain it became both necessary and urgent, as both an advocacy mechanism and a means of communicating with policy makers to identify, through participatory mapping of the functional spaces used by the local communities and the subsequent integration of the resulting data in a GIS.

Prospective studies in the same area had already established that these floodplains consists of a patchwork of fields (in use and fallow) as well as dispersed dwellings. A two-pronged methodology; one applying more traditional mapping techniques, and a second, enhanced by Geographic Information Systems and Technologies (GIS&T) was therefore deemed necessary to unravel this question of threatened livelihoods as well as facilitate communication between indigenous peoples and their government over rights to land and other natural resources.

2 - THE METHODOLOGIES

2.1 - The Environmental Planning and Participatory Mapping at Village Level

The participatory mapping exercise was part of a larger environmental planning process jointly conducted by the population of the selected villages, Rufiji District staff, IUCN technicians, Tanzanian and European scientists.

Participatory rural appraisal techniques were used to design the management plan according to the following steps:

A problem and opportunity analysis; priorities identification and proposing solutions; selection and training of a temporary village environmental

management planning team; development of village environment management plan; Implementation of the environmental management plan; review, revision of the plan, verification and/or developing supporting legislation for the plan.

Following the participatory mapping process, which employed local knowledge of land use arrangements, a paper map of the village was produced. A team of topographers from the National Forest service delimited the boundaries of the forest reserve to separate it from the farmed areas. A comprehensive map of the village landscape and land use was then produced by multi-institutional teams (Villagers / District Agents / Scientists) using GPS (Global Positioning System) and this was integrated into a GIS (Geographic Information System). The Products (VEMP, Maps) were discussed and approved. They were then ratified by the District authorities and the Forest Reserve and adjacent land uses were then registered at the National level.

2.2 – Geographic Information System - Enhanced Cartography

In the absence of an existing base map for the Rufiji District, two Landsat 5 Thematic Mapper images of 2000 were used (Pixel of 30m by 30m). These were combined with 250 1999 aerial photographs at 1/50,000 resolution obtained through Photomap Ltd. (Nairobi, Kenya) and these were geo-referenced.

Each GIS thematic layer was prepared according to the following steps:

2.2.1 - Preparation of Images and Photographs

- Scanning of 250 aerial photographs;
- Acquisition of GPS co-ordinates of recognisable objects (5 per photograph with 10 to 30m accuracy), usually crossroads, buildings or large trees or, in the mangrove, connection points between waterways;
- Geo-referencing of the photographs with ERDAS Imagine software;
- Spatial Analysis of the Landsat image with ERDAS Imagine software.

2.2.2 - Landscape Analysis and Land Use Cartography

On the basis of spatial heterogeneity in the images, landscape units were identified and their cover ground-truthed by a mixed team (villagers, a geographer, a botanist, an ecologist). Land use and topography were recorded during field visits by the same team supplemented with District staff. Each village delineated a village forest reserve which they intended to either manage jointly with the government (if it was already part of a reserved area) or autonomously on the basis of an approved management plan.

2.2.3 - Production of Maps

All the information collected were integrated in a GIS (ArcView 3.2a from ESRI).

The village land use maps were produced and draft versions were printed. These were completed after being reviewed by the Villagers and corrected. They were then edited in Arcview 3.2a (Fig. 1 to 4).

3 - RESULTS AND DISCUSSION

The participatory process for the production of the village management plans took about 5 years. It was very important not to rush things and to make sure each step was completed and that there had been sufficient awareness raising, information and discussion for consensus before moving to the next step (Hogan *et al.*2004). The mapping and integration into a GIS part took about 7 months to complete. In 2004, the VEMPs were awarded with the UN

Equator price dedicated to “outstanding local efforts to reduce poverty through the conservation and sustainable use of biodiversity (UNDP, 2006)”

The use of Landsat images was essential to achieve a geometrically correct map of the basic landscape units (terrace, floodplain, mangrove) and the linear features (roads, water bodies). However, the resolution (30mx30m pixel) was insufficient to allow an accurate interpretation of the complex mosaic of forest, closed and open woodland, grassland and agricultural areas. The aerial photographs were essential for the establishment of the detailed landscape and land use categories and extensive ground-truthing was necessary for validation.

Still, the mapping only provided a static picture and did not take into consideration the dynamics of use strategies. For example, in the floodplain, permanent fields on the sandy ridges bordering the water courses and in the deepest clay depressions, alternated with temporary fields and fallow areas. This gives the false impression that only about one third of the floodplain agricultural area is in use but users move when the yields in their current fields decrease. Also, an ordinary map would represent a certain geometric view of the world based on western concepts of private property, exclusive land use and commercial harvesting (Leroy 1991). This would often not take into consideration the complex sharing of ecosystems between villages or lineages, nor, would it represent the local perception of space (spiritual values, sacred groves). Traditionally, the floodplain and the hill tribes have ‘joking’ relationships tied in with a mutual aid ‘agreement’ which means that, in years of bad rainfall, the floodplain people cannot refuse to provide the hill people with food and vice-versa, in years with insufficient floods. Also, the forests and woodlands were traditionally the safety net which could provide subsistence foodstuffs or timber that could be commercialised to allow purchase of foods. Numerous taboos existed on certain species and their harvesting requiring complex rituals. By creating ‘forest reserves’ for the exclusive use by the successive governments (German and British colonial and independent Tanzania) local communities were effectively excluded from using this safety net.

Devolution of resource management to local government, in combination with improved road access and the opening-up of the Tanzanian economy, led to increasingly unsustainable use of the forests which provided 60% of locally raised district income (Rufiji District Forest Action Plan Task Force & Kessy 2002).

From the management point of view, the GIS-assisted participatory mapping process conducted by a multi-institutional team at least created a platform of dialogue between the administration and the users.

CONCLUSION

The participatory mapping exercise, conducted by multi-institutional teams, achieved its objective of producing village land use maps. The integration geographic information systems into the process facilitated the production of geo-referenced images of sufficient quality for the official recognition of village forest reserves and land use spaces. However, the process required substantial external support. In fact, throughout Tanzania there has not been a single transfer of natural resource management authority to the village level without external donor support such as this one.

The process was instrumental in a change of attitude in some of the district staff that now better appreciate the quality of traditional knowledge, the capacity of the local communities in resource management and the sophistication of their agricultural practices. The clarification of these, in relation to the use of the floodplain, will hopefully lead to a more secure land tenure situation for the floodplain dwellers.

The production of geo-referenced village maps has provided a useful basis for dialogue within the village, between villages and between villagers and local government, leading to better communication and improved information sharing. The village planning process, with its associated capacity building and locally facilitated dialogue, would seem to be more important than the current products (VEMP, map) and these should be regularly revised and upgraded thanks to their incorporation into a GIS.. The geometric delineation of space is essential for legal procedures such as the transfer of management authority but does not capture the cultural, economic and spiritual values of the area, nor does it elucidate the traditional intra- and inter-lineage and community management systems. It therefore needs to be complemented by a more anthropological and sociological analysis of perceived space. This is envisaged through a joint research project (2005-2008) by the Institute of Resource Assessment (IRA) of the University of Dar es Salaam (UDSM), the Research Unit n°169 of the French Institute of Research for Development (IRD) and French Institute for Research in Africa (IFRA) (Duvail 2004).

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FIGURES

Figure 1, 2, 3 and 4 are available in separate files.