CHAPTER 3

METHODOLOGY

The methodology used in this thesis is based upon the ideology of Participatory Rural Appraisal (PRA). It is hoped that this methodology could be repeated by lay persons if they were to receive the right instruction and have access to the relevant equipment/ software. Furthermore, it is quite possible for the outputs from this thesis to be used as the basis for a resource management and monitoring tool by any of the stakeholders. In the context of resource and land usage, the key stakeholders are the Maasai communities, CHCWP, government agencies and NGOs assisting/providing delivery of key services.

Part of the methodology employed in this thesis (PPPM) was also used to ensure that the data collection exercise benefited the participating communities by demonstrating to the Maasai a technique that they could employ in their own meetings about resource and land related problems. The preliminary findings of the fieldwork were presented to, and were well received by, the Maasai. Of particular note was that the attendees expressed their gratitude to the research team for enabling them, in their own words: "to see our problems with a new eye', this confirming the value of the PRA ideology.

The methodology used in this thesis incorporates a range of techniques including a partial census, People's Problem Perception Mapping (PPPPM) and Participatory Visual Analysis (PVA). The data obtained through these sources was combined with a Geographical Information System (GIS) that incorporated field vector layers created via digitization and shape layers based on data collected from the partial census as well as the spatial distribution of resources (partly data from CHCWP and partly data collected in this project).

Figure 3.1 overleaf is a model that demonstrates (in a simplified form) how the techniques (triangles) are used to gain information and data on Maasai livelihood strategy drivers and the adopted strategies (rectangles).

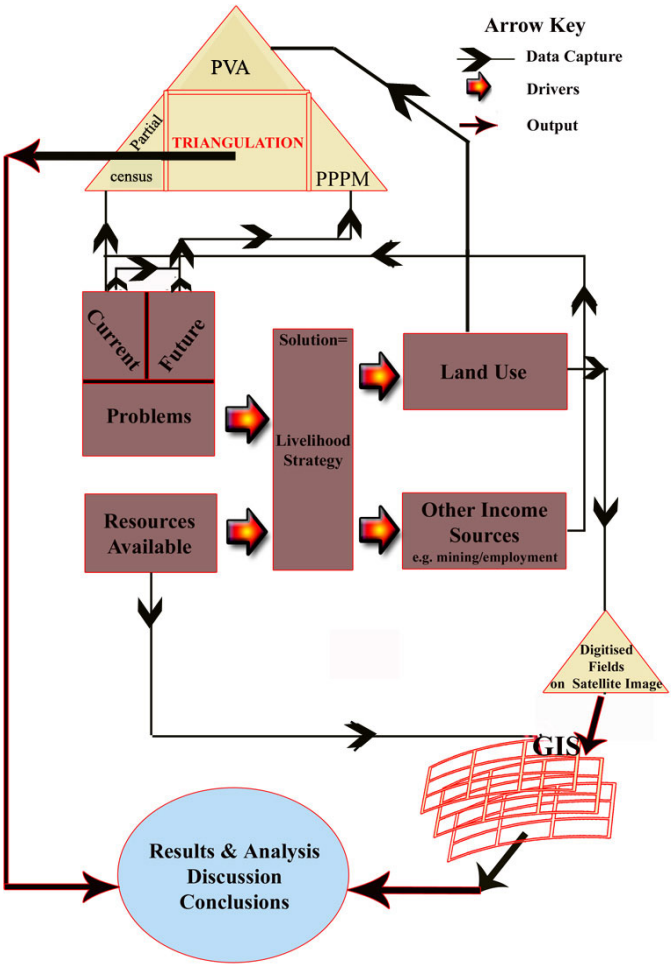

Figure 3.1 A model of the data capture techniques used in this project.

3.1 Land use change

To estimate land use change in the form of agricultural expansion, three georectified satellite images acquired by Landsat sensors were used (Table 1) taken in the years 1987, 2000 and 2005. The images have a resolution of 30m per pixel. All of the images were taken just after the 'short rains' which explains why water and

Table 1 Details of the satellite images used

	1987 (25th February)	**2000 (21st February)**	**2005 (12th March)**
Sensor	TM Landsat 5	ETM+ Landsat 7	ETM+ Landsat 7
Path	168	168	168
Row	062	062	062
Cloud contamination over project area	A few wispy clouds	None	Extensive heavy clouds especially over Lepurko

moisture in the ground can be seen. Although Landsat 5 and 7 are different instruments, the first five bands of ETM+ are identical to those on Landsat 5 and have the same spatial resolution (Lillesand *et al* 2004). This makes it easy to cross compare the images. The bands vary spectrally with Band 1 (blue), band 2 (green), band 3 (red)

band 4 (reflective infrared) and band 5(mid infrared). Band 3 is one of the most important bands for vegetation discrimination. Band 4 is extremely responsive to the amount of vegetation biomass on the image and Band 2 corresponds to green reflectance of healthy vegetation (Jensen 2000). These three bands were used to form a colour composite in ENVI of each of the satellite images.

Originally, the land within the project area covered in fields was to be mapped by running a supervised classification in the Environment for Visualising Images version 3.6 software (ENVI). However, after several attempts this methodology was aborted because the outputs were too inaccurate to use; the spectral classes were not differentiating between agricultural fields and other land uses and did not appear to improve substantially when training data was added to guide the classification.

Instead, the methodology actually employed in this thesis was based upon visual interpretation and digitisation of fields. This was developed for each village by creating a vector layer of the fields in each satellite image using the Regions of Interest Tool in ENVI and converting the ROI output into a vector layer (Figure 3.2).

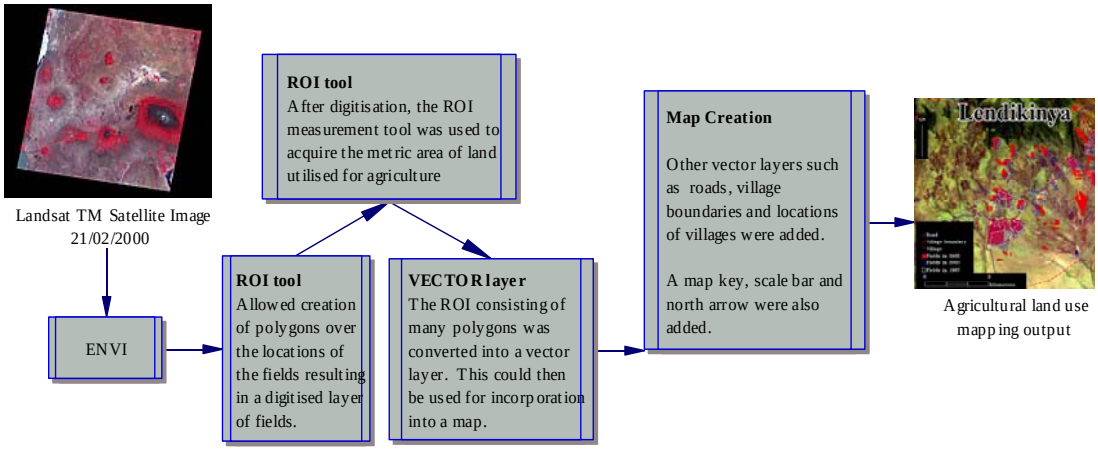

Figure 3.2 The process of mapping agricultural land use

3.1.1 Limitations with using satellite data

Ideally, ASTER data would have been used which has 15m pixel resolution (compared to 30m resolution of Landsat TM imagery). Unfortunately, the study area lies in a 'data gap'. The only images readily available were the Landsat TM 1987 image, the

2000 image and the 2005 image. Due to satellite damage, the 2005 image had to be reprocessed with corrections for data gaps. The missing image pixels were replaced with estimated values, derived from the 2000 image by the United States Geological Survey (USGS).

Whilst image processing techniques such as running a classification or a vegetation index can produce very accurate results of land use based on spectral information, they are vulnerable to contamination of the image, especially cloud contamination. Both the 1987 and the 2005 image have cloud contamination over the project area that is too extensive to accurately correct for.

3.1.2 Limitations of the digitisation method

Physical inspection of the areas included within village boundaries determined by Monduli District Council (MDC) suggested that they might not be wholly appropriate. For instance, in Arkaria, a whole sub village according to the MDC boundaries is actually located in Lendikinya. Therefore, for the purposes of this project, where possible, a combination of local knowledge and the boundaries contained within the GIS have been used to work out the spatial area of each village.

Visual interpretation can result in errors. It is possible that areas of shadow/water could have been mistaken for agricultural fields especially as in terms of shadow, cloud contamination can generate geometric shapes that resemble fields but are actually shadow. Further, because the images were acquired by the sensor just after the rainy season, there is a lot of moisture visible in them which, because of its dark colour when displayed, can be mistaken for cultivated land. These mistakes can be corrected for if validating the image from the ground but only the 2005 image could be validated by ground verification (locations of fields, water resources and different types of vegetation) and this in itself can only be a rough validation because the image was taken in March 2005 and validation occurred in July 2005. Consequently, accurate visual image interpretation is critical to the reliability of the results.

3.2 GIS

A GIS was compiled from data already collected by CHCWP (roads, contour lines, location of schools and villages, drainage features, estimates of village boundaries and

the boundary of the Burko hunting block), data collected in the field (locations of bomas interviewed in the Arkaria partial census, grinding mill machines, kiosks, small dams, dispensaries, village offices, chairmen's bomas and GPS control points for different types of vegetation) and the spatial subsets of the satellite images.

3.3 Partial Census

A partial census in the form of a semi-structured interview of the bomas in Arkaria was undertaken in order to collect information on a range of topics relevant not only to this project but also useful for our collaborators (a copy of the questions asked is attached in APPENDIX B).

The fieldwork was carried out over a period of three weeks in June 2005. Prior to this project, there was no map of Arkaria showing the location of bomas, nor were there any accurate records. Therefore, random sampling could not be conducted. Instead, it was decided that within the time frame dedicated to the data collection, the research team (the author and two Maa translators, 1 male, 1 female) would interview as many bomas as possible and ensure that both sub-villages and a range of elevations were covered. The chairman of Arkaria informed us that there were approximately 180 bomas in Arkaria. Participants representing 102 bomas (see figure 3.3) were interviewed. Of these, 8 participants represented bomas situated in the most inaccessible parts of the sub villages and, for this reason, we interviewed them at the kiosks in central Arkaria. The remainder of participants, the majority, were interviewed in their respective bomas. Although at a later stage we did conduct interviews in these participants' sub villages, we were able to avoid interviewing the same boma twice as the translators remembered the family names of people they had already interviewed.

Taking the Chairman's figure of 180 bomas in Arkaria as an accurate total, the partial census covered 56% of the number of bomas in Arkaria, which should render the statistics representative of the population with a good sample size. As can be seen from figure 3.3, the partial census covered the majority of the inhabited areas within Arkaria. It must be noted that, in the absence of an official census, the estimate of 180 bomas lacks official ratification. 1,515 people were accounted for within the 102 bomas interviewed. According to the CORDS (2005) socio-economic profile for Arkaria, the total population is estimated to be 1,766. Therefore, this indicates that the census results are viable for 86% of the population of Arkaria. .

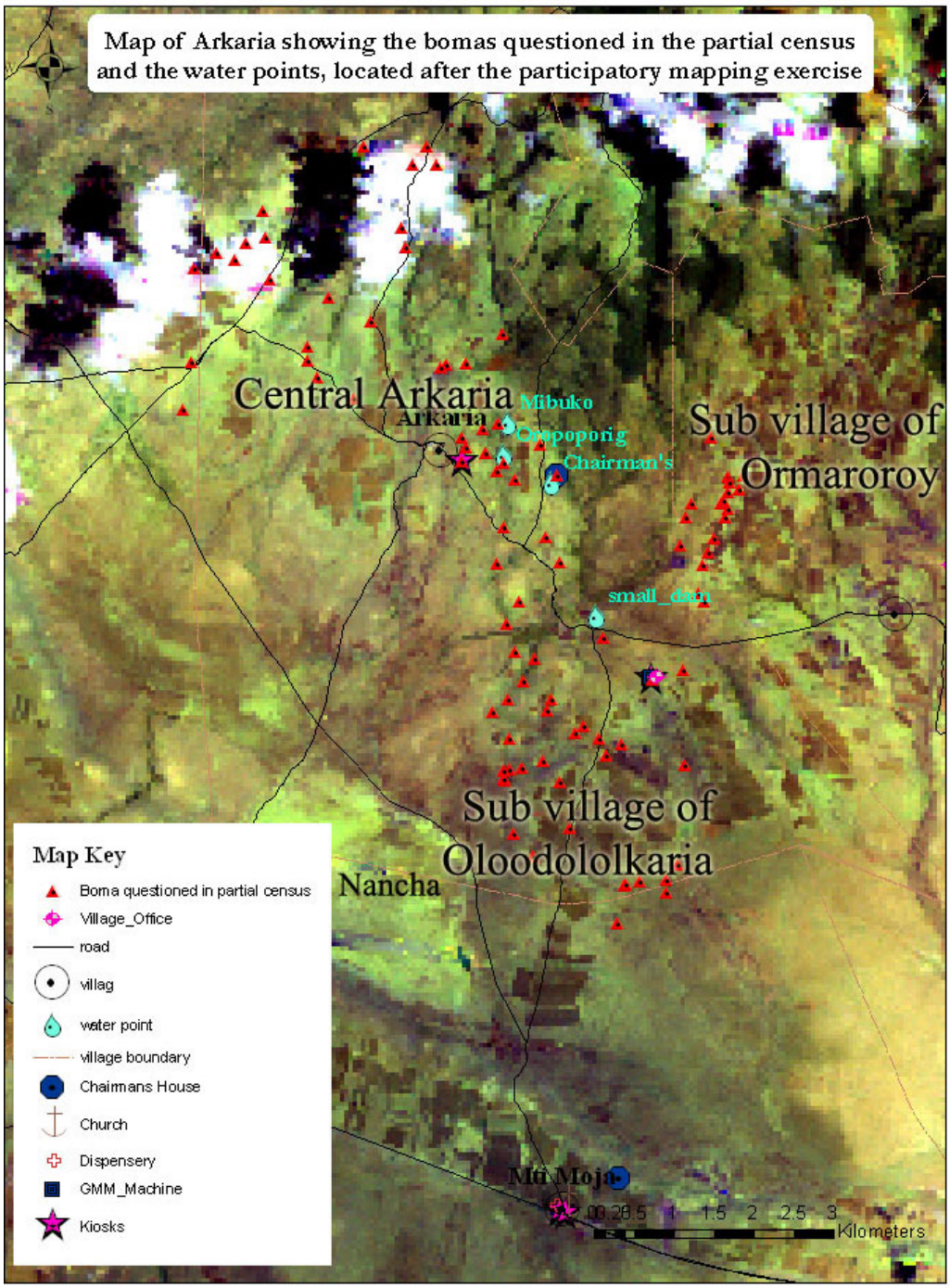

Figure 3.3 A map to show the location of all the bomas questioned in the partial census.

Approximately two thirds of participants were women as the field work could only be carried out during the day because of the risk of attack from wild animals after dark. We tended only to be able to question men if there had been a nearby political meeting or if we managed to meet them before they had taken out the livestock to graze in the morning.

3.3.1 Limitations of the partial census

For the majority of the fieldwork the research team had no access to a vehicle, so our progress was hampered by the time it took to walk to each and between each boma. Furthermore, we only had one Global Positioning System (GPS) so had to retrace our steps many times to collect the boma locations. Had we had more regular access to a vehicle and another GPS we would have managed to carry out a full census within the time spent in the field. However, whilst this is a limitation to the data collection, in many ways, because members of the community saw us walking every day from the boma we stayed in we became part of 'village life' after only a few days.

There were a few incidences when, after we had explained why we were carrying out the questioning and who we were collaborating with, participants asked what material goods they would get in return. This was because a researcher in the area the previous year had given a small gift, a cloth or some maize in return for the participants' time. Usually, once we had explained that, ultimately, the answers they gave would be used by the NGOs who collaborated in this project to help them, participants agreed to answer the questions.

3.4 Participatory Visual Analysis

Three PRA techniques were carried out during the month's field work.

3.4.1 Participant Observation

This is *"the process of collecting data from observations made during the course of participating in the everyday affairs of the research subjects*" (Robson and Willis, 1997). This technique did not take up any extra time but did act as a triangulation tool. Information gained chatting over lunch reaffirmed that the answers gained from the interviews in the partial census were given freely and were not restricted. If an answer to one of the questions in the partial census was a little different or provided new knowledge, we later pursued this with extra questions. Had the research team not stayed for the duration of the field work in a local boma in Arkaria, we would not have had the respect we did have shown to us from the community and the answers to our questions might not have been so forthcoming or full of information. As it was, many of the participants could see the long term benefit of taking the time to answer our questions.

The situation was further helped as the two translators were both true Maasai and educated and the female translator's family were from Mti Mmoja. This, after the initial period of scepticism at seeing a white person in Maasailand had worn off, won us instant trust and honest answers.

3.4.2 Photo-visual analysis

This was conducted with the Chairman of Arkaria with the purpose of eliciting information that would add context to the statistical findings of the partial census. The Chairman was given a disposable camera and asked to use half of the film to take photographs of places/things that had changed dramatically and also of places/things that had not changed at all. The other half of the film was allocated for his own personal use.

Initially, it had been planned to give out 6 disposable cameras to people in the different sub villages. However, the Maasai are very suspicious of any photographic equipment as the common belief is that the white person takes a picture and then makes thousands of dollars from that picture. Also, apart from mobile phones, there is really very little electrical equipment in Maasailand. The camera was politely declined by two men with suspicious eyes before it was decided to abandon the technique. However, the Chairman was more than happy to carry out the exercise. He had many photographs on the wall of his meeting house from white people who had visited in the past and so had no fear of the camera. He dispatched one of his sons off to various places to take the photographs. The discussion we had once the photographs were developed was extremely interesting and rewarding. This technique worked very well with the Chairman as it drew into conversation issues surrounding resource management in the area that all other methods of data collection had not managed to reveal.

3.4.3 GIS Participatory Mapping

The aim of this method was twofold. Firstly, it was hoped it would verify resource locations in the area and highlight any that possibly had not been noted through other collection methods. Secondly, it was to give the Maasai a chance to look at the GIS of the area and to see for the first time a view of their land that a bird might see. Their grasp of spatial understanding of the image was excellent as was their understanding of the GPS when we explained what it was to them (which we did at the majority of

bomas). The participant was given an A2 sheet of paper and many different coloured

Plate 4 RRA, participatory mapping with a young Moran

felt tips. The technique worked well because a young Moran did the first map (Plate 4) and then later we were chatting to the Chairman about it and he said that he and his friends could do better. So then he had a competition with one of his friends and we got another 2 maps. One was composed by a man directing one of our research team members to draw what he described. Interestingly, this gave by far the most accurate map of the ones that the data collection team compiled. Combined, the 3 maps provide very detailed information of Arkaria.

3.5 People's Problem Perception Mapping

This methodology is built on the basis of Smith *et al's* Participatory Risk Mapping (2000). Whilst the theory behind it is beautifully simplistic yet effective: to get populations to classify and order the sources of risk they face, it lacks a crucial feature of understanding risks; it lacks the temporal component of risk. What is more, as explained in Chapter Two, the definitions used for risk are somewhat theoretical when in practice it was found that participants understood 'risks' to mean 'problems'.

People's Problem Perception Mapping is therefore based on the concept of participants identifying and ordering problems encountered when trying to provide for themselves and their families. At the same time as ordering the problems according to

the most important through to the least important, participants were asked to assign each problem a frequency of occurrence.

3.5.1 Pilot Study

A pilot of the methodology was carried out in Mti Mmoja and from this pilot study a guiding categorised list of problems was constructed. The organisation of the categories followed the theme of capital assets as used by Quinn *et* al (2003) in their application of Risk Perception Mapping. We found that the methodology agreed upon and outlined below worked well. Modifications to the methodology were therefore small, consisting of deleting a few questions from the individual PPPM semi-structured interview (due to excessive time taken to complete) and working out a priority for discussion topics with the groups after they had finished the identification and ordering exercise.

3.5.2 Group work

For each village, we arranged with the village chairman in advance for him to agree a day on which a group of men and a group of women would be ready to participate in the process. Where possible we asked that the group be a minimum of 7 people and a maximum of 15 people (any more people and the ability to discuss and debate different issues is lost) (see Table 2 for numbers of participants).

Table 2 Information of location and number of participants in each PPPM group

Village	Group Gender	No. Participants	Location of meeting
Mti Mmoja	Male	6	Chairman's house
Mti Mmoja	Female	9	Church
Arkaria	Male	11	Under meeting tree
Arkaria	Female	9	Under meeting tree
Lepurko	Male	9	In a disused house in NSV
Lepurko	Female	10	At a boma
Lendikinya	Male	12	In temporary village office
Lendikinya	Female	28	Outside of church (hence the high turnout)
Arkatan	Male	12	In the primary school
Arkatan	Female	15	In the primary school
Nanja Sub Village	Male	6	In the Chairman's boma
Nanja Sub Village	Female	7	Outside, near the chairman's boma

On the day of the PPPM in the village, we first of all gave an introduction, outlining the purpose of the exercise and what it involved.

Problem Identification:

The group was asked *to identify the problems they face when trying to provide for themselves and their families, both those problems they are facing at the moment and those problems they might not be experiencing right now but could face at some other point in the year.*

Problem Ordering

The aim of the ordering was to gain an idea of the way in which people perceive the relative importance of each problem they had just identified. We started the process by explaining that *"we would like you all to think about which problem is your most important problem, which is your least important problem and where all the other problems fit in the scale.."*

The participants were allowed to rank more than one problem at the same level but only if they asked to do so.

Frequency of occurrence

Participants were asked how often each problem occurred/was encountered. The options were: daily, weekly/monthly, seasonally/yearly and rarely.

Discussion of solutions to the problems identified

The groups were asked what the community had done to try to solve each problem and what they would like to do to solve the problems both in the present and in the future.

Extra information for collaborating NGOs

We also collected information (dependent on how tired the group was) on a range of issues our collaborators were interested in.

3.5.3 Individual PPPM exercise

As this methodology is based on RPM, and as RPM had only been carried out on individual participants, it was thought important to test whether the group work would represent what problems individuals in the community face.

Problem identification and ordering:

The PPPM for the individual participants (Table 3) was the same as for the groups

Table 3 Information on the number and gender of individual participants interviewed

Village	Number of participants		Location of the Majority of the interviews
	Male	Female	
Arkaria	5	5	In participant's bomas
Arkatan	6	4	In participant's bomas
NSV	0*	9	In participant's bomas
Lendikinya	4	6	Under the tree opposite church or in boma
Lepurko	5	6	In participant's bomas
Mti Mmoja	7	3	At the tree, next to the main road

*There was a political meeting at the same time as we were interviewing so no men were available

Extra information

We also asked questions relating to land use change and livestock numbers in order to see whether the trends shown in Arkaria are similar to the area in general. Questions relating to opinions on equal opportunities in development, feelings on women earning money and attitude towards sending Maasai children to school were also asked for the benefit of collaborators (for original questions see APPENDIX C).

The following hypothesises were devised to be tested:

Hypothesis 1: That the group data does represent the problems faced by individuals in the community and is an unbiased process.

Hypothesis 2: That the problems identified by the group would show if the Government's perception that the Maasai have no interest in participating in Tanzania's national development is right that they lack any identification of problems with social assets.

Hypothesis 3: That the PPPM methodology could be repeatable both in terms of the communities' willingness and in the requirements that the methodology does not require specialist training.

3.5.4 Presentation of preliminary results from the risk perception mapping to the villages

This was carried out in Arkaria. We invited all 6 village chairmen. Unfortunately, there was a political meeting on the same day so only 3 of the village chairmen were present. The meeting was held in Arkaria and many other male inhabitants attended the meeting. During the meeting the ways in which the villages could use the data in the

reports to ask for support from organisations was explained. The research team explained briefly that in the meeting we would discuss the amalgamated results for the area. We discussed in order of importance (gained from the RPM graph) the risks raised by the majority of groups and the solutions that had been mentioned. We tried to draw into the meeting examples of where the villages could work together to try to solve their mutual problems. This meeting was an important part of the methodological process not only because it empowered the participants with cumulative knowledge for the area and encouraged them to think in a more futuristic way about managing resources and prioritising problems but also, because it enabled the participants to highlight a few discrepancies in what some villages had stated about other villages and what the actual truth was.

3.6 Methods of data analysis.

Partial census

The data was first inputted into EXCEL and converted into a numerical format. Some of the participants' responses had to be converted to ordinal data. The Statistical Package for the Social Sciences version 13 software was used to analyse relationships between the data. If the data was not normal then only non-parametric tests were carried out. Attempts were made to normalise data and were successful with two datasets.

This data was also inputted into the GIS (which was created using Arc GIS version 9 Desktop software) and was analysed visually within its spatial context.

PPPM

From the data collected the following Indexes were created based on the mathematics outlined in *Smith et al (*2000):

Incidence Index (I) 0=identified by no-one 1=identified by everyone
Severity Index (S) 1=most important 2= least important

From these to indexes, a total Problem Index was created PI=I/S. As it accounts for both the incidence and severity of the problem, as the value of PI rises from 0 to 1, so does the seriousness of the problem. Frequency was then plotted against the PI