Chapter 1
Introduction

1.1 Background and Justification

It is becoming increasingly apparent that the Maasai pastoralist system is breaking down, with settled Maasai pastoralists no longer adhering to traditional resource management methods (Lovett *et al.* 2001). Either as a consequence or as a driver of this phenomenon, land use change, in the form of settled agriculture, is rapidly occurring. For instance, it has recently been ascertained that the Maasai based in Kenya now derive their main livelihoods not from herding but instead from farming, wildlife tourism and/or leasing of land for cereal cultivation (Thompson and Homewood, 2002). It has been suggested that these new livelihood choices made by the Maasai are not simply a function of potential economic returns (Homewood, 2004; Thompson and Homewood, 2002). Rather, the factors impacting on decisions over land tenure practices and livelihood change will each have their own driving factors, based on historic trends, the current situation and future aspirations of the Maasai community. These livelihood choices might also be impacted by economic changes, population pressure, changing cultural trends (especially within the context of gender and social wealth), poor health and the stochastic nature of the environment. In the context of Maasailand in Tanzania, there is immense political pressure from the government for the Maasai to settle (which has recently been reinforced by the 1999 Land Act and Village Land Act).

These livelihood changes and subsequent land use changes are thought to be having a dramatic impact on local ecology within the Burko area in Tanzania, reducing habitat availability for wildlife. This area is a hunting area which provides important protection for local wildlife through the Cullman and Hurt Community Wildlife Project (CHCWP). CHCWP promotes wildlife conservation through the sustainable utilization of wildlife, delivering economic benefits from trophy hunting tourism to the local Maasai communities. It has been said that wildlife cannot be separated from the needs and involvement of rural people, or from ambient cultural, political, economic, and biological realities (Tambiah, 1995). If there is to be a viable future for wildlife within the area, the drivers of the change in primary livelihood and land use need to be determined and management strategies adapted to meet the current specific needs of the Maasai and to ensure their active involvement in such strategies.

Current and future research must, therefore, endeavour to understand the complex linkages and interactions between the different driving factors governing Maasai land use. The utility of such information will be greatly increased if the driving factors are defined within the context of the local communities themselves. One way of doing this is to focus at the grassroots level and ask the communities themselves to identify the problems they encounter during livelihood activities, attribute a relative importance value to each problem and discuss the frequency of occurrence of each problem.

Whilst a package of Participatory Rural Appraisal techniques (PRA) would allow for in depth assessment of the livelihoods of the Maasai and the issues surrounding them, these methods sometimes tend to be time-consuming (for instance, life portraits), spatially limited, hard to quantify and produce statistics from and, ultimately, are often unrepeatable as they are subject to the relationship between the original researcher(s) and the participants. As the Maasai's perception of problems relating to their livelihoods are likely to be influenced by physical, environmental and social factors prevailing at the time of data collection, and as the reason for looking at these problems in depth is to try to find solutions and to in turn measure the impact of these solutions, it is important to use a methodology that is not only easily repeatable but also gives outputs that all the stakeholders concerned, including the communities themselves, can readily understand and use to improve their quality of life and the status of the land. Therefore, this thesis proposes a combination of techniques, some PRA based and some of which will be more scientifically based, and will attempt to address the limitations of PRA whilst maintaining the benefits of the ideology behind it.

Recently, a study by Quinn *et al.* (2003) was published on the feasibility of Risk Mapping as a means of identifying factors that influenced local perceptions of livelihood problems in Tanzania. Quinn *et al*, concluded that the risk mapping method is a "*useful tool for understanding perceptions of risk to livelihoods in semi-arid Tanzania*" (Quinn *et al.* 2003 p118) and that risk perception not only varies according to livelihood strategy and gender roles but also varies according to spatial and temporal availability of key resources such as water.

Therefore, research into the drivers of livelihood change needs to incorporate not only local perceptions but also the corresponding spatial arrangement of the resources within the landscape in order to contribute towards successful sustainable management of common pool resources within the Burko area.

1.2 Aim and Objectives

Aim

The aim of this project is to identify problems that the Maasai Communities of six villages in the Burko area currently experience and associate with different livelihood strategies and to explore the complex linkages between these perceived problems, the available resources within the region and recent land use change.

Objectives:

1) To map and quantify the changing extent of land under cultivation in the project area from 1987 to present day.
2) To identify the problems that the Maasai community within each of the 6 villages in the project area believe threaten their livelihoods, using People's Problem Perception Mapping.
3) To carry out an in-depth case study into perceived problems and land use change within one of the villages and to use this information to verify PPPM as an appropriate methodological tool for the area.
4) To create a Geographical Information System highlighting the location of resources within the project area and to display spatially the results from the case study village.
5) To determine the factors driving land use change by examination of the relationships between the outputs of the land use mapping, resource mapping, PPPM results and the data collected from the case-study village.
6) To make recommendations for NGO interventions

1.3 Scope of the Project

This project combines the use of a Geographical Information System (GIS) of the project area with the outputs of People's Problem Perception Mapping (PPPM) and land use change mapping using satellite images, to provide an analytical tool for the production of a comprehensive overview of both human and resource related drivers of livelihood and land use change within the Burko hunting area contained within the Monduli District, Tanzania. This report argues that such an integrated overview of the area, in terms of the problem perception of the community, the recent changes in land use and the actual location and availability of resources, is vital for successful future management strategies whose aim is to encourage sustainable development and maintenance of biodiversity within the area. The GIS consists of available location points for resource locations (e.g. water points where recorded), social facilities (e.g. schools and dispensaries), crucial transport networks (roads), and the areas in which is designated as the hunting block, as well as a recent time-series of land use change within the villages (gained from visual analysis and processing of satellite imagery).

This report argues that it is important to gain livelihood problem perception information specific to each of the villages as the different spatial locations have different natural and anthropogenic resources which play a role in influencing their perception of livelihood problems. Detailed qualitative and quantitative information has been acquired for a case study village (the village of Arkaria) using PRA techniques and a partial census involving a semi-structured interview of the bomas, in order to provide detailed information as to the driving factors of land use change in the area.

This thesis is structured as follows: Chapter Two considers the received wisdom and public perception of the Maasai before providing a concise history of Maasailand and an overview of land use change in the project area. Chapter Two also includes a brief theoretical summation of the methodologies incorporated within this project as well as a site description of the project area. Chapter Three details the methodologies used and the ways in which they aim to fulfill the aim and objectives of this project as well as the limitations encountered. Chapter Four describes the results of the land use mapping, PPPM and the partial census using the framework of a model developed and outlined in Chapter Three. Chapter Five draws the results together in a discussion of the relationships between different driving factors, drawing on and comparing these results to other research that has been carried out in the area. General limitations are acknowledged and future work is suggested. The conclusion in Chapter Six summarises

the project's findings and discusses the implications these could have on future management strategies. Ways in which the methodologies of this project could be used and/or built upon by the Maasai and NGOs/agencies are discussed. Chapter Seven outlines some recommendations for NGO intervention made on the basis of the findings of this thesis.

Chapter 2

DIFFERING PERCEPTIONS & HISTORICAL CONTEXT

"*our culture is a living culture and not a historical one*"

Hon. Alhaj Juma A. Kapuya, former Minister of Education and Culture, Maasai in origin (Village Museum, 1998 p19).

2.1 Received wisdom and public perception

The Maasai are one of the few tribes whose name and integrity are globally recognised. However, they have recently been described in every edition of the Sunday Times published globally on the 28th August as, "mammalian bipeds" and "a distracting fraud" by the author A.A.Gill (2005).

Their current image according to Western advertising (tall men in red checked cloths often with spears in one hand and mobile phones in the other) is often used today in commercials for cars, airlines, fashion shoots and in magazines such as Hello! (Gill, 2005). Yet Gill suggests in his newspaper article that this image is false and states that they are "*nothing like as utopian as we want to believe*".

Often, by saying the word 'Maasai', images are evoked of "tall and slender and handsome, noble savages who looked the part, brave to the point of foolishness, peerless hunters and trackers" (Gill, 2005). This male dominated, coffee-table book image is, according to Dorothy Hodgson (an anthropologist who lived and worked with the Maasai), a legacy left by the British colonial administration who manipulated perceptions of ethnic and gender identity of the Maasai (Box 1).

Box 1

"*being Maasai was configured as a masculine category –'real' Maasai were pastoralists, warriors, and nomads, all of which were perceived as male pursuits. This static, andocentric image of Maasai ethnic identity persists today...*" (Hodgson, 2001 p130)

In fact, they are a people adapting to a westernized paradigm of the modern world. Gill's main complaints seemed to be that the Maasai hire lawyers for legal advice about

land alienation, that they wear fabricated tartan cloth from China and that, above all, they *"think it is beneath them to do any work but herd cattle"*.

This last perception could almost have been voiced by the Tanzanian National Government which purportedly shares a common misconception that pastoralists are "*problem people who choose to evade rather than participate in the process of national development"* (Homewood and Rogers, 1991, p 67). From research by anthropologists who have actually lived and spent time with the Maasai, it is apparent that the Maasai's inclination to participate is not the problem, rather it is the lack of appropriately prepared mechanisms that would enable them to do so.

Perhaps our understanding of the Maasai; their livelihoods, their land use and the ways in which these have changed lies not in misconception and theoretical debate but, instead, with the Maasai themselves. Dorothy Hodgson, a cultural anthropologist, said that she, "*listened carefully as people* [the Maasai] *discussed their problems, debated their development priorities"* and realised that they had challenged her *"preconceptions about their needs and desires" (Hodgson, 2001 p.3).*

2.2 The history of the Maasai

2.2.1 Origins of the Maa people

The Maasai are known as "Iltung' ana loo ngishu", people of cattle. Traditionally, they practice transhumance between different grazing pastures for their cattle according to season, searching for fodder and water (Mapinduzi *et al.* 2003).

Their origins are debatable as the Maa people have only an oral history (Njoolay and Loning'o, 1998). It has only recently been acknowledged by academics that the other Maa-speaking groups, whose livelihood strategies are based around hunting or farming, are linked to and are a part of the Maasai pastoralist system (Homewood and Rogers, 1991). The Maasai themselves believe that God (their God) created three classes of people: pastoralists, farmers and hunters (Njoolay and Loning'o, 1998). These different tribes were founded by the children of Maa's three wives (see Box 2).

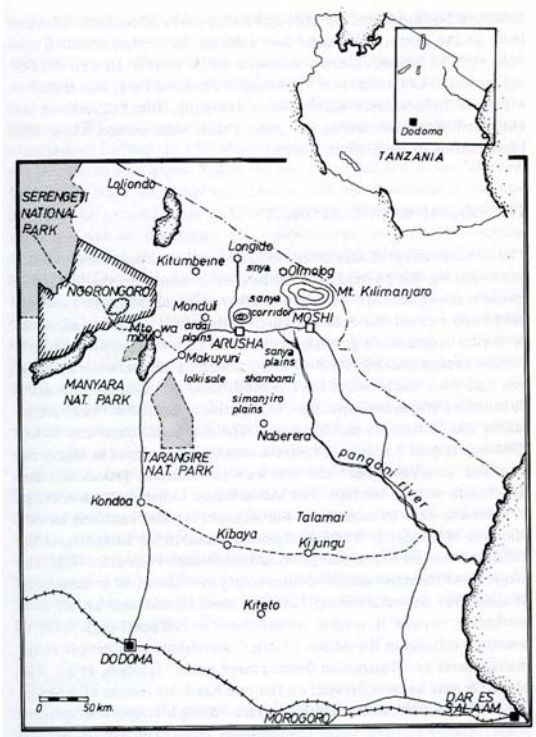
BOX 2

The first person was Maa (sometimes known as Maasindat), who lived at Kerrio and had three wives: Naiterokop, Nasotua, and Nainyiti. Maa gave birth to all Maasai. The first child of his wife Naiterekop was a son named Nagol, who had only one tooth. He was a bit of an outsider, and didn't get along well with others. His parents tried to pull out his one tooth, as he was laughed at, but it was too hard. He moved away, and started the tribe (entipat) called "Illogol lala" (hard teeth). They are still around these days in Kenya and Tanzania (Morogoro and Ruvu), sometimes called "Likikoine" or "Lmbwa". Naiterekop's second child, Maasai, fathered the Maasai, Purko, Arusha and Irkaputie. Maa's second wife, Nasotua, gave birth to a girl named Simal, who later left and was taken by Somali Dorobos. She gave birth to twins, a boy and a girl, in Somalia. The name "Somalia" comes from her name, "Simal", and is the reason the Somalis speak like Maasai. Finally, Maa's third wife, Nainyiti, gave birth to the Iltengwal, Samburr (Samburu), Ilaikipiak, Iluasinkishu.

Source: Dorothy L. Hodgson (2001) p23

Living memory of the Maasai dates the existence of Maa people as being long established in North Africa by the 1770s (Kimesera, 1998). It is thought that the main migratory period southwards took place between 1776 and the beginning of the colonial era (1850) by which time the Maasai were at the height of their power, with Maasailand covering an area that stretched from central Kenya down to central Tanzania (Arhem, 1985).

However, Maasailand today is a shadow of what it once was (Figure 2.1)



Map 2. Tanzanian Maasailand today.

Figure 2.1 Maasailand today (Arhem, 1985 p21)

2.2.2 Maasailand

By the end of the nineteenth century, Maasailand had struggled through a decade of disaster. The bovine outbreak of 1883 and the rinderpest outbreak of 1891 left Maasai herds substantially reduced (Rohde and Hillhorst, 2001). This, combined with a smallpox outbreak in 1892, initiated the process of transformation of Maasai social organization and gender relations. The immediate consequences were: the encouragement of Maasai to marry cultivators, boys to find wage employment and the trading of children for food (Hodgson, 2001). At the same time, the effects of colonial land policies in both Kenya and Tanganyika were being realised (Arhem, 1985); the white settlers and cultivators moved in and the Maasai were forced out. The reduction in Maasai cattle herds led to less grazing in the highlands which, in turn, caused vegetation changes ideal for tsetse infestation. This resulted in a large expanse of previously prime pasture land becoming useless (Rohde and Hillhorst, 2001).

At the end of this dire period for the Maasai, the survivors returned to pastoralism as their primary livelihood with the notable change that they chose to increase their food security by living amongst cultivators with whom they could trade (Hodgson, 2001). The Maasai bartered pastoral products for agricultural products as far back in time as the end of the nineteenth century (Ndagala, 1996).

The German colonial administration tried to restrict the Maasai to the southern end of their land in the arid Maasai-steppe whilst retaining the more fertile and less arid land in the north for white settlers (Arhem, 1985). However, the Germans were defeated in the First World War and Tanganyika was handed over to be administered by the British. The British created the first Maasai reserve in 1926. Tanganyikan Maasailand and the Maasai's grazing rights were protected. However, this was short-lived. More cynical academics suggest that the "protection" was a farce in itself (see Box 3).

Box 3

"one cannot escape the conclusion that the Land Ordinance was an exercise in cynicism, appearing to grant rights to the African population over their land while vesting complete legal control in the colonial administration… The provisions were deliberately made as vague and ambiguous as possible so that any further shift of policy could be readily justified legally by a reinterpretation of the statute"

Lyall (1973:12) cited in Mvungi and Mwakyembe (1996:75)

During the late1930s-1950s, the centre of Tanganyikan Maasailand became a target for large-scale land alienations (Arhem, 1985). In the 1950s, the borders of the Maasai

District were further restricted to allow for the influx of Il-Arusa cultivators, encouraged by colonial expansion programmes (Hodgson, 2001; Arhem, 1985). Compensation was given in the form of the Masai Development Plan which was promised would bring economic modernization to the Maasai through the provision of improved services, especially water resources and the eradication of the tsetse fly (Arhem, 1985). By 1955 that programme had failed.

Tanganyika was made independent in 1961, inspiring the continuation of colonial style land policy; acquisition of pastoral lands, more intensive land use practices put in place and compensation to the pastoralists in the form of extension services, often of little use to the pastoralists themselves (Arhem, 1985). This style of governance prevailed due to the Government's synthesis of pastoral people as "problem people", people that wanted nothing to do with national development (Homewood and Rogers, 1991 and see Box4).

Box 4

"The growing attitude of laziness connected with famine relief is distressing [sic]; were the concept of building a better country in which to live through hard work more prevalent, these troubles which have taken up so much of our time would never have arisen"

Water Officer to Provincial Commissioner, Northern Province, 15th June 1961 (cited in Hodgson 2001).

Dorothy Hodgson, in her book "Once Intrepid Warriors" (2001), commented that by the eve of Independence the Maasai had seen 50 years of development and yet they were by far the worse off for it, with the effects of drought increased by land alienation which reduced the dry-season grazing grounds and water points available. What new water points had been built had caused clustering of livestock and degradation within the immediate vicinity of the water points.

Implemented in the name of socialism by the single party state, headed by Dr Julius Nyerere, was one of the most renowned land policies of the Tanzanian government; the 1973 villigization programme. This aimed to resettle the entire Tanzanian rural population into co-operative villages (Rohde and Hillhorst, 2001). In Maasailand this meant that thousands of people were compulsorily relocated from their transhumant lifestyles to sedentary, nucleated villages. The implementation of this policy was often achieved by force. It has been said that, "*The concept of village stands in this context for a*

political and administrative unit imposed upon the pastoralists by the state" (Arhem, 1985 p45). The 'village' also refers to the land surrounding the village office. Boundaries are being mapped currently.

By 1976, approximately 31% of the Maasai population in the Monduli district had been resettled (Arhem, 1985). Far from providing development and modernisation benefits, this upheaval led to population pressure on land that, in the past, had only been found ecologically sustainable if it had been left fallow for long periods. Furthermore, the sedentarisation of the pastoralists, combined with decreasing herd sizes, led to an increasing dependence of the Maasai on grain (Arhem, 1985).

The aftermath of the villigization programme in the 1980s became a period of economic crisis (Ndagala, 1996; Sundet, 1996). The pioneering of mechanized agriculture was encouraged within the semi-arid Ardai plains. In reality, this meant pastoral dispossession and agricultural colonization of parts of what remained of Maasailand. Pioneer settlement, increasing cultivation and livestock numbers and deforestation led to problems still in evidence today of soil erosion, declining fertility of the land and overgrazing (Rohde and Hillhorst, 2001). However, livestock numbers were counterbalanced by the resurgence of disease. During the period after villigization, the Tanzanian Government had supported animal health infrastructure, providing facilities such as dips, which had the effect of lowering the animals' resistance to disease (Hodgson, 2001). However, due to the economic crisis, most government support was withdrawn with dire consequences, namely impoverishment in the form of decline of per capita cattle holdings, for the Maasai (Nelson, 2000; Ndagala, 1996). Economic differentiation among the Maasai has increased ever since (Arhem, 1985).

2.3 Land use and livelihood change

The Maasai pastoralists who inhabit the Ardai plains and the surrounding area still practise transhumance, although the majority of women, children and the elderly stay settled in the dry season whilst the men move the cattle to better pastures (source: data from this project). Together with this change in the traditional transhumance lifestyle, smallholder cropping in the area has increased. In order to ensure food security, the Maasai have had to consider the adoption of non-traditional means of livelihoods. It would appear in the Monduli district that this has resulted in the cultivation of marginal semi-arid lands with limited agricultural potential (Nelson, 2000).

The Maasai's increasing dependence on agricultural foods as food security and risk insurance (Arhem, 1985) meant that they could no longer acquire grain in larger quantities by the traditional means of bartering, especially as the value of grain increased faster than that of livestock (Ndagala, 1996). Pastoralists then turned to rainfed cultivation which enabled them to not only grow their own food (thereby preserving their meager herd sizes), but also enabled them, should there be an excess, to sell the surplus and restock their herds (Ndagala, 1996). The adoption of this rainfed subsistence farming by the Maasai can, according to Arhem, a historian (1985), be traced back as far as the 1960s and early 1970s.

Rohde and Hillhorst in their 2001 paper on environmental change in Lake Manyara area note that by far the most obvious land-use change in this part of Maasailand has been the increase in rainfed maize cultivation. They name agriculture and the run-off from cultivated fields during storms as one of the factors causing extensive gully erosion in the area. Mapinduzi *et al* (2003) noted during research into the use of Maasai ecological knowledge that the Maasai range scouts blamed crop cultivation for causing the erosion of grazing lands.

Sydney Kwiyamba's detailed article for *The Guardian* this year (2005) elaborated on the changing livelihoods in the Maasai plains. She attributed the change of livelihood strategies of pastoralists to the ecological stresses currently affecting their land (long periods of droughts and extensification of smallholder crop cultivation) and the change in tenure rights from communal to private ownership. These, in turn, had degraded the pastoralists' ability to retain their sustainable mobile livestock economies. The major shift in livelihood strategies of the pastoralists has, according to Kwiyamba, been to transgress from pastoralism to agro-pastoralism or, for the younger generation, to migrate to urban areas to seek paid employment.

Traditionally within Maasai society, agriculture was considered a desecration of the land on which cattle fed (Hodgson, 2001; Arhem, 1985). The question of why a society that, traditionally, was so adamantly against agriculture, has learnt how to till the land, is key to understanding the drivers of recent livelihood and land use change in Maasailand.

2.4 Maasai men and women: Their respective domestic roles.

Received wisdom of Maasai culture tends to be static and andocentric, the word 'Maasai' evoking for many an amalgamation of pastoralists, warriors and nomads (Hodgson,

2001) yet this is but one part of traditional Maasai life. It is true that men do herd livestock and that the warrior age group (Morani) carry spears. However, men have many more roles than just herding livestock. They have to treat diseased/sickly livestock, build houses, find food for the family, engage in the purchase and selling of livestock, weed the family fields, attend both political meetings and those concerning pasture management, provide enough income to cover school fees/equipment, fence the boma and, if they are elders, provide advice for the younger men. Women also have many livelihood roles not directly related to cattle, such as collecting firewood and water (see Plate 1), cooking for the family, repairing the houses, weeding the fields, making jewelry as well as bearing overall responsibility for taking care of the family (source: data from this project). Therefore, whilst cattle traditionally fulfilled the everyday needs of the Maasai (Arhem, 1985) current Maasai life is dependent on a variety of other resources.

Plate 1. Maasai women returning to Nanja Sub Village from collecting firewood (source: author)

2.5 The Maasai and the Il-Arusa

To the uninformed observer, it is hard to pinpoint any differences between the Maasai and the Il-Arusa (see Plate 2). Often, the only difference in appearance is that Il-Arusa have stained teeth whereas those of the Maasai are white. They both speak Maa. Both wear the same colorful patterned cloths. Both have the traditional holes in their ears. The Maasai traditionally are known to be cattle focused whereas the Il-Arusa are known

for their specialization in cultivation. Today, due to the increase in small-holder cropping by the Maasai, at first glance it is difficult to see any difference between the two groups. Both cultivate and both often own livestock. The Il-Arusa practise the same ceremonies as the Maasai, including circumcision, with often only minor deviations, especially with regard to dowries and traditional dishes eaten at ceremonies (Kambainei, 1998). In the Ardai Plains the two groups live interspersed. If asked directly, the Il-Arusa will say they are Maasai but the pure Maasai will tell you which bomas are Il-Arusa (source: information from this project).

Plate 2. An Il-Arusa woman and a Maasai woman (source: author)

2.6 Methodological Foundations

2.6.1 Risk perception mapping

Risk perception mapping requires data on the types and relative importance of problems perceived by individual people in village communities. It puts the onus on local communities to identify problems, priorities and improvements –the problems are thought of as perceptions of risk.

The methodology was first published by Kevin Smith (International Rescue Committee, New York), Christopher B. Barrett and Paul Box in 2000, in the Journal *World Development*. They wanted to create a "*systematic but simple approach to classifying and ordering sources of risk faced by subject population*". They used risk mapping to examine pastoral communities in the arid and semi-arid areas of Ethiopia and Kenya. They believed that by *"distinguishing between incidence and severity of subjective risk perceptions, this method enhances understanding of the nature and variation or risks faced within a population"*.

In 2001 the methodology was referred to in a report on common pool resource management in semi-arid Tanzania. The authors of this report (Lovett *et al.*) went on to use the risk perception methodology to examine variation in local perceptions of risk in semi-arid Tanzania. Their use of the methodology was a wider application than *Smith et al* (2000) because they included agro-pastoral and agricultural communities. Specifically, they were testing the hypothesis that people's perceptions of problems depends not only on the environmental conditions in which they live but also on their social situation. They carried out the process in 12 villages in 6 districts across Tanzania. For each problem identified, an incidence index (I) and a severity index (S) was calculated to produce a risk map. They concluded that risk perception varied according to heterogeneity of the resources in the area, variations in livelihood strategy and gender roles. They indicated that *"Development projects that seek to improve the livelihoods of poor rural communities need to recognise the factors influencing the ways in which people perceive their problems. Many projects implemented in the past have failed because they have not addressed the needs identified by the target communities themselves"*. They then devised a calculation for a "risk index" which takes account of both I and S, RI=I/S. The RI increases with the overall risk associated with each problem.

2.6.1.1 Use of the terms "risk" and "problem"

Quinn *et al.* in their 2003 paper defined risk in terms of the problems faced by respondents when providing for themselves and their families. They asked respondents across semi-arid Tanzania to identify and rank their "problems". The terminology used in Quinn *et al's* study is slightly misleading as "risk" is usually defined as encountering hazards or taking chances. They based their methodology on that of Smith *et al.* (2000) who defined risk as "*exposure to potentially unfavorable circumstances, or the possibility of incurring nontrivial loss…something undesirable*". Smith *et al's* definition of risk suggests what the layman would normally call a problem. Indeed, Quinn *et al* when collecting data from respondents had to ask the respondents in terms of "the problems that they faced" (p113). A "problem" can account for both certainty and uncertainty whereas "risk" can only account for uncertainty. Therefore, within this project the "risk perception mapping" technique has been used as the basis for the creation of a new and, perhaps, more appropriate technique for analysing livelihoods; People's Problem Perception Mapping.

2.6.2 RRA and PRA

Rapid Rural Appraisal techniques (RRA) evolved as a collective of data collection techniques in the late 1970s and 1980s. RRA techniques were developed to meet a number of demands including an increasing demand for ways of collecting information of the driving factors causing accelerating rural change (especially following the Green Revolution) and to incorporate recognition into the questionnaire methodology of interviewer and participant bias (Chambers 2004). RRA also provide a mechanism for triangulation. By using different techniques and a range of informants in a range of places, the researcher is able to "cross-check" information collected in order to get closer to the truth via successive approximations.

By the middle of the 1980s, Participatory Rural Appraisal began to develop. The distinction between PRA and RRA is that "an RRA is intended for learning by outsiders. A PRA is intended to enable local people to conduct their own analysis, and often to plan and take actions". (Chambers, 1992 p13) Uptake of it was rapid especially because it enabled data collection and more importantly articulation of local knowledge (Mosse, 1994). PRA was finally acknowledged as a type of RRA in 1987 at the Khon Kaen International Conference (Chambers, 1994). PRA is seen as a 'theory' of enabling empowerment of local communities whereas RRA focuses upon gathering data and knowledge as cheaply, quickly and effectively as possible (Baker and

Mwadsley, 2005). However, during the early 1990s, concerns were raised as to how unbiased data from PRA could be when the information produced was necessarily influenced by the gender and wealth of the respondents. Concern was also raised over the lack of acknowledgement of the limitations of the methodology (Mosse, 1994). It has since been suggested that PRA should be combined with other techniques of data collection to overcome the weaknesses it reputedly has and that a successful marriage of techniques is that of PRA and GIS (Mapedza *et al.*, 2003)

2.6.3 Satellite remote sensing and GIS as a tool for monitoring land use change

Remote sensing provides a promising technique for monitoring land use change temporally at large spatial scales with imagery available from the time that the first earth resource satellites were launched over three decades ago. Whereas traditional methodologies for assessing land use change provide data for often localised areas (normally in the form of aerial surveys, comparison of maps of the area or of ground-control point photographs), they are inadequate as a means of analysing the spatial patterns of land use change over a large area. In the case of the Monduli district, Tanzania, such material is rare and if available, hard to access. Satellite remote sensing, however, allows frequent and quickly accessible/continual monitoring of land use over large areas with data easily accessible to individuals and organisations via the World Wide Web.

Digital change detection, the process by which change of an object or phenomena is observed from satellite images taken at different times (Singh, 1989), is increasingly being used to observe changes in vegetation patterns over a large spatial extent. There are many diverse methods of analyzing land cover change using satellite imagery but many of these require images from the same sensor at different dates (Bergen *et al.* 2005) and depend on the features of the sensor itself. This can be a problem when wanting to conduct a time-series analysis starting prior to the 1990s as there were only a few sensors in operation and their coverage is extremely limited before this decade. Common methods include vegetation indexes and classification (Serneels *et al.* 2001). A classification is when the remote sensing software uses the spectral information in the image to define different types of land use. However, these techniques are reliant on good knowledge of remote sensing software and can be very time consuming. Ultimately, in trying to link PRA, remote sensing and GIS, it is hoped that a methodology could be developed that anyone with a basic understanding of computers

could use if given some basic instruction. A far less technical approach but comparably time efficient to the refining process of a classification (if only interested in change in one type of land use) would be to digitally 'trace' agricultural areas, creating vectors which can be added into a GIS system and further analysed in the context of other resources.

Whilst GIS offers the advantage of adding a spatial dimension to data, it also, in the form of participatory GIS, can inform communities in spatial decision-making (Abbott *et al.* 1998). For the most part, uptake of GIS in the PRA and RRA fields has been slow, mainly due to the expense and the perceived complex nature of the technology otherwise defined as its 'elitist and anti-democratic nature' (Ghose, 2001 p142.). However, there have been some explorations into this 'grey' area. For instance, a paper published in 2003 on forestry land cover change using GIS and participatory mapping, showed that there no longer needs to be a divide between scientific data (that gleaned from remote sensing) and human information (gained from interviews). The researchers successfully integrated participatory mapping outputs into their previously constructed forestry GIS finding that the participatory mapping revealed detail undetectable using aerial photo analysis alone (Mapaedza *et al.* 2003). It has also been used successfully to combine 'official' spatially-referenced data with indigenous geographical knowledge to produce risk maps for impacts on communities of landmines in North-West Cambodia (Williams and Dunn, 2003).

Therefore, it is of mutual benefit for the stakeholders involved to ascertain the driving factors of agricultural expansion, the resource problems and conflicts within the area as perceived by its inhabitants and solutions which can help make agriculture in the area more sustainable. Only by integrating PRA methods with GIS and satellite image processing outputs can such a synopsis be possible. The thesis trials this theory, examining in detail the combination of the outputs from the different techniques, focusing on changing land use in one village and providing a comprehensive overview for the southern part of the Burko hunting block, taking into account the resource problems of six villages within the area.

2.7 The project area

2.7.1 Location

The Burko hunting block, which contains the six villages this project focuses on, is located in the Monduli District, (part of the Sepeko Ward, in the Kisongo Division) just west of Arusha in Tanzania, in the continent of Africa. As can be seen from the Burko hunting area incept in Figure 2.2, the six villages are all located in the southern area of the Burko block, at different altitudes. Nanja Sub Village is a sub village of the village of Mti Mmoja but for the purposes of this thesis will be referred to as just a 'village'.

The villages are a result of the 1970s villigization programme. The village of Lendikinya was established in 1974 and at the time consisted of all the villages in the project area. It has only been recently (1999-2000) that Lendikinya has been carved up and Mti Mmoja, Arkaria and Arkatan have become separate villages in their own right.

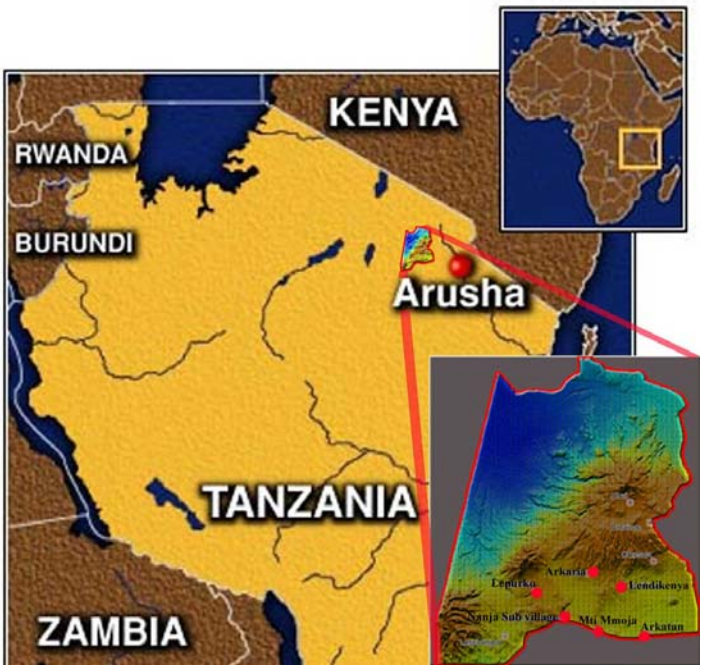


Figure 2.2. A location map to show the Burko Hunting Block (bottom right insert) and the 6 villages within the project area, with relevance to the location of the hunting block in Tanzania and the content of Africa.

All of the villages have at least one main dirt road which links them with the Arusha-Manyara tarred main road (apart from Mti Mmoja which lies alongside the tarred road). More detailed information for each village can be found in Figure2.3

LEPURKO

CORDS data not yet available

Lepurko was registered as a village in 1993.
As yet it has no certificate

(Personal Communication, 2005 CORDS)

ARKARIA

Registered:
2000. Formerly part of Lendikinya

Certificate of Occupancy:
Not Yet

Population:
1766

Physical Features:
Southern part=grass plain, used for livestock grazing
Also contains Nuncha dam depression
Middle part=former bush land that has been cleared for agriculture
Northern part=Dense Forest "Ehtim Ommong?"

Altitude at village location:
1475

Average Annual Rainfall:
800-1200mm

Soil Type:
Black cotton loamy soils

LENDIKINYA

Registered:
2000. Arkaria was taken out of it just before registration. Formerly established in 1974.

Certificate of Occupancy:
Not Yet

Population:
2207

Physical Features:
The northern part lies in the foothills of the Monduli Highlands. Dense forest has been cleared for agriculture

The majority is former bush land that has been cleared for agriculture.

Altitude at village location:
1364

Average Annual Rainfall:
800-1200mm

Soil Type:
Black cotton loamy soils

Mti Mnoja (contains Nanja Sub Village)

Registered:
1999. Formerly part of Lendikinya

Certificate of Occupancy:
Awarded 6 May 2005

Population:
1350

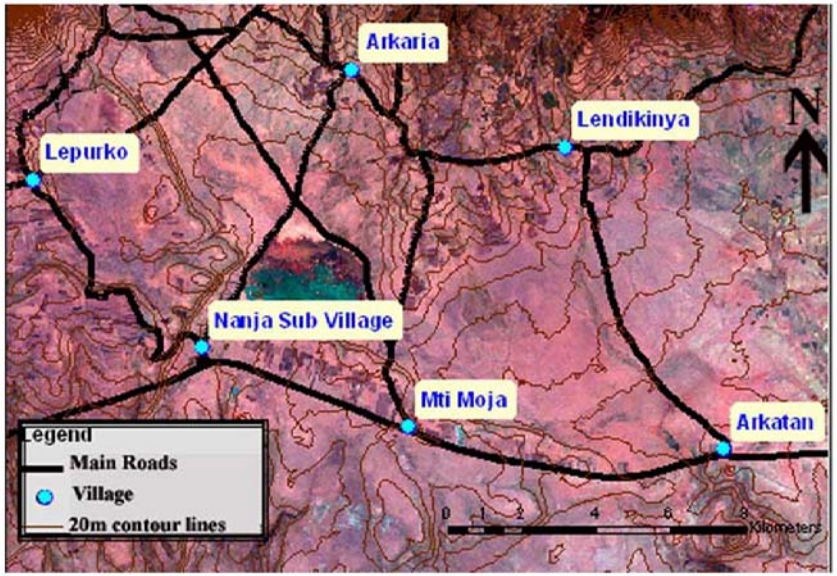
Physical Features:
The majority of the village lies along the Ardai Plain. Lololoumashi, a small hill is located in the western part of the village.

Nanja Sub Village lies to the west of Mti Mnoja, with the majority of bomas located south of the Arusha-Manyara road in the Tanzanian Army area.

Altitude at village location:
1411

Average Annual Rainfall:
700-900mm

Soil Type:
Variety of soils: low organic matter content.



ARKATAN

Registered:
2000. Mti Mnoja was taken out of it just before registration. Formerly established in 1977.

Certificate of Occupancy:
Not Yet

Population:
1487

Physical Features:
Northern part: The majority of the village lies along the Maasai Plains. The Orkoju depression used to retain water until the 1970s.

Middle part: former bush land cleared for farming. Contains the Ardai seasonal stream which feeds a dam.

Altitude at village location:
1341

Average Annual Rainfall:
800-1200mm

Soil Type:
Black cotton loamy soils

Figure 2.3 Village fact files surrounding a map of the project area based on a Landsat 2000TM satellite image spatial subset. (Data source: CORDS 2005)

2.7.2 Natural Environment

The area lies in the rain shadow of Mount Meru. What little rainfall the area receives (a range of 700mm-1200mm) is mostly in the form of bimodal relief rainfall with the "short rains" in November-January and the "heavy rains" during March-May (CORDS, 2005). The climate is described as 'semi-arid' (Mwalyosi, 1998). Most of the villages consist partly or totally of the Maasai plains with some villages incorporating parts of the Monduli Highlands. Geologically, the Monduli Highlands are of volcanic origin. These mountains are covered by sub-humid montane forests ecosystems which are the traditional dry-season grazing reserve. They are also designated as wildlife protection areas (Mapinduzi *et al.* 2003). Vegetation in the area varies according to altitude with the plains at the lower altitudes consisting of short grasses, acacia trees, shrubs and also agriculture (the majority cultivate maize and beans). The vegetation of the higher altitudes consists of dense woodland although there are patches of cleared areas for agriculture and settlements.

Sources of water in the area are mostly man made. There are a few natural springs but the majority of the population rely upon small dams (patches of land dug out before the rains) and rainwater harvesting. Some people travel by foot (often for 4 to 12+ hours) to the bigger dams, especially during the dry season when the smaller dams dry up, such as Soiminen, Monduli Juu. Many women have donkeys to help them bring back the required water. There are a few water taps in the area. One such tap in the area is located within the Tanzania Military Academy area, south of the Arusha-Manyara road. During the dry season the majority of the population have to supplement their water supplies by buying water from trucks that come from Arusha, Duka Bovu and Monduli at 200-500tsh per 20L depending on the distance of their tank from the tarred road (source of all data: this project). This expense is hard to meet for those with little or no regular cash income.

2.7.3. Current land use and related issues

The land is still used and managed according to the Maasai pastoralist traditions. Annually the livestock routes and pastures are debated and finalised. There are strict rules as to which pastures can be used for grazing and which must lie fallow in order to ensure regeneration of the fodder.

Due to the limited number of water sources and grazing lands in the dry season, these areas act as foci for livestock disease transmission, especially those diseases passed on by insect and bacterial vectors.

Agriculture is the other major form of land use in the area. The majority of the Maasai practice smallholder cultivation of maize and beans. As yet there are only a few cases of extensive commercial farming in the area. Stakeholders in the area are concerned that the recent appearance of extensive gullies (Plate 3) is a result of agriculture on land that is geologically and climatically unsuitable.

Plate 3 Extensive gully erosion in Arkaria. (source: author)

2.7.4 Case study village: Arkaria

Arkaria, formerly part of Lendikinya, was registered as a village in 2000. It consists of the main village area and two sub villages; Oloodulolkaria and Ormaroroy with a total population of 1766 people, 838 men, 928 women (CORDS 2005). Its altitude varies from 1409m in the southern part to 1791m in the northern part (source: data from this project)

The southern part of Arkaria consists of a flat grass plain, used for grazing livestock. It also contains a depression known locally as Nancha. Nancha was formerly a water reservoir until the 1970s when it stopped retaining water due to siltation and infiltration sheer (CORDS 2005).

The middle part of the village was formerly bush land but has been cleared for agriculture. The northern part of the village is located in the Monduli Highlands and is covered in a dense forest ("Entim Ormong'l) providing a source of building materials, firewood, medicinal herbs and grazing during the dry season (CORDS 2005).