

Journal Background and Scope

PROGRESS Multidisciplinary Research Journal is an academic and peer-reviewed journal published bi-annually by the Polytechnic of Namibia. The journal seeks to give visibility and worldwide access to applied research. It publishes research articles written by professional academics as well as doctoral students from original completed and ongoing research, special issues, short communications, and reviews. The journal serves as platform for discussion and dissemination of research findings, new research areas and techniques, conceptual developments, and articles with practical application to any field.

Its scope is multidisciplinary, covering studies in the arts, human and social sciences, economic and education sciences, natural sciences, engineering and technology. All articles are evaluated by the editorial board and two or more international reviewers with scholarly expertise in the subject.

Editor: Prof. Nnenesi Kgabi

Editorial Advisory Board

Prof. Ravinder Rena, University of Western Cape, South Africa

Prof. Simeon Materechera, North-West University, South Africa

Dr Ravi Kumar Jain, Department Finance, IBS - Hyderabad Campus, IFHE
University Dontanpally, Hyderabad

Prof. Jairos Kangira, University of Namibia, Namibia

Contact Details

Office of the Vice-Rector, Academic Affairs and Research

Polytechnic of Namibia

13 Storch Street

Private Bag 13388

Windhoek

Namibia

Telephone: +264612072609/2281

Fax: +264612072945

Email: nkgabi@polytechnic.edu.na

rngolo@polytechnic.edu.na

ISSN 2026-7096

An Exploration of Participatory Mapping Approaches for Integrated Land Use Planning in the Hardap Region, Namibia

Lisho Christoh Mundia

*Department of Geospatial Sciences and Technology
Polytechnic of Namibia, Namibia*

Abstract

The paper presents empirical findings on the potential value of participatory mapping for effective Integrated Land Use Plan (ILUP) by local communities in Hardap Region. It reflects on how future participatory approaches should be structured. The research applied a combination of approaches that include sketch mapping, photo-mapping and consultative meetings. Both positive and negative impacts of participatory mapping on ILUP were measured and local communities' knowledge of participatory approaches objectively tested on the basis of this investigation's findings. The research established that although participatory mapping is known to the experts in the fields of Geography, Geographical Information Systems (GIS) and Land Use Planning (LUP), it is still not well known to local land users whose knowledge of other participatory approaches that can support ILUP in Namibia is limited. Participatory maps that were produced by local communities in Hardap region suggest that local communities are willing to learn about participatory approaches and willing to share their knowledge on land use. Sketch and photo-maps - although not accurate and sometimes imprecise - were found to be satisfactory approaches to capture and document local knowledge. Local communities are motivated to improve their land use activities by the outcomes of their knowledge input in participatory mapping. Key recommendations include comprehensive participatory land use planning and better knowledge gathering from local communities. The paper presents results of participatory mapping and lessons learned from exploring participatory mapping.

Keywords: Participatory mapping, integrated land use planning, Hardap region, Namibia; local communities.

1. Introduction

Globally, land is a limited but vulnerable and renewable resource but if used properly. Human land use has considerable impacts on the natural environment (Randolph [1]). Human conversion of natural and productive land and inappropriate location of different forms of development such as roads and the construction of buildings and land use practices after development have numerous impacts on the natural environment (Randolph [1]). Several environmental and social planning approaches both in urban and rural communities have been developed. Integrated land use planning through participatory mapping can enhance community involvement in the planning process. Arendt (1996, 1999), Yaro, Arendt, Dodson and Brabec (1988 cited in Randolph [1]) "popularised the conservation residential design approach in protecting rural and small-town values and morals" while other analysts (Audirac, 1997; Golley & Bellot, 1999 cited in Randolph [1]) have focused work on rural sustainability.

Public participation is an important component of ILUP. Currently, GIS is used in ILUP to facilitate the handling of the extensive spatial environmental, ecological, land use, infrastructure, biological, archaeological and cultural data to assist in the decision-making process. The integration of LUP and GIS, however, is generally devoid of a community involvement component while the use of geo-visualization techniques rarely extends beyond two-dimensional mapping. The ILUP process is predominantly a top-down expert-driven quantitative approach that seeks to draw upon public participation at certain stages of specific projects to define and evaluate social, economic, and environmental issues. This public participation is however unable to meaningfully influence the expertise process. It is suggested in this study that such limitations can diminish and undermine community perspectives on a range of important issues in the ILUP process and constrain the public's ability to participate in defining, examining, and reviewing project development and decision-making.

Although various cost-effective mapping techniques such as sketch mapping and photo-mapping have been used in different programmes in different countries, their potential in terms of social inclusion in decision-making has not been adequately exploited while the use of GIS techniques in Namibia remains under-exploited and poorly documented. Resulting in little information on their impacts on participatory mapping.

2. The Study Area (Hardap Region)

After Namibia's independence in 1990, the Hardap Region was divided into six political constituencies: Gibeon, Mariental Rural, Mariental Urban, Rehoboth Rural, Rehoboth Urban East and Rehoboth Urban West. In August 2013, the Hardap Region was re-demarcated by adding two extra constituencies (Aranos and Daweb) following the 4th Delimitation Commission's recommendation to bring about better service delivery to the community of the Hardap Region. This study was confined to the six political constituencies of Gibeon, Mariental Rural, Mariental Urban, Rehoboth Rural, Rehoboth Urban East and Rehoboth Urban West partly because participatory mapping exercises of the study had already been done before the re-demarcation was implemented and also because of lack of data in the two new constituencies.

Approximately 75% of land in the Hardap Region is owned by private farmers on a freehold basis. The second largest landowner is the government that owns the extreme western part that constitutes approximately 15% of the region and is designated as part of the Namibi-Naukluft Park. The central-southern part of the region (about 10% of the area) is designated as communal farmland owned by traditional authorities and small-scale (Government of Namibia [2]).

Other small parcels of land scattered throughout the region are the 10 resettlement farms and protected area surrounding Hardap Dam owned by government which also owns two parcels of land dedicated to government agriculture (Mendelsohn, Jarvis, Roberts and Robertson [3]). Ten (10) designated local authorities are scattered throughout the area with the largest being Rehoboth in the far north and the regional capital, Mariental in the south."

The study area is located in the south of Namibia, (Figure 1). Hardap Region covers about 110 km² and has a population of approximately 79 000 people (Namibia Statistics Agency [4]). The region was chosen mainly due to a presence of a combination of issues that may easily lead to land disputes. These issues include, environmental issues (the area is prone to flooding), competing land uses notably mining, agriculture and nature conservation and uneven distribution of boreholes, wind pumps and water canals.

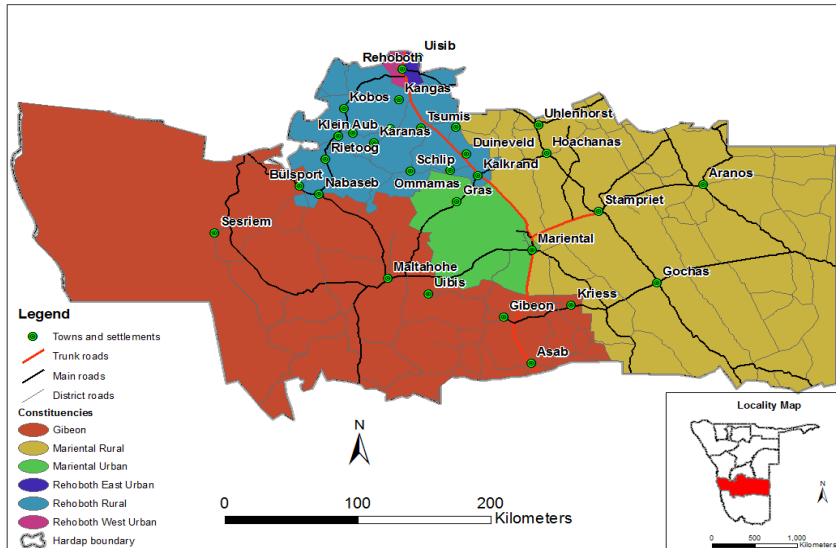


Figure 1: Study area

The word 'Hardap conveys the prominent role of the Hardap Dam in the agricultural, economic and tourism sectors of this region. The participatory approaches for sustainable land use planning were carried out in six different rural, peri-urban and urban sites with different land use practices in the Hardap Region.

3. Participatory Mapping Approaches [The Methodology Perspective]

3.1 The Evolution of Participatory Mapping

The participatory creation of maps started in the late 1980s when development practitioners adopted Participatory Rural Appraisal (PRA) methods such as sketch mapping (Rambaldi et al., [5]) although Participatory spatial information management and communication in developing countries and participatory creation of maps, above and beyond their interpretation started in the early 1980s (Rambaldi, et al., [6]). Preference during this period was given to eliciting local knowledge and building on local dynamics to facilitate communication between insiders (villagers) and outsiders (e.g. researchers, government officials, etc.). Using Participatory GIS ¹(PGIS) with communities can add value to local knowledge in support of development mechanism

¹ Participatory GIS is an emergent practice in its own right; developing out of participatory approaches to planning and spatial information and communication management (Rambaldi & Weiner (2004 cited in Rambaldi *et al.* [6]).

(Minang and McCall [7]). The state of affairs in mapping changed in the '1990s, with the diffusion of modern spatial information technologies including GIS, global positioning systems (GPS), remote sensing image analysis software and open access to spatial data and imagery via the internet."

Different participatory mapping strategies² including participatory photo-mapping and sketch mapping as well as participatory GIS (PGIS) have traditionally been used in the collection of data for monitoring land use development, urban development, land degradation, deforestation, urban settlement and other development activities.

The two methods, sketch and photo-mapping, were used to produce participatory maps in this study. Knowledge and opinions were gathered from the participants within the Hardap Region on land uses as per the objective. The participatory mapping exercises were applied to different units of land within the Hardap Region; the information for the maps was gathered from the residents of the various units of that land. The information on different land uses such as business, residential, industrial, garage, institution, open spaces and roads were obtained from the participants. Information on land cover such as rivers, riverbeds, dunes and sewage swap was also provide and mapped by the participants.

3.2 Sketch Mapping

Sketch mapping or "resource mapping" helps people in picturing resources and features on a given base and in graphically illustrating the significance they attach to them. It is a method for collating and plotting information on the occurrence, distribution, access and use of resources within the physical, economic and cultural domain of a specific community (Integrated Approaches to Participatory Development (IAPAD) [8]). Corbett, et al., [9] stated that Sketch mapping is a map drawing method that depends on observation and memory without exact measurements, consistent scale or georeferencing. It usually involves drawing symbols on large pieces of paper to represent features in the landscape and is often time-consuming compared to photo-mapping because of its dependence on the participants' memory, whereas photo-maps are drawn from georeferenced remotely sensed images.

The International Fund for Agricultural Development (IFAD) [10] describes sketch mapping as a "hands-on mapping that includes basic mapping methods in which community members draw maps on the ground (ground mapping)

² Participatory mapping is a map-making process that attempts to make visible the association between land and local communities by using the commonly understood and recognized language of cartography (International Fund for Agricultural Development [10]).

and on paper (sketch mapping) from memory. Although these maps do not rely on exact measurements, a consistent scale or georeferencing, they do show the relative size and represent key community-identified features on the land from a bird's eye view. These maps have been commonly used in Rapid Rural Appraisal (RRA) through Participatory Rural Appraisal (PRA) and Participatory Learning and Action (PLA) initiatives.

Sketch mapping outputs may differ according to the specific purpose the exercise is conducted for, and to the characteristics of participants (IAPAD, 2010). It is best associated with other participatory tools and in particular with transects walks, which contribute to a more critical analysis of the individual resource. Knowledge on the social structure of the participating community is a prerequisite for the facilitator because the community may consider resource distribution, use and access as sensitive issues. Sketch mapping techniques are a good starting point for framing important land-based issues and can help provide a broad picture of issues and events covering a large area and can be useful in introducing and acquainting a community with maps by building confidence in using the cartographic medium. Sketch mapping can help the planning of subsequent mapping activities and facilitate the engagement of non-expert users, non-literate communities and those from marginal livelihood systems including indigenous peoples, forest dwellers and pastoralists (IFAD [10]).

Sketch mapping also referred to as resource mapping, has its own strengths and weaknesses.

Strengths include:

- Low-cost and none dependence on technology (International Fund for Agricultural Development [10]).
- Repeatability at given intervals to become an integral part of participatory monitoring and evaluation (IAPAD [8]).
- Ability to provide in-depth resource mapping for a particular resource for times in the project cycle. It can help generating qualitative and quantitative information (IAPAD [8]).
- Ability to deliver in a short time frame and provide tangible short-term outcomes (International Fund for Agricultural Development [10]).
- Applicability to all ecosystems known to the community and amenability to different levels of definition and elaboration (IAPAD [8]).

Weaknesses include:

- In a general assessment of the approach, it was observed that the spatial confinement of the basic input - the participatory sketch map to the social, cultural and economic domains of those who produce it, the sketch maps becomes unrealistic from the practical points of view (IAPAD [8]).
- Dependence on good community mobilization, transect diagramming and plotting of natural and other resources onto sketch maps which make it difficult to produce precisely scaled authoritative information that can be used officially for management purposes hence the tendency of bureaucracies to pay little attention to sketch maps and other informal documents (IAPAD [8]).

Some of the drawbacks of sketch mapping, pointed out by the IFAD [10] are that “the final map outputs are not geo-referenced and can only be transposed onto a scale map with difficulty. This makes them less useful when locational accuracy is important i.e. when there is a need to determine the size of an area or make other quantitative measurements. This lack of cartographic accuracy undermines their credibility with government officials and thus diminishes their potential for advocacy. Although the final map can be photographed, the long-term usefulness of ground maps is further undermined by their impermanence and fragility.”

However the low-cost, low training requirements and ease of delivery make sketch mapping a useful tool for initially engaging communities - particularly non-literate groups (IFAD [10]). It is a useful process for determining and extracting community views and information and is capable of effectively empowering local communities.

3.3 Photo-Mapping

The photo-mapping exercise is usually carried out on the printouts of georeferenced or orthorectified remotely sensed images (Rambaldi et al., [6]). Orthophoto maps are some of the sources of accurate remotely sensed data that may be used for large scale community mapping. The International Fund for Agricultural Development [10] stated that “local knowledge is identified through conversation and then drawn directly onto a photo copied map or remote-sensed image (or else onto clear plastic sheets placed on top of the map). The position of features is determined by looking at their location relative to natural landmarks (e.g. rivers, mountains, lakes).” This method also works well with aerial and satellite images, which can be particularly helpful when working with people who cannot read a topographic map and with non-literate communities, including those from marginal livelihood systems (e.g.

indigenous peoples, forest dwellers and pastoralists). Additional information can be collected in the field using GPS and later be mapped on the map (IFAD [10]).

Muller and Wode (2003, cited in IAPAD [8]), photo-mapping is one of the “conventional approaches used to obtain land use maps usually conducted by outsiders who interpret remote sensing data without profound knowledge of local resource conditions. Limited field experience possibly results in inaccurate delineation and misinterpretation of land use classes.”

Muller and Wode [11] stated that “the objective of participatory photo-mapping is to enable villagers to carry out the interpretation of aspects of their land resources, which are of significant importance to them. In this process villagers delineate their land use on transparencies laid over an orthophoto. The information on the transparencies will later be scanned or digitized and geo-referenced. Involving local stakeholders with their extensive field experience is expected to improve the accuracy and precision of obtained data.”

Muller and Wode [11] further maintain that “*Orthophoto-maps are an effective participatory communication tool on village level to:*

1. *visualize resource use in order to facilitate discussions without communication barriers and to motivate participants to reflect and discuss about land issues;*
2. *allow a rapid identification of social, economic, and environmental problems of the village by determining and debating issues related to natural resource use with active participation of the community;*
3. *create a common understanding among local land users and administrative authorities on spatial distribution and status of resources and resource use;*
4. *provide a basis for joint and demand-driven decision-making between different villages and between villages and state entities;*
5. *acquire accurate spatial data on large scale on the basis of local knowledge;*
6. *provide options for participatory impact monitoring for rural development investments from government and other donors;*
7. *mediate and solve prevailing boundary conflicts;*
8. *generate accurately scaled information on land use that can be officially approved for management purposes.”*

Photo-mapping techniques are a good format for communicating community

information to decision-makers because they use formal cartographic protocols (e.g. coordinate systems and projections). Information can be incorporated into other mapping tools, including GIS and GPS data can be easily transposed onto these scale maps. When accuracy is required where scale maps are not available, scale maps can be made using survey equipment including compasses and GPS tools. This approach to participatory mapping is important in regions where accurate topographic maps are not available, such as in remote and marginal areas which often tend to be inhabited by indigenous peoples, forest dwellers and pastoralists. The time and energy required to create scale maps from scratch are considerable (International Fund for Agricultural Development [10]).

Like sketch mapping, the International Fund for Agricultural Development [10] maintains that the photo-mapping approach “is relatively cheap and fast and still provides an accurate spatial representation of local knowledge, particularly if the information drawn on the map is ‘ground-truthed’ using a GPS. The resulting map can be used to determine quantitative information such as distance and direction.”

Some of the drawbacks of photo-mapping are that in some countries, access to accurate scale maps is regulated and difficult. Furthermore, maps in some areas might not be accurate or up-to-date. A final drawback is that using scale maps requires understanding formal cartographic protocols such as scale, orientation and coordinate systems which can be challenging for non-literate people (International Fund for Agricultural Development [10]).

According to the International Fund for Agricultural Development [10] “scale maps and images have particular potential for adoption of delineated geographical features. The field application is straightforward, engaging and relatively cheap, although there are photocopying and pen costs. This process also permits the collection of geo-referenced spatial information that can be imported directly into GIS systems.” Like sketch mapping, the impacts of photo-mapping process are minimal in relation to long-term change and empowerment of communities engaged in the process.

4. The Complexity of Integrated Land Use Planning

Wade and Sommer [17] defined land use as the classification of land according to what activities take place on it or how humans occupy it; for example, agricultural, industrial, residential, urban, rural or commercial. Land use should not be confused with the term land cover, which concerns the natural and artificial features covering the earth's surface like forest, roads, grassland, bare soil, and lakes. According to Wade and Sommer [17] land cover entails “the classification of land according to the vegetation or

material that covers most of its surface; for example, pine forest, grassland, ice, water or sand.”

The Canadian Council of Forest Ministers [12], in its integrated forest land use planning projects emphasised that “integrated land use planning seeks to balance the economic, social and cultural opportunities in a specific area of forest with the need to maintain and enhance the health of the area’s forest. It is a process whereby all interested parties, large and small, come together to make decisions about how the land and its resources should be used and managed and to coordinate their activities in a sustainable fashion.” Amler, Betke, Eger, Ehrich, Kohler, Kutter, Lossau, Müller, Seidemann, Steurer, Zimmermann [13] stated that “in many countries there are traditional, non codified forms of agreements on land use which work well at local level. However, they often fail when social relationships become more complex (e.g. spontaneous migration, pressure of use on areas which had previously been reserved for pastoralists). Nevertheless they provide important connecting links for LUP at local level.” Among other things, what are common about the findings of the studies are the aspects of willing to maintain the integrity of the ecosystem as the primary consideration which plays an important role in LUP.

Amler *et al.*, [13] further maintains that “LUP is a partially integrating and sector overlapping process. The planning objects are the land resources. Therefore, LUP is not suitable for solving all local problems, nor can it replace the overall planning for an area.” The basic technical strategy in LUP is to plan land use according to the suitability and the various needs in the area to be considered.

Land use is characterised by the arrangements, activities and inputs of people to produce food, change and maintain certain land cover types (Di Gregorio and Jansen [14]). This definition of land use establishes a direct link between land cover and the actions of people in their environment. For a sustainable land use plan, nowadays, LUP requires more data integration, multidisciplinary and complex analysis and quick data retrieval. Not only does this facilitate the improved accuracy and scope for creating maps for use in land transactions, but also land administration processes. Longley, Goodchild, Maguire & Rhind [15] believe that “land administration can assist enormously in the process of data integration and the creation of a truly national GIS.” According to Cloke [16], “the role of planning is important because of one fundamental premise; namely that planning and policy-making are undeniably an integral aspect of state activity and as such are subject to the context and constraints of all activities.”

Wade and Sommer [17] defined land use as the classification of land

according to what activities take place on it or how humans occupy it; for example, agricultural, industrial, residential, urban, rural or commercial. Land use should not be confused with the term land cover, which concerns the natural and artificial features covering the earth's surface like forest, roads, grassland, bare soil, lakes. According to Wade and Sommer [17] land cover entails "the classification of land according to the vegetation or material that covers most of its surface; for example, pine forest, grassland, ice, water or sand." LUP should be understood as the systematic assessment of physical, social and economic factors that encourage and assist land users in selecting options that increase their productivity, sustainability and meet the needs of society.

Land use planning is generally applied at three interactive levels; national, regional and local level (FAO, 1993, cited in Nabwire [18]), where different priorities, planning strategies and kinds of decisions are made. At the national level general land use planning policies, priorities and legislation are set. Whereas at the lower levels the plans become more detailed e.g. putting in place water sources and infrastructure (Nabwire [18]). Interaction, information flow and data sharing between the planning levels are important.

In Namibia positive and negative land use changes are taking place naturally. Being the most arid country in sub-Saharan, land use is generally adapted to highly variable and arid climatic conditions. However, certain policies and cultural barriers may have contributed to the entrenchment of inappropriate land use systems.

The Namibian constitution makes provision for central, regional and local levels of government. The central government consists of the legislature or parliament (the national assembly and national council), the judiciary (supreme, high and lower courts) and the executive (the president, cabinet and ministers). At regional level, there are 13 political regions as depicted in Figure 2, comprising of 107 constituencies. According to Mendelsohn *et al* [3] "these were first demarcated in 1993 for the purposes of regional representation." Local governments or authorities are provided for by proclamation of settled areas as municipalities, town and villages. This means that each region is responsible for its land management activities within its area of jurisdiction.

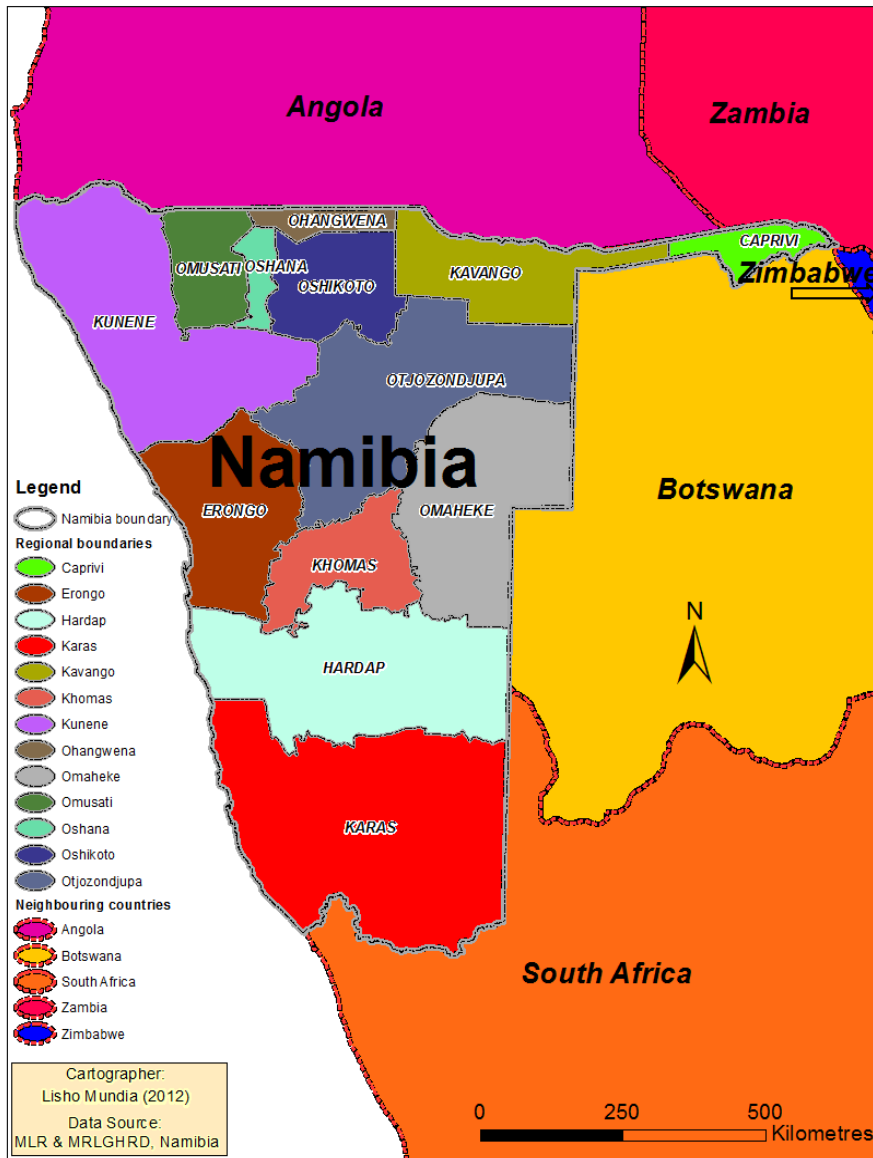


Figure 2: Regional map of Namibia

There is no legislation in Namibia that requires the preparation of a coherent, national and regional land use framework but it is envisaged that this will be introduced when the Draft Urban and Regional Planning Bill is enacted.

Currently the establishment of towns and the subdivision of land are regulated by the Townships and Division of Land Ordinance of 1963 while the development and application of town planning schemes is regulated by the Town Planning Ordinance 18 of 1954. Both these ordinances must be read together with the Local Authorities Act 23 of 1992.

An Integrated Land Use Plan (ILUP) considers the full range of resources and values present on public lands and aims to blend or coordinate management strategies and implementation requirements across jurisdictions. ILUP is a tool which provides a means for stakeholders, communities, individuals and civil society to engage in collaborative decision-making about land use and resource management within a defined area.

The Ministry of Lands and Resettlement (MLR), within its mandate to facilitate utilisation of land as custodian of land, are the main actor and coordinator in the planning and administration of land falling within the rural areas of Namibia. As stated earlier, the Division of Land Use Planning and Allocation (LUPA) under the Directorate of Land Reform of the MLR are responsible for developing plans for commercial and communal land use. It is mandated to provide guidelines for drafting regulations on land use planning. The integrated land use plans are the direct outcome of the MLR mandate.

The Hardap Regional Council is instrumental in successfully implementing and monitoring the recommendations made by the Hardap IRLUP as it holds in trust the Hardap Region's natural and cultural resources for present and future generations, and has a responsibility to the public to ensure that resource management represents a balance of community, economic and environmental needs. The Hardap Integrated Land Use Plan (HIRLUP) provides the mechanism for making comprehensive decisions about the use of land and resources within the Hardap Region, setting out coordinated management directions for future uses of land and resources while allowing for the evaluation of the success of management activities over time. The plan is future orientated and interactive, allowing plans to be adjusted in response to changing social and economic demands and circumstances.

In Namibia, overall development planning including planning of land and other natural resources is vested in a number of different government institutions. Amongst other key responsibilities, the Ministry of Regional and Local Government, Housing and Rural Development (MRLGHRD) through the Directorate of Decentralisation Coordination is responsible for the effective and efficient implementation of a decentralised system of governance through providing management direction, co-ordination, consultation, trading and research to all stakeholders (line ministries, regional and local authorities, non-

governmental organisations, community-based organisations and the public at large). The Ministry of Lands and Resettlement through the Directorate of Land Reform and Resettlement (Division of Land Use Planning and Allocation - LUPA) is responsible for land use planning in the country - more specifically the communal areas and commercial farms.

5. The Participatory Maps [The Results Perspectives]

5.1 Participatory Mapping Results in the Rehoboth West Urban Constituency

In the Rehoboth West Urban Constituency, participatory mapping took place in the Rehoboth formal urban area. The size of the mapped area is estimated to be 1500 square metres. It is managed and administered by Rehoboth Town Council. Seven (7) local community members participated in the mapping activity. In this area, the participants mapped various land uses, such as industrial, business and related infrastructure.

Based on the knowledge that the participants showed, the researcher is of the opinion that the participants could contribute to the development of land use plans because they know their area better than an outsider (researcher). In recent trend, local communities are included in the discussion periods that precede the implementation of land use planning projects (Emery [19]). Land use plans projects should strive to have the broadest possible knowledge base to achieve the best possible results.

As it can be seen in Figure 3 and 4, residential, general residential and open spaces are the main land uses identified and mapped by the participants in the Rehoboth formal area. The main road leading to Windhoek in the North and Gibeon in the South can be viewed on the map. The gravel roads show access to both residential areas and general residential areas are also shown. In sketch mapping exercise, the participants could not map land cover adjacent to the area as the main emphasis was on various land uses. However, the participants mapped land covers when they delineated the same area using an aerial photograph (Figure 4) as base material for photo-mapping technique. New information about other land uses and land covers were mapped.

In the Rehoboth formal urban area, the participants were eager to share their land use issues. Some participants shared their knowledge and opinions about how the town council of Rehoboth rejected their subdivision and consolidation applications for land adjacent to their erven. Through the briefing and random communication with the participants, the researcher is of the

opinion that the participants have reasonable knowledge about land use and their rights regarding their respective land.

Although the maps are not to scale, the researcher acknowledged the participants understanding of the size of their land. The participatory mapping exercises were observed by the researcher to be good methods for bringing communities together to share their knowledge of the various land uses and their experience of their surroundings. The local communities' experience contributes in a meaningful way to the development of land use plans. This is also supported by the current related legislations on LUP which requires strong participation of local communities in developing and compiling land use plans.

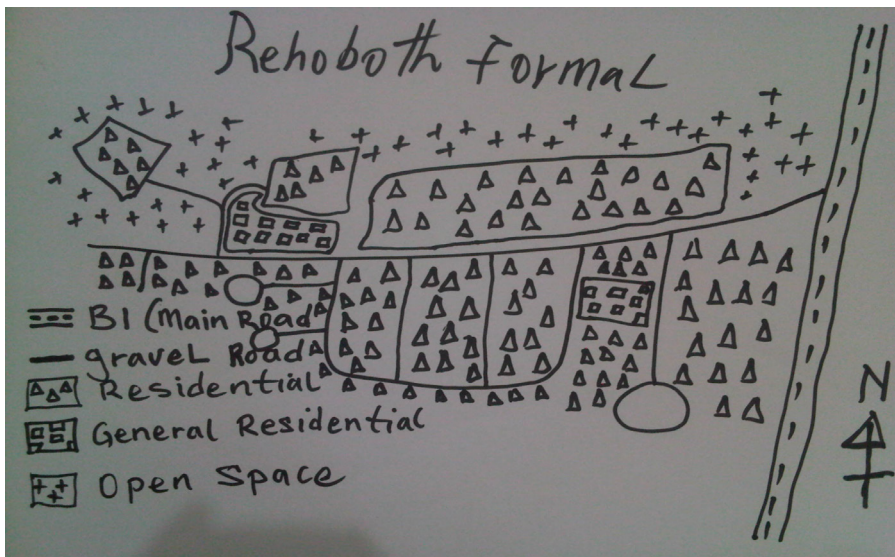


Figure 3: Sketch map of Rehoboth urban area section
Mapped by: Rehoboth local community members, 2012

Figure 4, a map based on an aerial photograph shows comparable results to that of the sketch map results. New detailed information can be seen on the photo-map, this include the riverbed in the South, the garage zoned land (including a filling station) in the south-eastern part of the map and industrial land use in the far South. The open spaces and general residential land uses increased in most parts of Rehoboth formal area and were clearly mapped in Figure 4. Although the aerial photograph was two years old and did not depict some of the recently constructed buildings, the participants could still identify

the land uses. The participants indicated that they found it easier to interpret the aerial photographs than a sketch map.

When discussing the aerial photographs, questions were raised as to how the participants benefit from land zoned as general residential. The participants indicated that the land tenure on general residential zoned land allows the land owner to rent out his or her built units of land to a specified maximum number of tenants.

Industrial land use was indicated as undesired by many participants. This was because industrial land use (such as welding work) is one of the main causes of noise in the neighbourhood.

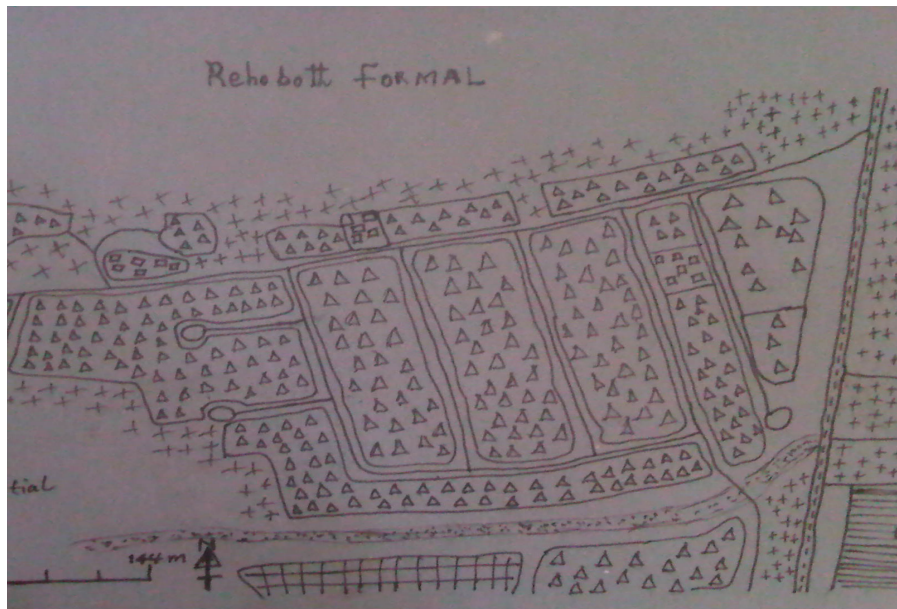


Figure 4: Photo-map of Rehoboth urban area section from an aerial photograph of 2010
Mapped by: Rehoboth local community members, 2012

The gravel roads with dead end (cul-de-sacs) were clearly delineated as shown on Figure 4. The area has access to electricity, sewerage, voice and data telecommunication infrastructures and streetlights. The most common mode of transport, as revealed by the participants is private cars and taxis.

5.2 Participatory Mapping Results in the Rehoboth East Urban Constituency
In the Rehoboth East Urban Constituency, participatory mapping activity took place in Rehoboth Block E, Extension 1. The mapped area size is estimated

to be 2500 square metres. Seven (7) local community members participated in the mapping activity. Block E. Extension 1 is a description given to the land by the early town planners of the Rehoboth Town Council. It is an informal settlement situated in eastern Rehoboth. According to Shack Dwellers Federation of Namibia [20] this “informal settlement was established in 1983. People in this settlement came from Bahnhof Station and the old location of Rehoboth town.”

The major land uses in this settlement as depicted on the sketch map (Figure 5) are residential, institutions, business (shops) and church. Institutions such as schools can be seen on the centre of the map. The participants indicated that the most desired land use was the residential one because it provides them with access to land on freehold tenure. Institution such as a school was also indicated as preferable because of the need for their children to attend school. There are infrastructures depicted on the sketch map, as shown in Figure 5 and discussed by the participants that there are house buildings and roads in this informal settlement. The nearest primary school was also mapped and was observed to be about 600 to 700 metres away. A secondary school was about the same kilometres away. This kind of mapped results also confirms that “land use is characterised by the arrangements, activities and inputs by people to produce land use change or maintain a certain land cover type” (Food and Agriculture Organization, 1999: 32). There is also a clinic which was observed about 500 kilometres away which the community have access to for health services. The community members stated that part of Rehoboth Block E, Extension 1’s land belongs to the Town Council of Rehoboth. The other part of the land was bought by some community members at a cost of between N\$ 300 and N\$ 400 per erf in the year 1999. This was also confirmed with the Rehoboth Town Council.

Although the sketch map shows the main land uses and basic infrastructures in the settlement (Figure 5), no great emphases were put to indicate the numbers of houses as there are represented in their respective locations. Figure 5 shows that more efforts were put on mapping roads, businesses (shops) and institutions (schools), than other land infrastructures such as sewerage points, telecommunications and dumping sites.

In addition, a church and natural features such as river and dunes are shown on the sketch map but there were observed residential houses along the riverbed and dunes which were not depicted on the sketch map. This can possibly be a result of lack of participation, lack of understanding of land use features or lack of knowledge of the settlement by the participants. Repeated sketch mapping exercises confirmed that this kind of sketch mapping capability can be improved.

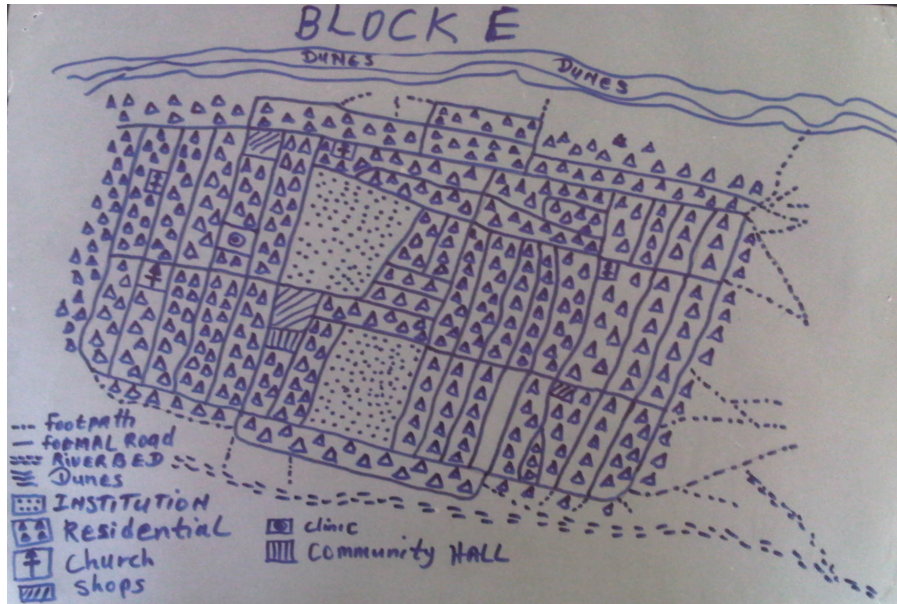


Figure 5: The sketch map of Rehoboth Block E, Extension 1 area
Mapped by: Rehoboth Block E local community members, 2012

The researcher observed that there are no water borne toilets in this settlement. People use removable buckets, pit latrines as well as the bush to relieve themselves. A public prepaid water system is available to the community. Few households have in-house sanitation facilities with proper water connection in the area.

The results help contribute to improved service delivery to the communities as maps will be used to measure infrastructure services provided to the communities. The appropriate government ministry could then take appropriate steps in planning and budgeting for basic services such as community toilets and water infrastructures in the informal settlement.

5.3 Participatory Mapping Results in the Rehoboth Rural Constituency

In the Rehoboth Rural Constituency, the participatory mapping took place in a village called Kalkrand, managed and administered by the Kalkrand Village Council. The mapped area size is estimated to be 3000 square meters. Seven (7) local community members participated in this participatory mapping activity. Both the sketch and photo-mapping approaches were undertaken in this area. In this area, the local community took their time to map their land uses and related infrastructures such as roads and contribute to their knowledge about the land uses.

Figure 6 and 7 demonstrate that residential, business (shops, offices), church, institution, open spaces and sport fields were the main land uses identified and mapped by the communities themselves in Kalkrand. Although the maps are not to scale, a very good understanding of their land was confirmed. A participatory mapping exercise was observed by the researcher to be a good method for bringing communities together. They were encouraged to share their knowledge and experience of their surroundings. The participants mentioned how open space areas are undesired within Kalkrand because they believe the land has to be occupied by landless people. They also indicated that the land belongs to individual farmers in the Hardap Region. The town council was in negotiation with the landowners (farmers) to purchase the land for residential purpose.

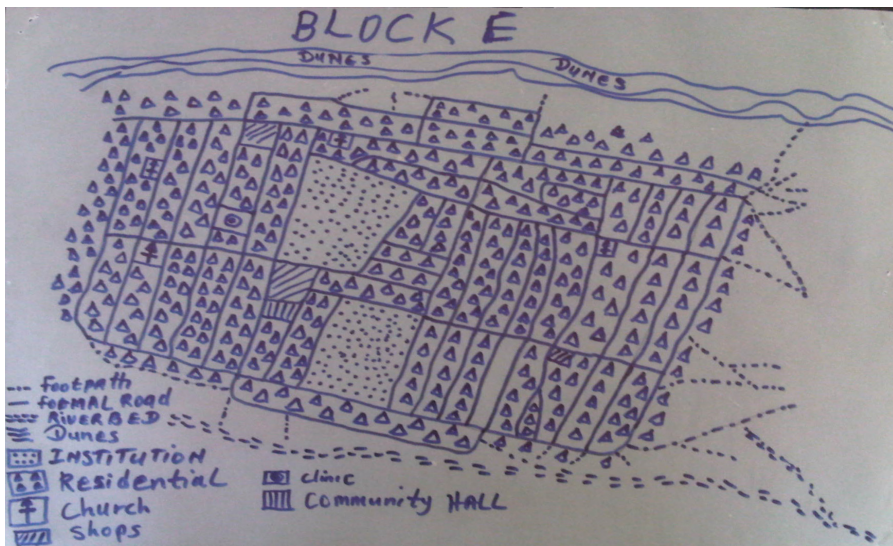


Figure 6: Sketch map of Kalkrand' village
Mapped by: Kalkrand local community members, 2012

Figure 7, a map based on an aerial photograph shows different results compared to the sketch map results. The land uses on the photo-map (Figure 7) were more than on the sketch map. Such and similar results could mean that the aerial photograph was well interpreted as the aerial photograph contained relevant data which depicted the current land uses and it was understood better by the participants to compare and describe features depicted on it.



Figure 7: Photo-map of Kalkrand from an aerial photograph of 2010
Mapped by: Kalkrand local community members, 2012

Different land uses were mapped on the aerial photograph as base material, including roads such as gravel roads. Beside gravel roads there are earth graded roads. Streetlights are also provided in the settlement but do not cover the whole village settlement. The most common mode of transport, as revealed by the local community is donkey carts with few people using private cars and taxis. Otherwise most walk to various places. The participants also confirmed that community members in Kalkrand participated in the installation of water pipes as part of a community project supported by the Village Council. This kind of information is also important for inclusion in future LUP of Kalkrand because it helps to provide the socio-economic status of the area.

5.2 Participatory Mapping Results in the Mariental Rural Constituency

In the Mariental Rural Constituency the participatory mapping took place in Stampriet. The mapped area size is estimated to be 2500 square metres. It is managed and administered by the Stampriet Village Council. Nine (9) local community members participated in this activity in this area. As confirmed by

the village council officer and the community members, every part of the land in this village belongs to the Stampriet Village Council.

The Shack Dwellers Federation of Namibia [20] maintains that “the estimated number of households is 500 and the estimated population is 2,500. There are a few brick houses and the rest are made of corrugated iron sheets.” Figure 8 represent the sketch map of Stampriet Village as drawn by the local community.

The various land uses within Stampriet were mapped on the sketch map in Figure 8. These land uses are residential, industrial, cemetery, open spaces and institution. Infrastructures and services such as roads, buildings, bed and breakfasts (B&B), a clinic and a service station can be found in the village. The location of the informal settlement in this village was also indicated as in the northern direction of Figure 8. With regard to natural features, a seasonal water channel was seen as dominating the major part of the village and it is surrounded by residential buildings.

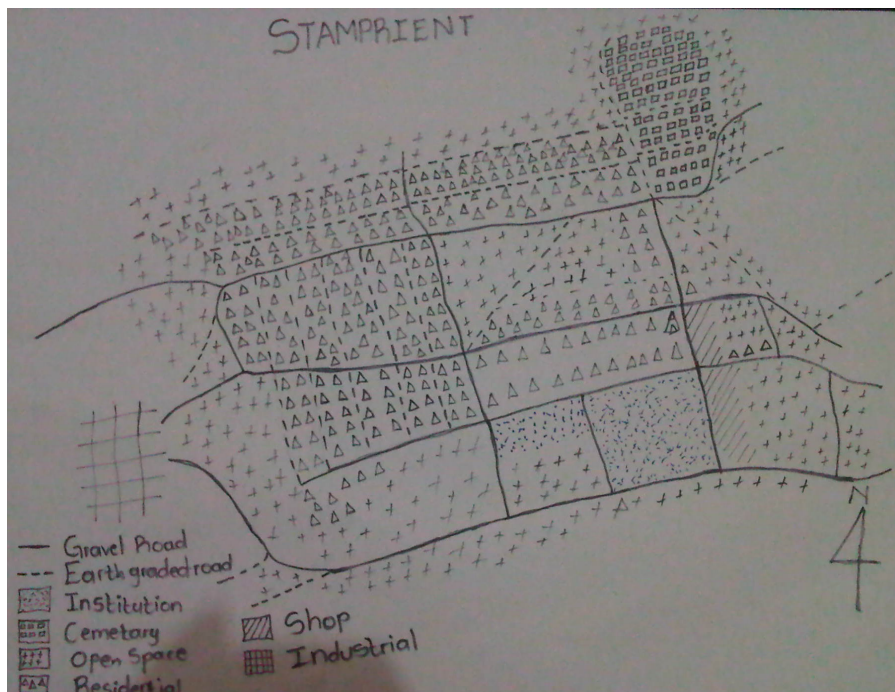


Figure 8: The sketch map of the Stampriet area
Mapped by: Stampriet local community members, 2012

Although main infrastructures and natural feature were mapped as shown in Figure 8, the photo-map (Figure 9) revealed some of the infrastructures which were not mapped in the sketch map. This is acceptable for two participatory mapping methods to produce different results. Many researchers in different parts of the world have taken advantage of various mapping methodologies, i.e. highly participatory approaches such as PRA to the newer participatory approaches such as participatory photo-mapping, participatory GIS, crowd sourcing and more complex spatial technologies, such as GIS. The demand for participatory approaches is far greater than what can be delivered, and the distribution of indigenous mapping initiatives has been extremely uneven (Chapin, Lamb and Threlkeld [21]). Approaches involving the people who live in the area such as participatory mapping promote community engagement in planning, sharing ideas among participants and it help generate new information. Broadening public participation, data access, local knowledge integration and community empowerment are key concepts in a participatory mapping approach to LUP.

The Stampriet photo-map in Figure 9 shows new information such as a sport field. Some of the dominating land uses which were shown on both sketch and photo-maps by the local communities includes the cemetery, open space, industrial and institution such as schools within the village.

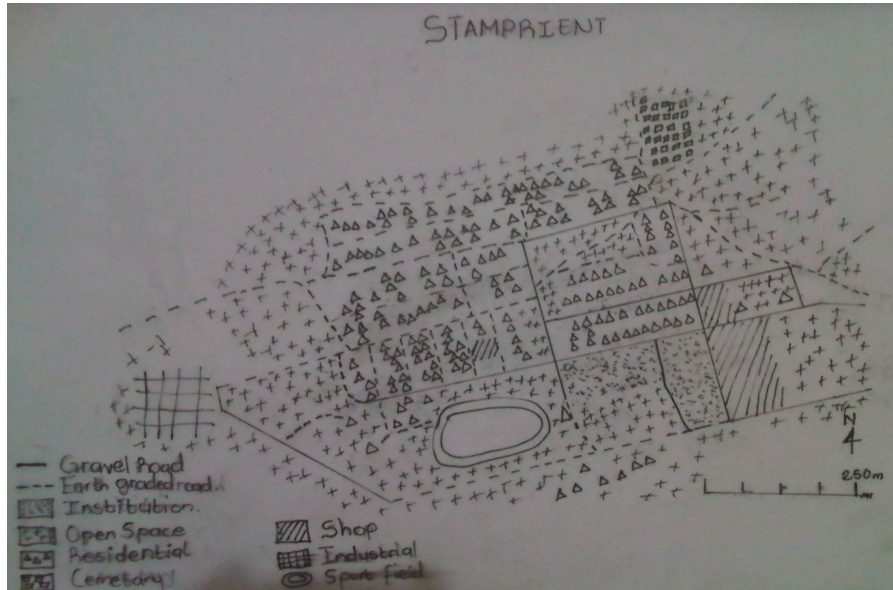


Figure 9: Photo-map of Stampriet from an aerial photograph of 2010
Mapped by: Stampriet local community members, 2012

In participatory mapping, it is important to map with understanding. Basic knowledge of infrastructure development is useful in mapping in order to produce understandable maps. Figure 9 shows some of the isolated buildings with no access to roads. Some of the buildings do not have access to roads as can be seen in the part of the illustration which shows the southern direction. Although the results of Figure 9 are based on mapping what was visible on the aerial photograph and what is known to the participants, there is a need for better interpretation of infrastructure relationship. For example, a building should always have an access to a road.

Some of the observed services provided to the local communities in Stampriet include public water taps for lower income earning households, as well as electricity for those who can afford to connect. The existence of schools, the police station, churches and a graveyard was also confirmed in this area. There are no constructed roads except for one, which is the main road. Streetlights are provided in the village of Stampriet.

5.3 Participatory Mapping Results in the Mariental Urban Constituency

In the Mariental Urban Constituency, the participatory mapping took place in the informal settlement called Oshiwana Penduka in Mariental. The mapped area size is estimated to be 2400 square metres. Eight (8) local community members participated in this mapping activity. The name "Oshiwana Penduka" is a plea that means "to wake up the nation", presumably to the plight of the informal settlers. The estimated number of households is 650 with an estimated population of 4, 000 (Shack Dwellers Federation of Namibia [20]). With the exception of three brick houses, all the houses are shacks built with corrugated iron sheets.

The Shack Dwellers Federation of Namibia [20] stated that "people in this informal settlement came from different towns and some people came from farms. Most parts of this informal settlement's land in this area still belong to the Municipality of Mariental as only a few people bought individual plots."

In Oshiwana Penduka, the researcher observed that the residents have access to gravel roads, earth graded roads, electricity and streetlights. The participants confirmed during the FGD that those without electricity make use of candles, paraffin, gas and firewood. Public garbage drums are also available for solid waste management purpose. The nearest police and fire station is in town which is about 1.5 kilometres away from Oshiwana Penduka community.

Figure 10 of the sketch map produced by the local community of Oshiwana

Penduka reveals that the community's land is serviced with basic facilities such as water points, community toilets and roads. The residential erven in this informal settlement are well planned and have access to a road. The sketch map further reveals that there is a church in the area, and that the residents have access to a seasonal river and open spaces.

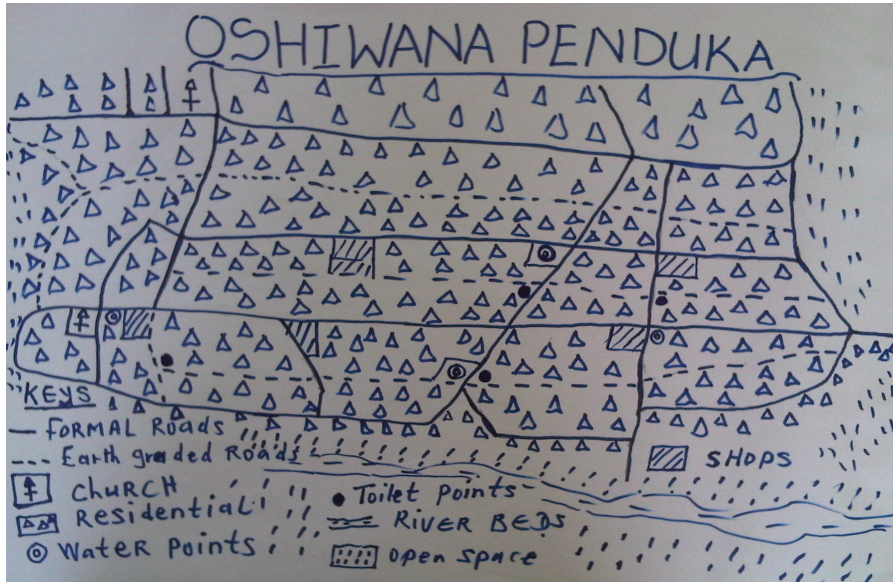


Figure 10: The sketch map of the Oshiwana Penduka area
Mapped by: Oshiwana Penduka local community members, 2012

The participatory mapping activity in this area helped to further get the insight on the future development of this informal settlement. The local residents stated that the municipality has been in contact with them to help support them to upgrade the informal settlement from corrugated iron sheets houses to low-income brick housing structures. This was then confirmed by the Municipal official in Mariental, but the process of implementation had not started at that time and will be lengthy.

5.6 Participatory Mapping Results in the Gibeon Constituency

In the Gibeon Constituency, the participatory mapping took place in the informal settlement called Helena Pieters Section. The mapped area size is estimated to be 2500 square metres. Seven (7) local community members participated in the mapping activities of this constituency. Both sketch and photo-maps were compiled in this informal settlement. The Shack Dwellers Federation of Namibia [20] stated that it had been established in 1970 and

people had come from the areas surrounding Gibeon. Legally, the land belongs to the Village Council of Gibeon. The residents were given permission to occupy the land by the Village Council of Gibeon, but no written agreement was signed.

Figure 11 reveals that a few facilities such as water points, toilet point and roads are provided to the small settlement of Helena Pieters Section. These services are not structured. Land uses such as businesses (shops), residential and open spaces can be spotted on the sketch maps. Land covers such as river beds were also observed. The official road access to buildings in this informal settlement is earth graded roads. A sewerage swap can be seen in the western direction of the settlement of Figure 11.

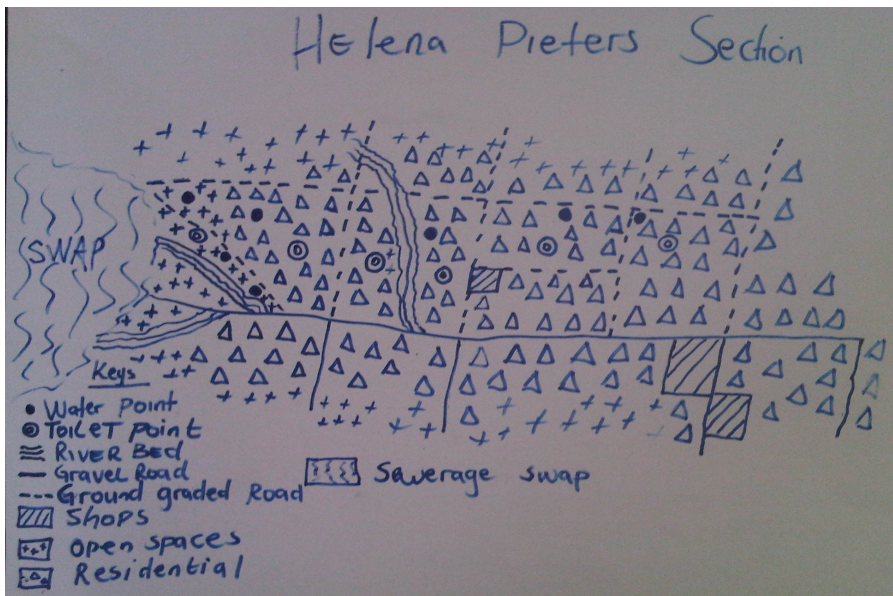


Figure 11: The sketch map of the Helena Pieters Section area
Mapped by: Helena Pieters Section local community members, 2012

Figure 12 of the photo-mapping shows very few features mapped by the local community as the aerial photograph of 2010 depicted only a few housing structures, roads and river beds in the informal settlement. The limitation of this map is due to poor resolution and poor quality of the aerial photography used in the participatory mapping. Such limitations in the quality of the aerial photographs had been expected by the researcher and resulted in disadvantaging the photo-mapping approach.

The estimated number of households in the informal settlement is 300 people. Most of the families live in houses constructed with corrugated iron sheets with a few households who live in brick houses. The estimated population living in informal houses is about 1,500 (Shack Dwellers Federation of Namibia [20]). It was also observed by the researcher that there are about five prepaid water taps. There are no schools, clinics or other social services in this informal settlement. Some local communities confirmed that they only access social services in neighbouring settlements. The delimitation of photo-mapping is that poor resolution and poor quality aerial photographs can be avoided when good quality aerial photographs are available.

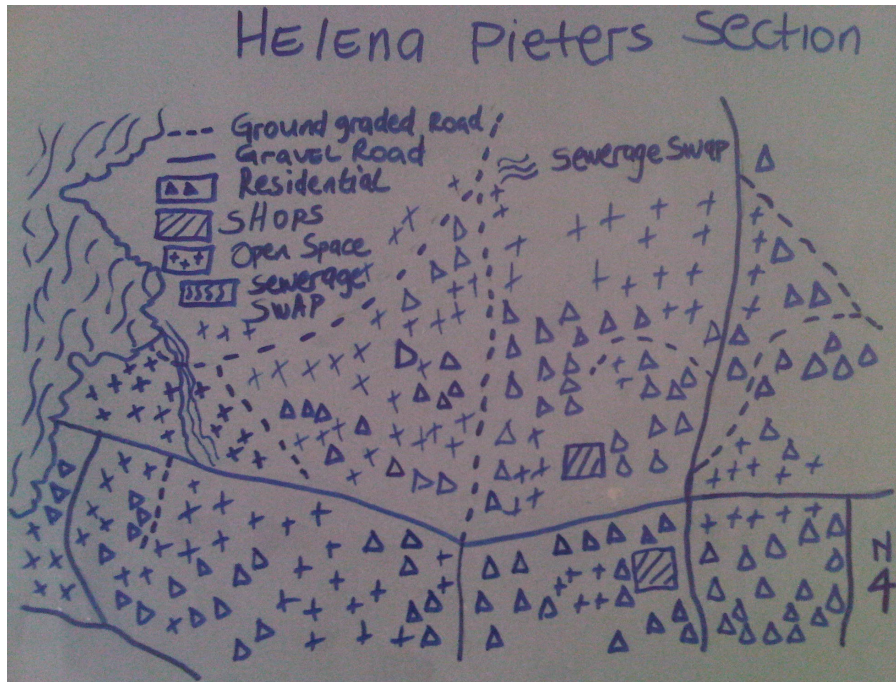


Figure 12: Photo-map of the Helena Pieters Section area from an aerial photograph of 2010

Mapped by: Helena Pieters Section local community members, 2012

As it can be seen on both Figures 11 and 12, there are no tarred roads in this informal settlement. Residents mostly walk to various places. The nearest police station was 2 kilometres away. The community members confirmed that they are not involved in any development activity because there is no development at all in this area.

6. The Participatory Mapping Approaches [The Findings and Participants Perspectives]

6. 1 Comparison of Sketch and Photo-Mapping Results

At times the information on the sketch map supplied by the participants sometimes differed from information obtained from the aerial photograph as base material for photo-mapping method due to the characteristics and limitations of each method. However, results from each method were compatible and complementary to each other.

This study confirmed that maps can be created with relevant information from the participants by drawing either on the ground or on a piece of paper large enough for participants to see clearly and mark on the map after discussing where the many buildings, structures and infrastructures are located. According to Wu and Isaksson [22] “participatory maps cover the heterogeneous subjects mentioned by the locals, including land use, movement routes, places that once existed and those that still exist.” Although several areas were mapped within the Hardap Region, they are not categorised or weighed against each other. The two types of maps (sketch and photo) are different in their precision of locations as well. The International Fund for Agricultural Development [10] defines sketch mapping maps as “represents key community-identified features on the land from a bird’s eye view.” Photo-mapping is based on an aerial photograph as base material. This means that location based information is delineated based on the resolution, scale and accuracy of the aerial photograph.

6.2 Advantages and Disadvantages of Participatory Mapping Methods

Participatory sketch and photo-mapping maps have both advantages and disadvantages. Some of the advantages of sketch and photo-maps produced through participatory mapping are that they:

1. are easy to explain
2. can be used to collect additional primary data
3. are inexpensive tools to record information on how the land is used
4. can be used for further studies in the areas of geography, social and environmental science and for any mapping needs where residential areas need to be mapped
5. can be stored electronically
6. can be printed as needed
7. can be mailed electronically as needed

The disadvantages of sketch and photo-mapping maps produced through participatory mapping are that they:

1. are static maps
2. lack flexibility, i.e. data cannot be added or removed.
3. are not interactive
4. not as effective as expected as the participants' level of understanding has an influence on their drawings
5. The sketch map results can be too vague

Although there are general comparisons of both sketch and photo-mapping maps, the outcome of the two might be different. Table 1 shows some of the differences encountered during this study.

Table 1: Differences between sketch mapping and photo-mapping in LUP

Sketch mapping	Photo-mapping
<ul style="list-style-type: none"> • Sketch maps are drawn directly from memory and therefore not to scale. • They are roughly drawn maps which may be inaccurate but can be quickly created. • Sometime the information on the sketch maps can be too vague. • Creating a map from memory can be a time consuming exercise as usually more than one person is involved who draw information from memory only. 	<ul style="list-style-type: none"> • Photo-maps are approximate to scale drawing when the base aerial photograph is geo-referenced. • Photo-mapping is usually drawn on large scale (i.e. 1:25 000 to 1: 50 000). • Features are drawn in their true position (within limitations of scale). • Maps can be completed promptly when the features are clearly visible.

6.3 Challenges during Participatory Mapping Exercises (Participants Perspective)

Some of the encountered challenges for the participants of participatory mapping in general are that drawing a feature polygon in the field is very time consuming. Some of the challenges encountered include:

1. Half of the participant had difficulty reading maps and aerial photo graph, so in many cases the community members would misread some of the features.
2. Half of the participant had difficulty orienting themselves to aerial

- photo-maps because there were few recognisable landmarks.
3. Difficult to keep the participants focused to land uses only. The inhabitants have to continuously be reminded and confronted to concentrate on mapping land uses and related geographical features, the situation which can be challenging to the researcher.

As a tool to facilitate decision-making in land use planning, participatory mapping methods should contribute to adding value to development of land use plans where participants discuss their land uses and contribute to those land uses' management. Different land uses were created with the two participatory methods (sketch and photo-mapping) from different participants and different areas within the Hardap Region. Land management challenges such as land use conflicts and land allocation are typical examples where stakeholder participation is needed. In many developing countries such as Namibia, Zimbabwe and Zambia, for example, information on the local social values on cultural landscapes is completely missing, and natural resources are under constant pressure from various stakeholders (MA; FAO, cited in Fagerholm & Käyhkö, [23])

7. Concluding remarks

In this study participatory mapping was identified as an important approach in land use planning, particularly in sharing land use ideas among participants and collecting data related to socio-economic issues. Participatory methods, if applied properly, allow the user to grasp the intangible and invisible through a concrete medium that can be shared with others. Participatory mapping is significant for all areas of land use planning and natural resource management. The study supports participatory mapping as a potentially viable tool, technique and methodology to clarify local community knowledge and create media that permit different voices to enter into dialogue with one another.

Another purpose of participatory mapping was to gather and share information about different land uses among different participants in different areas of the Hardap Region. The participatory mapping methods proved to be an excellent process for allowing local people of all ages to engage with their surroundings and heritage. In an inspiring and motivating way they were encouraged to use their land appropriately, such as avoiding using residential land for industrial purpose.

In addition, the participatory mapping activity offered other advantages of allowing local communities to learn about basic map-making the map. The participatory mapping method proved also to be a catalyst in stimulating memory and in creating visible and tangible representations of the natural

environment. The time spent working on the legend allowed for greater clarity on meanings, and the relationship between natural land features and land use features. The participatory maps are able to capture both land use and natural features.

Many researchers in different parts of the world have taken advantage of various mapping methodologies, i.e. highly participatory approaches such as PRA to the newer participatory approaches such as participatory photo-mapping, participatory GIS, crowd sourcing and more complex spatial technologies, such as GIS.

The demand for participatory approaches is far greater than what can be delivered, and the distribution of indigenous mapping initiatives has been extremely uneven (Chapin et. al., [21]). Approaches involving the people who live in the area such as participatory mapping promote community engagement in planning, sharing ideas among participants and it help generate new information. Broadening public participation, data access, local knowledge integration and community empowerment are key concepts in a participatory mapping approach to land use planning.

8. References

- [1] Randolph, R. 2004. Environmental Land Use Planning and Management. USA, Washington: Island Press.
- [2] Government of Namibia. 2006. Regional Poverty Profile: Based on Village-level participatory Poverty Assessment in Hardap Region. National Planning Commission, Windhoek, Namibia.
- [3] Mendelsohn, J, Jarvis, A, Roberts, C, Robertson, T. 2002. Atlas of Namibia: A Portrait of the Land and its People. Ministry of Environment and Tourism, Windhoek, Namibia.
- [4] Namibia Statistics Agency. 2013. Namibia 2011 Population and Housing Census Basic Report. Windhoek, Republic of Namibia.
- [5] Rambaldi, G., Chambers, R., McCall, M, Fox J. 2006a. Practical ethics for PGIS practitioners, facilitators, technology intermediaries and researchers [Online]. Accessed 26th March 2010 from: http://www.ppgis.net/pdf/ch14_rambaldi_pp106-113.pdf
- [6] Rambaldi, G., Kyem, P.A.K., McCall, M, Weiner, D. 2006b. Participatory Spatial Information Management and Communication in Developing Countries [Online] Accessed 26th March 2010 from: <http://www.ejisd.org/ojs2/index.php/ejisd/article/viewFile/237/158>
- [7] Minang, P.A, McCall, M.K. 2006. Participatory GIS and local knowledge enhancement for community carbon forestry planning: an example from Cameroon [Online]. Accessed 26th March 2010 from: <http://www.communitycarbonforestry.org/NewPublications/Participatory%20GIS%20and%20local%20-%20Minang.pdf>
- [8] Integrated Approaches to Participatory Development [IAPAD]. 2010. Participatory Mapping Toolbox [Online]. Accessed 28th April 2009 from: <http://www.iapad.org/toolbox.htm>
- [9] Corbett, D., Rambaldi, G., Kyem, P.A.K., Weiner, D., Olson, R., Muchemi, J., McCall, M, Chambers, R. 2006. Overview: Mapping for Change – the emergence of a new practice [Online]. Accessed 26th March 2010 from: http://www.iapad.org/publications/ppgis/ch01_overview_pp13-19.pdf
- [10] International Fund for Agricultural Development [IFAD]. 2009. Good Practices in Participatory Mapping: A review prepared for the International Fund for Agricultural Development (IFAD) [Online]. Uttar Pradesh: India. Accessed 25th March 2010 from: http://www.ifad.org/pub/map/PM_web.pdf
- [11] Müller, D, Wode, B. 2003. Manual on Participatory Village Mapping Using Photomaps. Social Forestry Development Project (SFDP) Song Da. Second Draft, 30/06/2003 Son La
- [12] Canadian Council of Forest Ministers. 2009. Fact Sheet - Integrated Forest Land-Use Planning [online]. Accessed on the 22nd June

- 2011 from: http://www.sfmcanada.org/english/pdf/LandPlan_FS_Eng.pdf
- [13] Amler, B., Betke, D., Eger, H., Ehrich, C., Kohler, A., Kutter, A., von Lossau, A., Müller, U., Seidemann, S., Steurer, R., Zimmermann, W. 1999. Land Use Planning Methods, Strategies and Tools - Eschborn, 1999 [online]. Accessed 22nd June 2011 from: <http://www.mpl.ird.fr/crea/taller-colombia/FAO/AGLL/pdfiles/gtz-lup.pdf>
 - [14] Di Gregorio, A, Jansen, L.J.M. 1998. A New Concept For A Land Cover Classification System. The Land 2(1): 55-65 [Online]. Accessed 09th June 2013 from: <http://www.fao.org/docrep/004/x3810e/x3810e04.htm#g>
 - [15] Longley, P.A., Goodchild, M.F., Maguire, D.J., Rhind, D.W. 2005. Geographical Information Systems: Principles, techniques, management and applications. (2nd ed.). Abridged. United States of America. John Wiley.
 - [16] Cloke, P.J. 1989. Rural Land Use-Use Planning in Developed Nations. St David's University College, Lampeter, London: Unwin Hyman.
 - [17] Wade, T, Sommer, S. 2006. A to Z GIS: An illustration dictionary of geographical information systems. (2nd ed.). California. ESRI Press.
 - [18] Nabwire, N. 2002. An Integrated Information System For Decision Support In Sustainable Land Use Planning: A Case Study Of Kunene Region Namibia. International Institute for Geoinformation Science and Earth Observation (ITC), Masters of Science in Geoinformation Management for Rural Development and Resource Management [Online]. Accessed 16th August 2012 from: http://www.itc.nl/library/papers/msc_2002/nrm/bamulesewa_nabwire.pdf
 - [19] Emery, A.R. 2000. Integrating Indigenous Knowledge in Project Planning and Implementation [Online]. Canadian International Development Agency. Accessed 22nd June 2011 from: [http://www.acdi-cida.gc.ca/INET/IMAGES.NSF/vLUIImages/ea/\\$file/IndiKnowNP-e.pdf](http://www.acdi-cida.gc.ca/INET/IMAGES.NSF/vLUIImages/ea/$file/IndiKnowNP-e.pdf)
 - [20] Shack Dwellers Federation of Namibia. 2009. Community Land Information Program (Clip) Profile of Informal Settlements In Namibia, March 2009 [online]. Accessed 16th June 2011 from: <http://www.citiesalliance.org/ca/sites/citiesalliance.org/files/NamibiaCLIP092.pdf>
 - [21] Chapin, M., Lamb, Z, Threlkeld, B. 2005. Mapping Indigenous Lands. United States of America, Washington.
 - [22] Wu, C.J, Isaksson, K. 2008. Participatory mapping as a tool for

capturing local perspectives on cultural landscape case study of Ostlänken [Online]. Accessed 07th July 2011 from: <http://www.mistra.org/download/18.87749a811cbd4c4fb4800010902/Participatory+mapping+as+a+tool.pdf>

- [23] Fagerholm, N, Käyhkö, M. 2009. Participatory mapping and geographical patterns of the social landscape values of rural communities in Zanzibar, Tanzania. *Fennia* 187: 1, pp. 43–60. Helsinki. ISSN 0015-0010. [Online]. Accessed 07th July 2011 from: http://www.landscapemap2.org/Fagerholm_Zanzibar.pdf