Through the Eyes of Hunter-Gatherers: participatory 3D modelling among Ogiek indigenous peoples in Kenya

The participatory mapping of their ancestral territories stimulated community cohesion among the Ogiek indigenous people of Kenya and helped them to appreciate their unique cultural identity and indigenous knowledge system.

Giacomo Rambaldi, Julius Muchemi, Nigel Crawhall and Laura Monaci

INTRODUCTION

The participatory three-dimensional modelling (P3DM) exercise discussed in this paper is part of a 2006–2008 project aimed at 'Strengthening the East African Regional Mapping and Information Systems Network'. The project was implemented by the NGO Environmental Research Mapping and Information Systems in Africa (ERMIS-Africa), and technically and financially supported by the Technical Centre for Agricultural and Rural Cooperation (CTA) and the Indigenous Peoples of Africa Coordinating Committee (IPACC). In parallel to fulfilling its main objective, the initiative provided the Ogiek indigenous people with an opportunity to apply P3DM to their situation of vulnerability, land and natural resource loss. The Ogiek application of the participatory methodology whilst mapping out their ancestral territories served as a training ground for representatives from non-governmental organizations (NGOs) and indigenous peoples[1], community-based organizations (CBOs) from ten African countries in practicing participatory GIS (PGIS) methods and specifically P3DM in the contexts of collaborative natural resource management, customary resource tenure, and safeguarding cultural identities.

The exercise took place in the village of Nessuit, Nakuru District, Kenya during the month of August 2006 after a 10-month preparation period. It has been the first of its kind in Africa and has drawn from P3DM experience in other regions of the world, in particular, Southeast Asia and the Pacific (Rambaldi and Callosa-Tarr, 2002; Rambaldi, Tuivanuavou et al., 2006). The village of Nessuit is located on the slopes of the Mau Forest Complex and is mainly inhabited by Ogiek people who, traditionally, used to be one of the larger hunter-gatherer communities in Eastern Africa. The Ogiek have used other participatory mapping methods before, including working with aerial photographs. This was their first opportunity to work on model building using a fully participatory method.

Within the context of the mapping exercise this paper focuses on the course of action and related human dynamics which led to the production of the map legend through a participatory process. Though community mapping processes have many interesting components, it can be argued that the collaborative development of the map legend is the key process on which the quality of a participatory mapping exercise and its outputs depend. It is a community-developed and universally understood map legend that allows local spatial knowledge to be expressed in an objective and efficient manner which may contrast with the dominant intellectual framework which is usually presented on 'official' maps. When a map is used to support dialogue or negotiations, it is particularly important that its graphic vocabulary is fully understood by all parties involved and each displayed feature has a key to be objectively interpreted (Rambaldi, 2005).

BACKGROUND

The Mau Complex

The Mau Forest Complex forms the largest forest block in Kenya, and the largest single block of closed-canopy forest in Eastern Africa (Nkako et al., 2005). The Mau Forest Complex is one of the five water towers in the country, providing the upper catchments of major watercourses, including the Nzoia, Yala, Nyando, Sondu, Mara, Kerio, Molo, Ewaso Ngiro, Njoro, Nderit, Makalia, and Naishi Rivers. In turn these rivers feed major lakes, including Natron, Victoria, Turkana, Baringo and Nakuru (Nkako, 2005). The boundaries of the Maasai Mau Forest were agreed upon in 1987, based on the work of the Ntutu Commission. Since the

delineation, large tracks of forest were cleared outside the boundaries and more recently severe encroachments have taken place inside the forest boundaries leading to a dramatic loss of forest cover, and to the destruction of large forest ecosystems (Nkako et al., 2005; United Nations Environment Programme and Kenya Wildlife Service, 2005) and severe impacts on the livelihoods and cultural landscapes of the concerned indigenous communities.

The Ogiek Peoples and their Environment

The Ogiek are one of the so-called 'Dorobo' peoples of Kenya: hunter-gatherers whom the colonial British preferred should not survive as a people and who hence lost their legal status as an ethnic group with any rights to land or identity. The word 'Dorobo' is a derogatory name derived from a Maa term 'il Torobo', referring to people without cattle or hunter-gatherers (Towett, 2004). Today, like many other African indigenous peoples, the Ogiek are not formally recognized by the State and find themselves in a vulnerable situation politically, economically and culturally.

The Ogiek were originally forest dwellers with a hunting-gathering economy that was symbiotic and articulated with their other Nilotic neighbours, including the Maasai, Kipsigis, Nandi and some Bantu agricultural peoples. Over time, and particularly with land insecurity built into the equation, the Ogiek of the Mau Forest Complex lost their autonomy, their traditional economy collapsed and the forest was targeted for eradication by new settlers and logging.

From the 1920s, Nessuit became a site of both colonial missionary activity and industrial forestry. Over time, both of these influences deterred people from maintaining their traditional economy and belief systems. Particularly in the last 10 years, the Kenyan government has overtly or tacitly permitted logging on the Mau Forest Complex, leading to a serious ecological disaster, the depletion of the forest and related biological diversity, and consequently the destruction of the Ogiek natural and cultural landscapes.

Threats to the Ogiek Community

The threats faced by the Ogiek people are similar to those of all hunter-gatherers in Africa. Non-recognition and small population numbers make them politically vulnerable. Forests are also being targeted by both logging companies and settlers looking for more farmland.

In an effort to conserve their territorial entitlements, which include natural resources and cultural heritage, the Ogiek have resisted the attempts of successive governments to arbitrarily reallocate their lands. The colonial and post colonial governments denied the Ogiek community the rights over their ancestral domains. The 1932–1933 Kenya Land Commission chaired by Sir Morris Carter aimed to assimilate the Ogiek people into the dominant ethnic groupings (Kilson, 1957). In 1992 the Government de-gazetted part of the forest reserve and supported the resettlement of poor and landless households from other parts of the country within the Ogiek's ancestral land. The initiative had political dimensions and was characterized by forced evictions and depletion of livelihood sources.

The Ogiek, despite their poverty, launched a series of court cases[2] to challenge the de-gazetting and the subsequent allocation of lots to non-Ogiek settlers, as well as the subsequent surge of deforestation. Their cause gained a degree of international recognition for their attempts to use the courts to challenge the Kenyan Government (see www.ogiek.org). Case HCCA No. 635/97 was successful though the Ogiek are now threatened with being displaced by belated conservation efforts by the State. According to recent media reports, their denuded traditional territories may be included in a National Park to protect the exposed sources of Kenya's major rivers.

Ogiek Mapping their Lands

In pursuit of obtaining extra-judicial resolutions over existing territorial disputes and of securing their territorial rights, the Ogiek people have embraced modern Geographic Information Technologies to delineate their ancestral lands and inventory natural and cultural resources. In June 2005 ERMIS-Africa, with financial and technical assistance provided by the Eastern and Southern Africa Partnership Program (ESAPP)[3], assisted members of 21 Ogiek clans in using aerial orthophotomaps to identify ancestral landmarks and delineate the clans' territorial boundaries. In the process, elders from neighbouring clans validated the boundary outlines. The encompassing areas were further divided into main family lineage units and finally into natural resource management units. Map attributes for indigenous spatial units and features were included using vernacular toponomy[4]. The data were transposed into a geographic information system (GIS) and overlaid with additional information. Ogiek

elders requested the mapping of their entire ancestral territories and deliberated on the need to develop, publish and disseminate (to various government ministries, research and education institutions, and development organizations) a multimedia atlas consisting of interactive maps and media capturing and disclosing selected knowledge and wisdom of the Ogiek clans. To support their quest and extend the area covered by the photo-mapping exercise, members of a clan sold some cattle in order to buy missing aerial photographs.

Ogiek activists learned about P3DM at the 2005 Mapping for Change Conference[5] in Nairobi and requested for the method to be introduced in support to their ongoing participatory mapping efforts. Participatory 3D modelling (P3DM) is a communicative facilitation method. It supports collaborative processes related mainly to resource use and tenure. It aims to facilitate grassroots participation in spatial problem analysis and decision-making. P3DM integrates people's knowledge and spatial information (contour lines) to produce standalone scale relief models. These have proved to be user-friendly. They are relatively accurate data storage and analysis devices and at the same time excellent communication media. The difference between an ordinary contour map and a 3D relief model is the vertical dimension. This provides important cues to stimulate memory and facilitates the establishment of spatial associations (Rambaldi and Callosa-Tarr, 2002).

Significantly, despite the highly politicized context in the Mau Forest Complex, the Ogiek elders opted to use the P3DM process for documenting, safeguarding and transferring their traditional knowledge across generations rather than for supporting their cases in court. According to the elders, young people do not hunt, gather or even walk to the remoter parts of the ancestral Ogiek territory and are losing their cultural heritage and knowledge.

Figure 1. Ogiek elders establishing spatial relations between the blank 3D model and their real world. Colour versions of figures are available in the online version, see Editorial for details.

THE PROCESS

Preparatory Phase

The preparation of the 3D mapping exercise took several months and included the following activities:

- establishment of an organizing committee
- consulting and mobilizing students and stakeholders
- choosing the appropriate mapping scales (vertical and horizontal) and area of interest
- acquiring topographic map sheets from the Survey of Kenya
- generating digital contours and preparing a base map
- procuring inputs
- making logistical arrangements.

Although the drafting of the map legend was listed among the preparatory activities, it was omitted at this stage because of other priorities.

The Mapping Exercise

The 3D modelling exercise lasted for 11 days and involved the following activities:

- delivering an orientation on facilitation techniques and P3DM practice
- facilitating the construction of a scaled and geo-referenced 3D model by school children
- facilitating the composition of the map legend depicting mental maps by elders
- extracting of these data via digital photography.

On-screen digitizing, ground-truthing and generation of thematic maps followed during the months of September-December 2006.

The mapping exercise was attended by members of the local communities, facilitators, and a number of national and international trainees. The local community was represented by schoolchildren (30), schoolteachers (6) and approximately 120 Ogiek elders, men and women delegated by the 21 clans.

Students manufactured the blank scaled 3D model in three days. Once the model was completed (Figure 1) elders from selected clans worked on it in three shifts each lasting approximately 1.5 days. Each shift accommodated 5–7 clans and every clan was represented by four to five elders. Participants were provided with all necessary tools and codes to work on the model. The latter was composed of two units measuring 2.4 m × 1.2 m each. The authors of this paper facilitated the exercise together with the trainees, who formed a well-assorted multidisciplinary team.

The exercise led to the construction of a solid three-dimensional 1:10,000-scale model of the Eastern Mau Forest Complex covering a total land area of 576 km^2 (Figure 2).

The final model depicts the physical biological and cultural environments as they used to be in the 1920s with a highly dense forest cover, a permanent river network flowing from the upper water catchments and a dense population of beehives among other characteristics. The decision to visualize the local bio-physical and cultural landscapes as of the 1920s emerged from an intense dialogue between elders and middle-aged activists. Though only a few elders were alive at that time, they felt that 1920 marked a period in living memory characterized by pristine environments and corresponding to the first arrivals of the missionaries and foresters. Questioned on how they could know the territory as early at the 1920s, middle-aged Ogiek replied that they were not *visitors* in the area, meaning that although born after the 1920s they were quite conversant with the landscapes of that period thanks to detailed knowledge acquired from their parents and grandparents.

The fact that no map legend[6] had been drafted ahead of the mapping workshop called for the *ad hoc* organization of a dedicated exercise which went through the following phases:

- one-to-one consultations
- focus group discussions
- composition and adoption of a draft legend
- discussion among elders on the understanding of the proposed definition of a series of land units
- realization that there was lack of consensus
- matrix making
- composition of a final draft legend
- updating of the legend.

Ogiek Legend Making

The making of the legend took approximately three days of intense discussions among elders. It involved reaching agreements among clans on the naming and description of "the way the Ogiek traditionally discern the territory and its eco-cultural-systems" to define and code culturally acceptable land units[7]. This process – which is the main subject of this paper – benefited

Figure 2. Ogiek elders transposing their mental maps on the 3D model.

from skilled facilitation. It has been flexible and able to adapt to changing circumstances. It started with individual consultations followed by focus group discussions.

During the one-to-one and focus group discussions an Ogiek facilitator with a handful of elders worked out the types of spatial data they would expect the informants to display on the model (see Table 1). The Ogiek facilitator was supported by a linguist with anthropological training. His role was to watch the process and help investigate and sharpen the concepts as they emerged. Questions posed by the support-facilitator included: *If a tree is sacred, is it only a certain species or can any tree be so designated? Is this information restricted to certain ritually qualified people or can such a tree be indicated to a non-initiate?* and so forth. This was the basis of the legend building. In ideal circumstances this procedure would be initiated in advance of the actual mapping exercise. In the Nessuit case, the composition of the legend happened concurrently with the actual building of the model.

The focus group discussions involved a limited number of elders who did not fairly represent all 21 clans. This resulted in a draft legend which raised animated discussions when proposed to the first group of informants. The facilitators realized that there were still a number of inconsistencies to overcome, specifically related to objectively defining and describing – across clans – the criteria used by Ogiek people to differentiate land units. The key issue was that criteria were multiple and cutting across biophysical and social-economic domains, as discussed below. In addition to that, as mental maps were progressively visualized by elders on the model, it became evident that the facilitators' preliminary understanding of the altitude as the only element of categorization of land units was too simplistic.

	Vernacular	English
Polygons (paints)	Mosop, Mosop, Moou, Gaporowo, Ing'utngutioit, Rogroget, Teegeg, Tuimasat, Logomo, Tiriig, Saapo, Isawanit, Sooywo	The detailed description of each legend item (area) was produced via the matrix making process.
Point (pins)		
	Kaap Timwueg	Forester
	Maat	Makeshift Hut
	Inaagai ta	Homestead
	Gesuungut	Honey pot
	Mwenget	Bee Hive
	Goog	A place where elders stay
	Gereret	Boundary Tree
	Tielumbut	Sacred tree
	Iyegisonei	Death tree
	Poonet	Tree Hole
	Sopoitiit	Sacred Fig
	Iyegiunekee	Wash Place
	Iyekirusin Toorusiek	Initiates Wash Place
	Koong'ta	Spring
	Luglugkoonik	Rapids
	Isawanit	Swamp
	Iyetaltal	Crossing
	Tiriikweg	Clearing
	Kapkol	Logging Company
	Iwoyet	Bridge
	Kepenet	Cave
	Mapwaitap	Shrine
	Tugosiek	Shop
	Sipitali	Hospital
	Sugul	School
	Iwoyet-Topcherangany	Traditional Sengwer-Built Bridge
	Tuunoeg Cheriigoti	Hunter Trap
	Opis	Office
	Lembagaa	Festival Arena
Lines (yarn)		
	Wakta	Path
	Wakta oo	Road
	Irongiit	Animal Track
	Oinet	River
	Koong'it	Tributary
	Tiilet	Boundary

Table 1. Sample items appearing on the final version of the map legend.

To address this shortcoming the facilitators decided to use a matrix, first to collate the terms by which the Ogiek would traditionally differentiate land units, secondly to establish the criteria used to differentiate these terms, and thirdly to facilitate a process whereby each term was described against set criteria. The matrix would enable informants to clearly discern the individual land units by describing their biophysical and cultural characteristics, thereby allowing for a consistent use of the identified classes during mapmaking (Figure 3).

All of the conceptual work was carried out in the Ogiek language, then translated back into Swahili and English for the non-Ogiek participants.

The Matrix Process

A land cover mapping expert assisted by translators facilitated the elucidation of the matrix. Altitude was considered the main criterion of distinction, then other important indicators for the categorization of different units were listed, such as rainfall, soil type, temperature, vegetation, quality and type of honey, medicinal plants and game.

The development of the matrix occurred via focus group discussions (Figure 4). Men and women contributed separately; they are apparently holders of overlapping but distinct knowledge fields. In particular women displayed deep knowledge of plants and their medicinal uses, whereas men were more conversant with game and beehives distribution, and types of soil.

The matrix was also the first occasion where the Ogiek needed to make a specific decision on privacy and their intellectual property. Good PGIS practice puts great emphasis on protecting people's rights, privacy and intellectual property (Rambaldi, Chambers et al., 2006).

Land Unit	**Differentiation criteria**							
	Rainfall ***Ropta***	**Temperature** ***Garisto***	**Altitude** ***Torotindo***	**Vegetation Type** ***Timdo***	**Soil Type** ***Ng'unyenyeg***	**Game Tioindo**	**Honey Sweetness** ***Gomeg (Anyinyindo/ Ng'wan)***	**Medicinal plants** ***Ketig***
Mosop (lower elevation)	*Nyigis* Heavy rain	*Kaitit* Cold	*N'guony* Low	*Timdo* Indigenous forest	*Ng'eremug* Red soil	*Tumba* Big wild pig	*Anyiny* Sweet	
					Menet Clay soil	*Puteito* Warthog	*Ng'wan*Bitter	
						Minde Antelope	*Kipirigei* Dark but not very aggressive bees	
						Rogoyuet Antelope		
						Poinet Antelope		
						Inderit Hyrax in the tree		
						Tisiet Black monkey		
Rogroget (higher altitudes)	*Nyigis* Heavy rain	*Kerundet* Mist	*Toror* High	*Sisieg/ Ketig* Small Bamboo/ Trees	*Gemgem* Brown (infertile)	*Poinet* Antelope	*Anyiny* Sweet	
						Inderit Hyrax in the tree	*Kipirigei* Dark but not very aggressive bees	
						Tisiet Black monkey		

Figure 3. Sample of the content of the matrix.

Figure 4. Ogiek people working on the matrix.

As the matrix emerged, the discussion touched on the subject of medicinal plants. After being made aware on the possible implications of disclosing such knowledge, informants decided that such information be collated but kept confidential. Consequently when the matrix was transcribed and photographed, one column was obscured (Figure 5).

Consolidation of the Legend

The matrix exercise provided elders from different clans with the opportunity to get to a consensus or at least to a common understanding about the terminology and categorization of areas.

The legend items (Figure 6) were divided into three categories: points, lines and polygons (areas). Points, including dwellings, evocative trees, water points, beehives, and others were represented by various pins (map-pins, push-pins and flat pins) of different colour, size and shape (bridges belonged to this group even if they were represented by small striped rectangular pieces of light carton board). Place names were located by the use of a label fixed with a pin. Linear features (lines) like human or animal paths, rivers or clan boundaries, were represented by yarns of different colours. Homogeneous surfaces (polygons) like land units were represented by different uniform colours or patterns.

As the legend went through updating and integration throughout the mapping exercise, the trainees were tasked with mixing new paints and inventing new pin codes to capture the full diversity of the Ogiek worldview. Records taken show the changes. On day 5 the legend contained 9 areas, 6 lines, and 29 points, or a total of 44 elements. On day 11 the final version shows 15 areas, 6 lines, and 30 points, for a total of 51 elements. New legend items were added, others were reworded

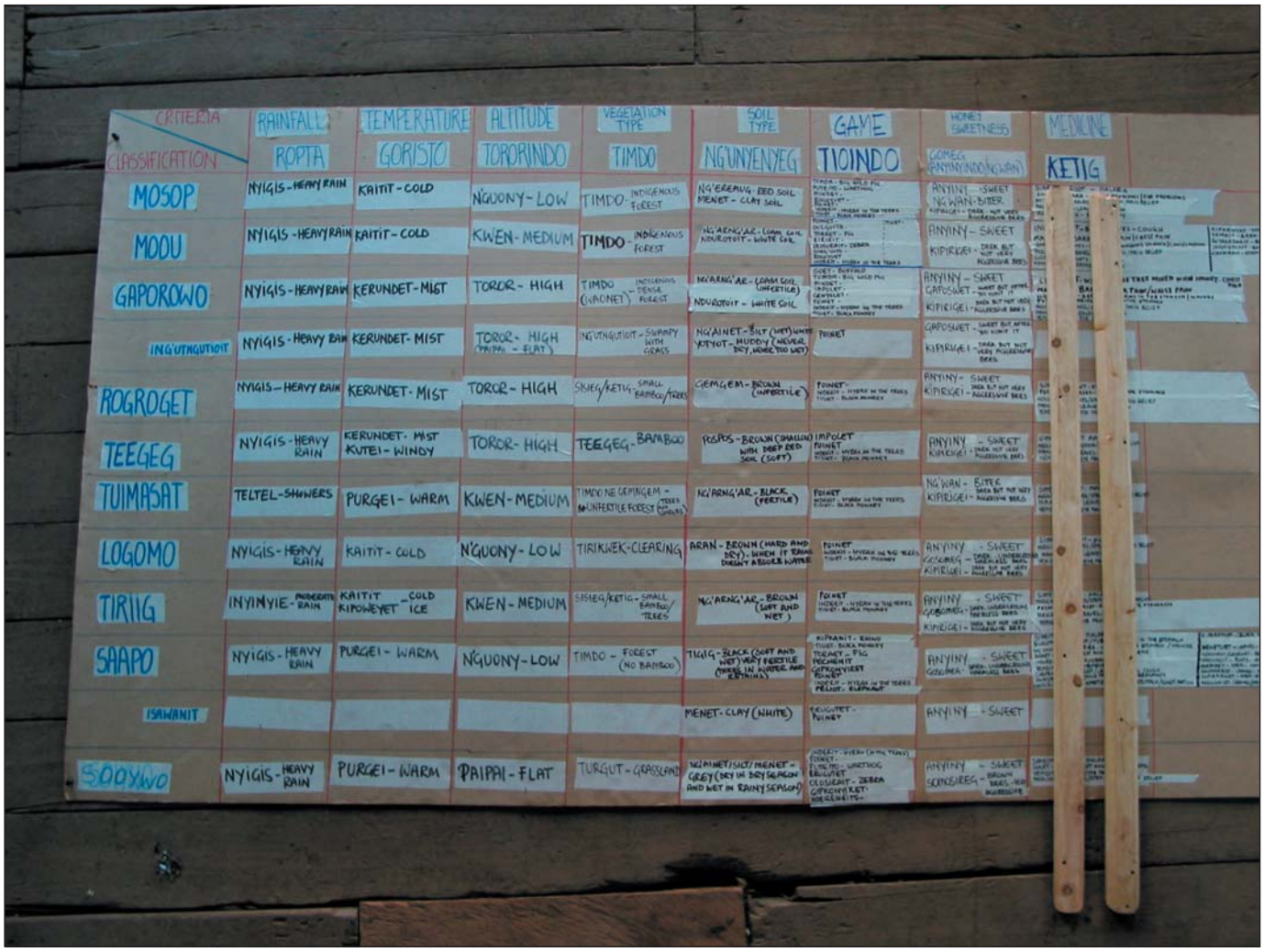

Figure 5. The completed matrix (some data are covered because considered as sensitive)

as elders debated the meaning and spelling of concepts and words in Ogiek and some were dropped (most soil types appearing in the initial version of the legend were not visualized, except for 'salty soils' which are related to the occurrence of game and are therefore important hunting grounds). In addition to this the model features hundreds of labels locating place names, names of water courses and water bodies, and clan classifications.

The Coding Process

When invited to transpose their mental maps, elders started by locating and naming landmarks, clan boundaries followed by relevant land units. Thereafter informants added additional single elements (points), linear features and place or area names.

The Ogiek have not been active hunter-gatherers for more than two decades. It is only the older generation who have active experience tracking animals and digging out roots and locating berries for subsistence food. Yet the mapping process revealed a conceptual system closely tied to predictive hunting and gathering.

Ogiek elders navigate through their territories using naturally occurring trees as boundary and site markers. Five significant tree markers were identified: *giigotwot* is a tree which marks the boundary between clan territories; *tielumbut* is a sacred tree associated with rituals and the ancestors; *sopoitiit* is a sacred ficus tree; *ponet* is a naturally occurring hole in a tree where one can find either honey or a tree hyrax; and *iyegisonei* is a tree where sometime previously an ancestor has been laid out upon his or her death. Unlike the agricultural and industrial habit of physically transforming the landscape to create meaning, hunter-gatherers rely on memory and species information to mark their intangible heritage.

Figure 6. The final version of the map legend

When it came to marking out lines on the map, the hunter-gatherer conceptual system emerged again distinct from agricultural orientations. Ogiek mapmakers noted three different types of pathways: *wakta* are human (indigenous) pathways in the forest; *waktawo* are broad paths used by outsiders and associated with danger (this is now use for gravel and tar roads); and *irongiit* the discreet patterned footpaths of wild animals, usually connecting to watering spots in the forest. The hunter needs to be a specialist in spotting and trapping along *irongiit*.

When the map was complete, there were a number of *irongiit*, clearly marked *waktawo*, but almost no *wakta*. The non-hunter participants queried this. Had the Ogiek forgotten where their pathways were? The Ogiek, and all the other hunter-gatherers present among the trainees were perplexed by the ignorance of the question. Why would indigenous peoples have regular footpaths? If you have walked one way through the forest, you know what is there, you will come home a different way. "*Only the hyena returns on its spoor!*" All of the hunter-gatherers shared this basic premise, and even had the same sayings about hyenas and foxes being so depraved as to have regular pathways.

Land units, as schematically indicated in the matrix, were based on the combination of different criteria related to rainfall, temperature, altitude, vegetation and soil type, game species, type of honey and medical plants.

Interestingly, in the matrix the informants listed the twelve land units[8] according to a specific East to West, lowland-upland-lowland transect starting with the warm lowlands, *sooywo* and *saapo*, all the way up to the misty highest altitudes, *teegeg, rogroget, garopowo* and *moou*, down again to the lower elevations of the *mosop*. The very name of the Mau Forest comes from one of these altitude area terms, *moou*, referring to a

cold area near below the upper peaks and containing the life-giving high altitude swamps which feed Kenya's most important rivers.

Different vegetation and soil types were also indicated for characterizing the different land units, though the Ogiek elders showed limited interest in their specifics. The relevance of their categories of soil and plants was related to predicting what type of game would likely occur. Salty soils, *ng'eeinda* would attract certain antelopes. The dense indigenous forest, *timdo waonet*, was significant as it houses particular food resources, as well as buffalo and other animals.

It was not a surprise to find out that traditionally the Ogiek lived by vertical transhumance. They seasonally migrated up and down the mountains depending on the temperature, rainfall, availability of game and the quality of honey they were looking for.

LESSONS LEARNED

For the Ogiek people, the priority purpose of the exercise was to transfer knowledge and hopefully wisdom and values from the oldest generation to the youngest. The 3D mapmaking proved to be an excellent process for allowing people of all ages to engage with their landscape and heritage in an inspiring and motivating collegial environment.

The three-dimensional model offered advantages over two-dimensional maps. It allowed youth to handle the materials, learn about contours and map making, and build the map. The size of the map, and the use of two tables, allowed a relatively large number of adults and youth to engage with the model together, as a group, with group dynamics of story telling, attention to detail, attention to broader stories, and allowing different clan perceptions to be treated equitably.

The three-dimensional model proved also to be a catalyst in stimulating memory and in creating visible and tangible representations of natural landscapes. The time spent working on the legend allowed for greater clarity on meanings, and the relationship between natural and cultural features. The map could capture both the tangible and intangible heritage of the Ogiek people, showing cultural sites, knowledge systems, as well as physical sites of importance.

In the Ogiek case, it was impressive how the community members were able to grasp the methodology and infuse it with their own cultural system and meanings. Whether the participants were really able to map the fullness of the Ogiek relationship with the landscape is unlikely, but the map and particularly the legend made the intangible heritage of the Ogiek fully accessible to future generations. The intensity of the intergenerational dialogue should also inspire younger Ogiek to value the knowledge of the elders and possibly engage with the political and policy processes required for protecting Kenya's highly threatened natural heritage.

The Indigenous Peoples of Africa Co-ordinating Committee (IPACC) sponsored attendance by a number of neighbouring peoples who live or lived by hunting and gathering. For them, the mapping was an important experience. Though each people has distinct cultural systems and lives in a different natural context, they recognized many of the Ogiek concepts and priorities. This reinforced solidarity amongst indigenous peoples and validated their particular relationship with the land, natural resources and the forest in particular.

The difference between hunting and farming peoples may at first appear trivial, however, the Nessuit process showed that there is a substantial intellectual and moral difference between how hunters and farmers engage with their environments.

Farmers have less direct dependence on natural biological diversity and hence cut down trees, clear fields and kill animals they perceive as a menace to their families, crops or livestock. The result, when combined with poverty and weak or absent environmental policies, is a downward spiral for hunter-gatherers, their knowledge systems and the biodiversity of the ecosystem they populate. In the case of the Mau Forest Complex, the forest is so damaged[9] that the important highland swamps are now drying out and impacting the famous Lake Nakuru and the equally famous Mara River that runs across the Maasai Mara National Park.

This exercise proved to be distinctive because of the special worldview of hunter-gatherers. This relates specifically to the land units identified by the Ogiek people and the criteria used to differentiate these. In a separate participatory mapping experience conducted by Nigel Crawhall with members of the African Biodiversity Network in Cape Town, it emerged that farmers, whether European or African, tend to see forests as a place 'outside' civilization associated with ghosts and witches. Hunter-gatherers had a reverse perception, namely that danger lurks in sedentary life and towns (Crawhall, 2005). This was well represented in the Nessuit mapping of pathways *wakta* and *waktawo*.

Politically, hunter-gatherers find it difficult to resist land invasion by farmers. In his work on an ecological description of human history, Diamond (1998) has attempted to demonstrate that hunter-gatherer territories act as vacuums in the face of advancing agricultural societies and economies. Only if there are environmental barriers can hunter-gatherers live in proximity to farmers (Diamond, 1998). African hunter gatherers survived because they lived either in desert or deep forest territories which were unsuitable to agricultural peoples. Colonialism created state systems which entirely excluded hunter-gatherers and gave agricultural peoples total control over the political economy. Crawhall has argued that *de facto*, the modern African state is a consolidation and bureaucratization of agricultural dominance over pastoralist and hunting peoples and territories (Crawhall, 2005).

Despite the vulnerability of hunter-gatherer economies and territorial control, the Nessuit mapping demonstrated that indigenous knowledge of biological systems and the endurance of their cultural frameworks for understanding the landscape and territory, outlast the specific economic system. Hunter-gatherers, even if they are not actively hunting on the land, retain a particular set of values, information and even wisdom about the ecology of their home territories. This has significance for national environmental, educational and heritage policies and practices.

Universality and Particularity of the Map Legend

The P3DM method has been developed in consultation with cognitive psychology to maximize the universality of working in three dimensions in a 'culturally neutral' space which the participants can fill in according to their own frames of reference.

It is a critically important part of the process that the legend codes are generated by the community in their own language. This aspect of participatory mapping is not only important, it is even vital for the process to be genuinely participative and owned by the mapmakers. The challenges faced by indigenous and local peoples are that their languages, knowledge and spiritual systems are marginalized, ignored or simply not understood by those in power. This not only includes state cartographers, but sometimes also those trying to protect Africa's forests and biodiversity, who would otherwise be important allies for indigenous peoples in defending the cultural and biological diversities of their territories.

Brody and colleagues at Strata360 (a Montreal-based GIS company) have demonstrated that indigenous peoples are good at moving from lived experience into two dimensional mapping. The problem is not the map, it is the ability to communicate the system of knowledge that links the cultural framework and the natural system together, and then transmit this intact to those from the dominant culture. Indigenous peoples are rich in knowledge but until recently poor in data that could be used for securing rights and a stake in land management (Brody, 1988; Brooke and Kemp, 1995; Poole, 1995). At the heart of 'community' or 'participatory' mapping is the challenge to allow the dominant paradigm to subside and create an opportunity to witness the invisible, the silent, the unknown and the powerful indigenous and local paradigm.

To facilitate a good legend-making process does not necessarily require previous exhaustive knowledge of the particular language or culture, but it does help to have some appreciation of the variation of cultural systems and how natural resources are conceived of and used in different subsistence economies. The legend system provides a helpful framework on which local people can overlay the particularity of their culture. It does not necessarily capture all of the complexity of such cultural systems, for example the moral or wisdom functions of place names (see Basso, 1996), but with additional heuristic devices such as the matrix, it allows a great deal of complex knowledge to surface, be captured and represented in a medium that is intelligible across different cultural perspectives.

CONCLUSIONS

P3DM has allowed a rural, marginalized indigenous people to capture an important part of its threatened intangible heritage and transmit it to younger generations. The three dimensions of the model effectively enhance the participatory aspect of the exercise. The way the methodology prioritizes local language and concept building makes the materials a tool rather than an impediment to the community process. The P3DM method brings GIS closer to those who otherwise would be left behind in the digital divide. Knowledge, in this case threatened knowledge anchored in an equally threatened physically environment, can be regained and put to work for a community with adequate facilitation.

Despite never having worked with a three-dimensional model, Ogiek elders were able to grasp the method and

apply it in the manner that was a priority for them, i.e. an exercise in memory and intergenerational knowledge transfer. At the end of the mapping, the community is left with a good process of intergenerational and intercultural dialogue, with detailed documentation of their knowledge of the landscape and territory, and a physical model that allows them to explore different subsequent activities.

The methodology, which has been elaborated primarily with indigenous peoples in Asia, found an easy transition to a post-hunter-gatherer people in Africa. In the Nessuit mapping a non-dominant paradigm of a non-agricultural society has been able to be expressed adequately and used as a training tool.

The legend-making was a central component in elucidating the relationship between a stigmatized indigenous cultural system and a remembered natural landscape. The legend-making is perhaps the most important part of the P3DM process. If done correctly, it puts the holders of the local knowledge in the driver's seat. It allows them to express a complex network of ideas, concept and interlocking criteria that will be expressed in the coding of the map.

In the Nessuit case, a legend preparation process was not sufficient to capture the multiple aspects of each of the polygon land type designations. Here, the matrix supplemented the process, deepening the intercultural and intergenerational understanding of the terminology and cultural system. Aspects of taboos, inter-clan legal systems, faith systems, and the requisites for sustainable hunting and gathering all emerged in a complex but comprehensible web of information and coding.

According to statements made by participants using metacards, the composition of the legend and the making of the model stimulated community cohesion and represented a milestone for Ogiek clans in terms of working together towards a common goal, and realizing that the Ogiek people are more than scattered clans but an entity with a unique cultural identity and indigenous knowledge system. A selection of statements written by the elders at the end of the exercise:

"I felt overwhelmed to see it [our land] brought back."

"I learned that we are lost and need to unite ourselves."

"We are happy for we have learnt things about our land we had forgotten."

"I discovered that we can do mapping which we thought we could not be able to do."

"I learnt that other people of different technologies can help unearth lost information."

"I felt proud of my clan territory being marked out and also the entire community land."

"I noticed that if there is a case, I can answer the questions of my living area because I know my landscape better."

"I discovered that we have potentiality of managing of our rivers and plant trees."

"I discovered that 3D Model help solving dispute/conflicts."

Figure 7. Elders posing behind their artwork.

"I learnt that this exercise could be of good help to the future generation in terms of learning."

"I learned that indigenous knowledge is powerful."

"I feel that these maps can be used by Ogiek people to enhance their land legal issues."

THE WAY FORWARD

The participants concluded that they had a more holistic understanding of their social, cultural and biophysical environments and that they would agree among themselves the best way forward in terms of using the model and derived GIS maps to improve the safeguarding of their traditional knowledge system, the sustainable management of natural resources and advocacy actions aimed at regaining recognition of their ancestral rights.

The Ogiek are active in advocating for the retention of their lands and the protection of their heritage. The hunter-gatherer peoples of Kenya have recently formed the Hunter-Gatherer Forum (www.hugafo.org) to create a coherent platform for dialogue with the State and their neighbours within which the Ogiek will operate. In addition, after learning about the results of the Nessuit exercise, UNESCO, the Africa Conservation Foundation, and Egerton University have expressed interest in helping the Ogiek community explore how the P3DM process, and particularly the legend and matrix, can be used to promote education for sustainable development (Stan and Amiel, 2007; de Haas, 2006; Wegulo, 2006). Government officials from the National Water Service/Management Board have visited the model and expressed interest in using it for participatory watershed management planning.

The Ogiek elders have expressed their desire that the 3D model (Figure 8) be extended to cover the entirety of the 21 clans' territory. To this effect financial and technical resources have been mobilized to assist the Ogiek in manufacturing four additional model units thus expanding the total area covered to a total of 1,728 sq. km at a 1:10,000 scale.

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Notes

1. Hadzabe from Tanzania, Khwe San from Botswana, Sengwer and Yiaku from Kenya.
2. The Ogiek filed seven cases in the Kenya high court. As of the writing of this paper most of these are still open.
3. ESAPP (Eastern and Southern Africa Partnership Program) is a program run by the Centre for Development and Environment (CDE), University of Berne, on behalf of the Swiss Development Co-operation.
4. Local place name denomination.
5. Mapping for Change International Conference on Participatory Spatial Information Management and Communication; PGIS '05 – KCCT, Nairobi, Kenya, 7 –10 Sept 2005.
6. A legend is an explanatory list of the symbols on a map or chart.
7. Homogenous areas represented by coloured polygons on the model/map.
8. *mosop*, *moou*, *gaporowo*, *ing'utngutioit*, *rogroget*, *teegeg*, *tuimasat*, *logomo*, *tiriig*, *saapo*, *isawanit* and *sooywo*.
9. After completing the 3D model the facilitators and trainees made a field trip up to the very top of the Mau Range and specifically to the swamps where the Mara River is born and saw visible evidence of the widespread conversion of indigenous forest into farmland.

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Abstract

Describes a participatory process by which Ogiek indigenous people in the Mau Forest Complex in Kenya rendered their spatial memories through the making of a georeferenced three dimensional model covering part of their ancestral territory. The paper focuses on the course of action and related human dynamics which led to the production of the map legend via deep reflections and intense negotiations among elders of different clans. The 3D mapmaking process proved to be a catalyst in stimulating memory, articulating tacit knowledge and creating visible and tangible representations of the physical, biological and cultural landscapes of the area in the 1920s. Elaborating and negotiating agreement on the elements of the map legend allowed the participants to gain greater clarity on meanings and relationships between natural and cultural features. Once completed, the model selectively displayed both the tangible and the intangible heritage of the Ogiek people. The composition of the legend and the making of the model stimulated collegial learning and community cohesion. The process has been perceived as a milestone for Ogiek clans in terms of working together towards a common goal, and in realizing the value and potential authority of their spatial knowledge once it was collated, georeferenced, documented and visualized.

Keywords: Participatory geographic information systems; participatory three dimensional modelling; participatory community mapping; Ogiek indigenous peoples; Mau Forest Complex; Kenya

Giacomo Rambaldi is senior programme officer at the Technical Centre for Agricultural and Rural Cooperation (CTA) in the Netherlands. Giacomo has worked in community mapping in developing countries since the late 1980s. In 2000, he launched Participatory Avenues www.iapad.org, a well-known website dedicated to sharing knowledge on participatory 3D modelling. In 2004, he launched the Open Forum on Participatory Geographic Information Systems and Technologies www.PPgis.net. His expertise includes visualizing indigenous spatial knowledge for improving communication, participatory spatial planning; and networking, information management and communication. Giacomo is doing a PhD in Communication Sciences Wageningen University in the Netherlands. Email: rambaldi@cta.int or grambaldi@iapad.org

Julius Muchemi is the Executive Director of Environmental Research Mapping and Information Systems in Africa (ERMIS Africa), Kenya. Since the 1990s, he has

been engaged in PGIS/community mapping initiatives to develop compatible, spatial-based solutions for securing territories, cultures and commonly shared resources among indigenous people in Africa. He is pursuing his PhD in Environmental Monitoring and Information Systems with special focus on Traditional Spatial Knowledge Systems at Moi University, Nairobi, Kenya. Email: julius@ermisafrica.org

Nigel Crawhall is Director of the Secretariat of the Indigenous Peoples of Africa Co-ordinating Committee (IPACC). IPACC was established by the African Indigenous Peoples' caucus at the United Nations in July 1997. He has been a consultant to the South African San Institute, the Working Group of Indigenous Minorities of Southern Africa (WIMSA), and UNESCO's Cultural Policy Division. He has a PhD in Linguistics from the University of Cape Town. Email: kalahari.culture@gmail.com

Laura Monaci is a photointerpreter and landcover mapping expert. Since 1992 she has worked as a consultant for the Food and Agriculture Organization of the UN (FAO). Her professional fields of expertise are remote sensing data processing and analysis; small databases and GIS development and maintenance; and natural resources evaluation and planning. Email: lmonaci@gmail.com

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