NATURAL RESOURCES SYSTEMS PROGRAMME
PROJECT REPORT[1]

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Strengthening social capital for improving policies and decision-making in natural resources management

Project Leader

Dr. Pascal Sanginga

Organisation

International Centre for Tropical Agriculture-
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NRSP Production System

Hillsides Production System

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NATURAL RESOURCES SYSTEMS PROGRAMME
FINAL TECHNICAL REPORT R7856

Strengthening Social Capital for Improving Policies and Decision Making in Natural Resources Management

ANNEX F

PARTICIPATORY LAND DEGRADATION ASSESSMENT IN THE HIGHLANDS OF KABALE DISTRICT, SOUTHWESTERN UGANDA

REPORT
SUBMITTED TO
AFRICAN HIGHLANDS INITIATIVE (AHI)

BY

PAMELA MBABAZI, ROBERT BAGYENDA AND ROBERT MUZIRA

SEPTEMBER 2003

TABLE OF CONTENTS

LIST OF TABLES

LIST OF MAPS

LIST OF FIGURES

LIST OF PLATES

ACKNOWLEDEMENTS

This report presents information generated from a participatory mapping and assessment exercise about the extent of land degradation in Rubaya sub-county, Kabale district in the highlands of south-western Uganda.

It provides information required for developing community-based action plans to address land degradation and resultant problems in the area. The project was carried out between August 2002 and January 2003.

We wish to extend our sincere thanks to all the farmers in Buramba–Mugandu and Kitooma watershed areas of Rubaya sub-county for their tireless contribution to the success of this exercise. We do recall the tiresome transect walks with you up and down the hills of Rubaya. To chairperson of farmer's groups we area highly indebted for the mobilisation and arrangements well-done.

Our thanks are also due to the District leadership especially the district planning unit for giving us access to the secondary data.

We are extremely grateful to Dr. Pascal Sanginga, for his patience and guidance during data collection and compilation of this report. His informed suggestions and comments were very helpful and without his continued encouragement and support, this research would have been difficult to complete.

Our efforts greatly benefited from the initial insights provided by Prof. Michael Stocking when he visited the study area and reviewed the data collection tools at the beginning of the exercise. To him, we say many thanks indeed.

Lastly, we would like to thank the Department for International Development-Natural Resources Systems Programme (DFID-NRSP) for funding this project for the benefit of the poor in this developing country

To all of you who contributed to the successful completion of this project, we shall forever be indebted, as we all continue to work for better livelihoods of the rural farmers.

Pamela K Mbabazi,
Robert Bagyenda,
Robert Muzira,
2003

1.0 INTRODUCTION

In the highlands of Kabale district, 93% of the population live in the rural areas outside Kabale Municipality and therefore depend on the land for their livelihood. Agriculture is the main occupation of the population with 86% producing at subsistence level (Kabale District Local Government (KDLG), 2002). A close linkage therefore exists between land productivity and rural livelihoods. The implication of this is that where land gets degraded, rural livelihoods are obviously threatened in form of decline in food production, famine, loss of income and, consequently, reduction in access to any other goods and services with a cost attached.

The participatory mapping and land degradation assessment project initiated by African Highlands Initiative (AHI) aimed at mapping and assessing the levels of land degradation in the Buramba-Mugandu and Kitooma watersheds in Rubaya sub-county, Kabale district. The district is one of the most densely populated districts in Uganda. The exercise was conducted by a team of experts[2], local residents and the community leadership.

The aim of the project was to generate and strengthen knowledge about Natural Resource Management (NRM) and sustainable development in Rubaya sub-county and to document the information from which lessons could be drawn to improve NRM management in the sub-county and other similar areas in Uganda.

Assessment of land degradation is largely about determining what the farmer can or cannot do with respect to protecting his land and ensuring that he can utilize it productively. It is about finding out peoples' coping strategies and responses with regard to land degradation.

The major task in the terms of reference of the consultancy was to facilitate a participatory mapping and land degradation assessment in four villages and contribute to the analysis, interpretation, reporting and dissemination of results in form of feedback to communities and other stakeholders for the development of community action plans for effective NRM. It also involved identifying the research, development and policy implications based on the findings of the study.

The issues investigated included:

i. Land degradation,
ii. Bund destruction,
iii. New terrace construction,
iv. Major erosion events, causes and location,
v. Soil conservation measures/practices being used by farmers,
vi. Woodlot planting,
vii. General land cover and use,
viii. Livestock interactions: grazing areas, pathways, grazing on crops, etc,

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[2] The team of experts included Mrs. Pamela Mbabazi (M.A Development Studies and MSc Development Planning and Management), Mr. Robert Bagyenda (M.A Land-use and Regional Development Planning), and the CIAT – Kabale Soil Scientist, Robert Muzira (B.Sc. Agriculture, M.Sc Soil Science)

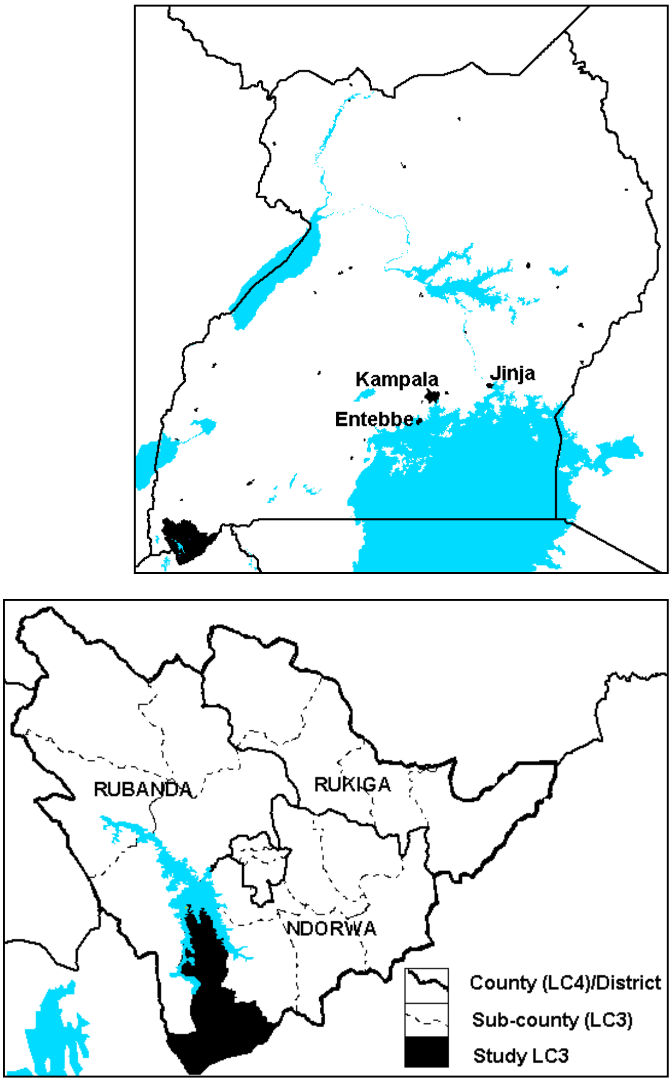
ix. Soil characteristics: slope, fertility gradients, depth and history,
x. Land fragmentation, ownership, transactions and exchanges,
xi. Wetland management,
xii. Conflicts: where and on what issues, who is involved, damages and consequences,
xiii. Water management in general (springs/water sources management, location, trends, etc),
xiv. Burning – grazing land and residues: frequency and consequences

The report is structured as follows: section 1.0 gives the reader an introductory background, section 2.0 presents information about the research setting in terms of its geographical location, agriculture and land use, relief, drainage, soils, weather, resource access, control and ownership. It also presents the justification for Rubaya as the study area. Section 3.0 contains a detailed description of the methodology used, while section 4.0 contains the major findings of the study. The last, section 5.0, presents the way forward in form of discussions about the planned community NRM action planning process and highlights areas of research and policy implications.

2.0 THE RESEARCH SETTING

Kabale district lies in the South West of the Republic of Uganda. It lies between $29^{0}45^{'}$ and $30^{0}15^{'}$ East and $1^{0}00^{'}$ and $1^{0}29$' South. It borders with the districts of Kisoro in the West, Rukungiri to the North, Ntungamo to the East and the Republic of Rwanda to the South (Map 1). The district has a total land area of 1,827 km^2, out of which arable land is 1,695km^2, water bodies 48.5 km^2, swamps/wetlands 79.4 km^2 and marginal land 41.1 km^2. About 75% of the arable land is owned according to customary laws (KDLG, 2002(b)). It has a total population of 461,785 people. Of these, 245,453 are females while 216,332 are males (Table 1). The district has 96,869 households.

Rubaya sub-county, which is the project area, is located close to the Uganda-Rwanda border in the south-western part of Kabale district, and is 40 km from Kabale town on the Katuna-Muko road. The sub-county has an estimated population of 25,773 people (Table 1), 30% of which are literate (KDLG, 2002(a)). The population density ranges between 325 – 349 persons per km^2 (KDLG, 2002(b)). The area is predominantly occupied by Bakiga, although there are a few other ethnic groups found in the area mainly the Banyarwanda and Bafumbira.



Map 1: Location of the study area

Source: World Agroforestry Centre (ICRAF), 2002

Table 1: Rubaya population by parish and sex

Parish	Households	Males	Females	Total
Buramba	784	1,685	2,069	3,754
Karujanga	1,136	2,528	2,927	5,455
Kibuga	878	1,978	2,335	4,313
Kitooma	682	1,505	1,815	3,320
Mugandu	759	1,817	2,071	3,888
Rwanyena	1,054	2,260	2,783	5,043
Total	**5,293**	**11,773**	**14,000**	**25,773**

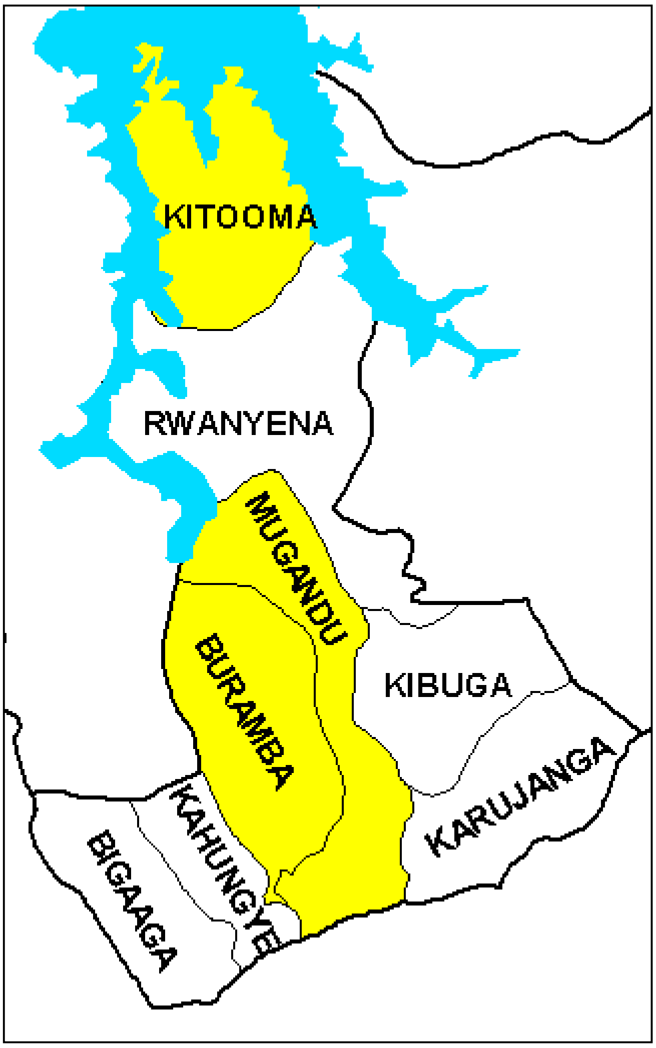
Source: Kabale District Planning Unit Population and Housing Census, 2002

For administrative purposes, the sub-county is divided into six parishes, which include Mugandu, Buramba, Kibuga, Karujanga, Rwanyana and Kitooma (Map 2). The sub-county borders Bufundi sub-county in the northwest, Kitumba sub-county in the north east and Kamuganguzi sub-county in the east. The sub-county is predominantly rural with subsistence agriculture as the main occupation of the local population. The majority of the population live in detached houses (or huts). Most of these houses are made of mud and wattle, some often roofed with iron sheets.

Rubaya sub-county evidently is a mountainous region with extreme socio-cultural and biophysical diversity. It is a remote and marginal region with very fragile eco-systems that are susceptible to soil erosion, landslides and rapid loss of habitat and genetic diversity.

The study was conducted in the Buramba-Mugandu and Kitooma watersheds. These watersheds are located within Rubaya sub-county, comprising of three parishes namely Kitooma, Mugandu and Buramba (Map 2). These watersheds are some of the areas in the district experiencing acute environmental degradation and there is not enough documented information on use of natural resources on a sustainable basis in the area yet this is necessary for planning purposes in agricultural and natural resource management and poverty alleviation hence the aim of the study.

Map 2: Rubaya sub-County showing the location of Buramba – Mugandu parishes



2.1 AGRICULTURE AND LAND USE

Agriculture and agricultural related activities are the main occupation in Rubaya sub-county (Table 2). As in the rest of the district, it is estimated that over 90% of the population in Rubaya sub-county, are engaged in agriculture from which they earn their income and get their source of livelihood (NEMA, 2001). However some people in the sub-county earn their income through 'stone crushing' *(okuhonda amabare)* and distilling the local potent gin *(enguri)* as well as running small shops *(dukas)*. Other locals earn their means of livelihood as civil servants while others run a credit scheme (Table 2).

Table 2: Major sources of household income in order of importance in Rubaya

Parish	Major Sources of income	
Kabuga	• Agriculture • Small scale industries	• Business e.g shops and bars • Casual employment
Kitooma	• Agriculture • Water transport	• Charcoal burning • Trapping mudfish

Rwanyana	• Agriculture • Fishing	• Casual employment • Civil employees (Teachers) • Charcoal burning
Buramba	• Agriculture • *Enguli* distillation	• Civil employees • Business (shops/bars)
Karujanga	• Agriculture • Casual labour	• Business (shops & bars)
Mugandu	• *Enguli* distillation • Business	• Agriculture • Civil employees

Source: sub-county Profiles for updating Development Plans 2002/3 – 2004, Kabale District Council

In terms of gender division of roles and responsibilities in agriculture, the women are more involved in the cultivation of the land and weeding of crops while the men mainly join in the harvesting and control the proceeds from the sale of crops. The Men own the land though women have access to it. This in effect determines the manner in which the land is utilised.

With regards to agricultural produce, most of the crops produced in Rubaya sub-county are consumed at household level and it is only the surplus that is put to market. There are no organised agencies particularly handling the marketing of crops. It is only pyrethrum that is grown with the assistance of interested companies like Agro-Management Inc. (NEMA, 2001). Agricultural production per unit area is generally low in Kabale district (Table 3).

Table 3: Crop productivity on fields in Kabale district

Crops	Area (ha) Total	*Total production (t year^{-1})*	*Average yield (kg ha^{-1})*
Beans	27,538	20,847	757
Sorghum	20,580	16,464	800
Sweet potatoes	18,500	79,499	4,297
Maize	19,714	25,675	1,303
Irish potato	23,328	168,877	7,239
Field peas	14,374	7,531	523
Wheat	764	1,531	2,003
Finger Millet	11,873	16,920	1,425
Cassava	4,887	41,834	8,560
Groundnuts	311	236	759
Bananas	40,616	201,615	4,964

Source: Raussen, et.al (2002)

Data earlier generated in 1999 by Kabale district production department (Table 4 and Figure 1) indicated large yield gaps per hectare if farmer and research station output levels are compared. At research stations, land is better managed and chances of land degradation are minimised, good quality seed is planted and crop pests and diseases are controlled, thereby accounting for higher yields as compared to those at farmer level.

Table 4: Crop yields at farmer level compared to yields on research station, 1999

Crop	Farmer level t/ha	Research station t/ha	Yield gap t/ha
Beans	1.4	3.0	1.6
Maize	1.5	8.0	6.5
Irish potatoes	8.8	35.0	26.2
Sweet potatoes	5.5	30.0	24.5
Sorghum	1.0	7.5	6.5
Wheat	1.0	15.0	14.0

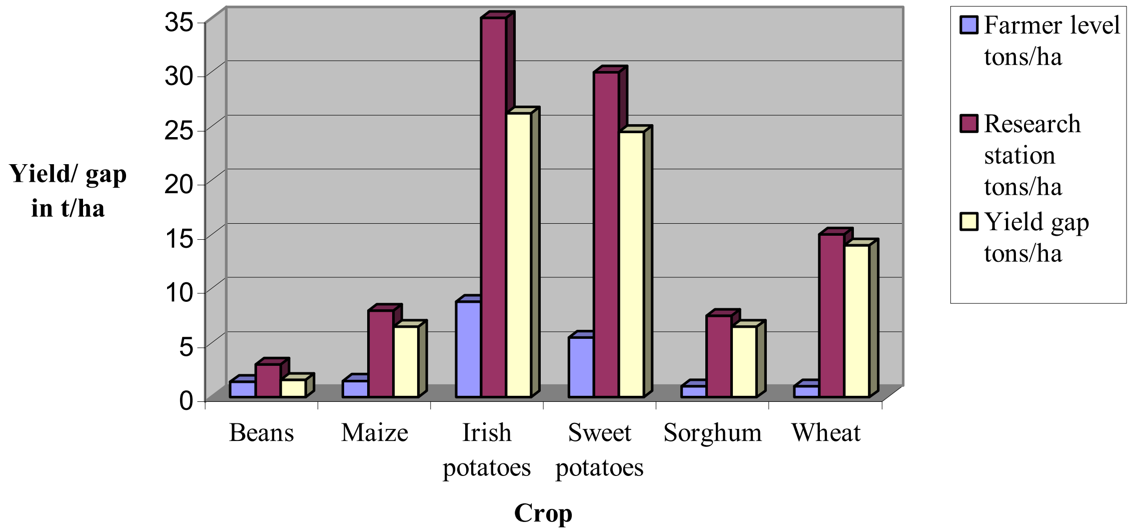
Source: KDLG, Production department,(1999)

The average land area for agriculture is 5.08acres per household (KDLG, 2002(b)). Most farmers interviewed indicated that they had acquired land through inheritance, while a limited number indicated they had purchased the land. The other form of land aquisition highlighted was rented.

Arable farming is practised on the lowlands, on the slopes and on the hill tops with main crops grown being sorghum, irish potatoes, sweet potatoes, maize, beans peas, finger millet and vegetables while wheat, passion fruits, cabbages and pyrethrum are also grown moderately for sale. Due to the steep terrain, crop production is done on terraced benches developed between 1930-1940. Valley bottoms are often used for vegetable and potato growing. Areas abandoned due to severe land degradation are normally left under woodlots consisting of mainly eucalyptus trees.

Use of inorganic fertilizers is rare, while use of manure, compost and mulches can occassionally be noticed though inadequately applied. The predominant soil replenishment method is bush fallowing mainly during the dry seasons. Bush fallowing in Rubaya sub-county, just like the rest of Kabale District is done at various levels namely inter-seasonal fallow (1-2 months), short-term fallows (6-12 months) and long fallows (1-3 years) (Sub-county Council: 2002).

Figure 1: Crop yields at farmer compared to yields on research station, 1999



2.2 CLIMATE

Kabale has a montane climate with a bimodal rainfall pattern. The first rains, which are normally heavy start from March to May and light rains from September to November. June to August is the main dry season and December to February is the short dry period with little rain. The mean annual rainfall and temperature are 1,092 mm and 18° C respectively and the relative humidity ranges between 90-100% in the mornings and decreases to 42-75% in afternoons throughout the year. Mean annual monthly maximum and minimum temperatures are 24.1 and 11.6 °C respectively (Table 5). However, the rainfall totals vary from year to year (Table 6) due to global and local environmental changes.

Table 5: Mean annual monthly maximum and minimum temperatures for Kabale, 1994-1999

Month	J	F	M	A	M	J	J	A	S	O	N	D	Mean annual
Max temp °C	24.3	25.0	24.1	23.7	23.3	24.2	24.1	24.6	25.0	24.3	23.3	23.6	24.1
Min temp °C	11.6	11.4	12.0	12.5	12.5	10.8	10.0	10.9	11.3	12.2	12.4	11.8	11.6

Source: Kabale District meteorological Department, 2003

Table 6: Mean annual rainfall for Kabale, 1994-1999

Year	Rainfall
1994	1,077.3
1995	1,124
1996	1,222.6
1997	1,109.6
1998	1,163
1999	856

Source: Kabale District meteorological Department, 2003

2.3 RELIEF AND DRAINAGE

The relief of Rubaya sub-county generally ranges between 1800 m and 2500 m above sea level with the highest points being to the northern part of the sub-county.

A fully developed/mature drainage pattern of major and minor streams covers much of the sub-county. Young/youthful drainage patterns with V-shaped valleys are present in the area often with silted floors and seasonal swamps. One of the largest lakes in the district, Lake Bunyoni, occupies a wide valley at a depth of about 40 metres to the south of the sub-county. Most of the natural vegetation has been cleared for cultivation (NEMA, 2001).

2.4 THE SOILS

The soils in Rubaya sub-county, like those in other parts of Kabale district, are mainly volcanic and ferralitic in nature (NEMA 2001). They are generally dark brown, often acidic and low in base, derived from basalt lava ash and in some places phyllite. There are some scattered peat soils in the valley bottoms. The volcanic soils owe their productivity to the retentive nature of their clay fraction and to the rooting depth. In the lowlands, there are humose brown loam soils, which are typically of moderate to high productivity. The peat soils mainly in the swamps show low soil pH values, ranging from 2.4 - 2.7, and this renders the soils unfavourable to plant growth especially those that cannot tolerate such low acidic levels. Another limiting factor to plant growth is the rooting depth. Most of the soils on the hilltops and upper parts of the terraces are shallow to moderately deep. This shallowness of the soils limits crops to low soil volume for anchorage and nutrient exploitation (NEMA, 2001).

Soil erodibility is low and while rainfall erositivity is moderate, the potential for erosion is high due to the long steep slopes in Rubaya sub-county.

2.5 GENDER ANALYSIS OF RESOURCE ACCESS, CONTROL AND OWNERSHIP

Women and girls in Rubaya sub-county, like in most other parts of Uganda do more work in the home as opposed to the men and boys. They do much of the cultivation, all the home care like cooking and cleaning and are responsible for collecting water and firewood. With regard to land ownership as well as other resources like agricultural tools, agricultural produce, livestock and business. The number of women who own land and any other resources including money is rather negligable; control is often by the men.

A scoring scale of 0 - 5, where 0 represents no chances of ownership and 5 represents total ownership, was used by sub-county technical staff to determine ownership of resources in Rubaya (Table 7). Concerning land, men scored 4 and women 1, agricultural tools 1 and 4, livestock 3 and 2, utensils 3 and 2, furniture 4 and 1, money 4 and 1, radiods 4 and 1, bicycles 5 and 0, business 4 and 1, agricultural produce 2 and 3 for men and women respectively (KDLG, 2002(b)).

Table 7: Summary of access to, control and ownership of resources by sex in Rubaya

Score: 0-5: where 0 = least control /ownership & 5 = strong control / ownership

	Access		**Control**		**Ownership**	
Resources	**Men**	**Women**	**Men**	**Women**	**Men**	**Women**
Land	2	5	3	2	4	1
Agricultural Tools	1	2	1	4	1	4
Livestock	3	1	2	1	3	2
Utensils	0	3	1	3	3	2
Furniture	3	1	2	2	4	1
Money	3	2	4	1	4	1
Radio	3	0	3	1	4	1
Bicycle	4	0	4	0	5	0
Business	3	2	3	2	4	1
Agricultural Produce	2	3	2	3	2	3

Source: sub-county Profiles for updating Development Plans 2002/3 – 2004, Kabale District Council

It is also clear that men rarely use tools implying that it is mostly the women who do the cultivation. Culturally it is the men who own livestock, ride bicycles and have the time to listen to radio. Although items like household furniture belong to the man, it is the women who contol and manage these and much of the household affairs. Money and other financial assets however are largely the exclusive domain of men and women tend to be more engaged in production. This no doubt has an impact on the NRM measures to be suggested on improving the livelihoods and utilisation of resources in this area as it all depends on who owns the resources.

Women and girls evidently do more work in the home as opposed to men and boys (Table 8) who tend to spend most of their time relaxing with alot of leisure time. Men benefit most from the work that is done by all household members and the implication is that men in Rubaya sub-county, like in many other parts of the country tend to trod over women, which to a high extent, is due to cultural beliefs. There is need to strengthen sensitization programmes to encourage equitable division of labour at the household level.

Table 8: Division of labour in the household

Men	Women	Girls	Boys
Clearing Bushes	A lot of Digging	Cleaning Utensils	Grazing
Building	Caring for Children	Fetching Water	Fetching Water
Limited Digging	Cooking Food	Gathering Firewood	Gathering Firewood
Threshing	Cleaning the Home	Care for the Young	Limited Digging
Grazing Animals	Gathering Firewood	Limited Digging	
	Fetching Water		

Source: sub-county Profiles for updating Development Plans 2002/3 – 2004. Kabale District Council

3.0 METHODOLOGY

3.1 SAMPLING PROCEDURES

3.1.1 Selection of villages

Four villages were selected for the study from three parishes in the watershed (Table 9). The focus was at community landscape level where particular villages to investigate were sampled based on varying local and physical environmental conditions. The other criterion for selection was existence of well organized farmer groups involved in research and development with other organisations such as AHI, International Centre for Tropical Agriculture (CIAT) and AFRICARE. Refer to section 2.0 concerning the research setting for details about the population sizes in the study area. The villages selected are given in Table 9 below.

Table 9: Selected villages for the study

Village	Parish
Karambo	Buramba
Kagyera	Mugandu
Muguli B	Mugandu

These were considered a good representation of the rest of the watershed.

3.1.2 Selection of participants

Selection of participants for the study in each village was based on pre-exiting locally organized farmer's groups. These groups were composed of both women and men involved in agricultural research conducted by AHI, CIAT and other Non-Government Organisations (NGO's). They were of varying social, economic and education levels. Local leaders and more especially Local Councilors (LC's), LC1 Chairpersons and secretaries for production and environment, were in most cases included among the participants. Arguably thus, the selected participants were representative of the local community.

3.1.3 Selection of plots/farms/farmers for detailed land degradation assessment

The study also placed focus at plot/farm/farmer level for detailed land degradation assessment. The criteria for selection of these plots/farms/farmers was based on the following factors/variables that needed to be studied:

i. Wealth rank of the farmer,
ii. Position of plot/farm on slope,
iii. Gender of the farmer,
iv. Geographical location in the village and,
v. Availability of byelaws in the village.

Based on these, out of the four villages selected for the entire study, Habugarama, Muguli B and Karambo villages were selected for the detailed on-farm land degradation assessments. In all, 25 plots/farms/farmers were selected for this purpose and were considered representative enough, basing on the fact that they represented farmers of varying wealth ranks, gender, different positions on slope and villages (Table 10).

Table 10: Selected farmers, their villages, gender, wealth ranks and positions on slope

Village	Farmer	Wealth rank	Gender	Slope
Habugarama	Kenama Moses	Average	M	Upper slope - gentle
Habugarama	Nzarwahabi Isaac	Poor	M	Lower slope - steep
Habugarama	Mugisha Daudi	Poor	M	Mid slope - gentle
Habugarama	Mashakarugo Noreda	Poor	F	Mid slope - gentle
Habugarama	Kikomo Noreda	Poor	F	Lower slope - gentle
Habugarama	Kaburabuza Petero	Poor	M	Upper slope - gentle
Habugarama	Rwehobuganzi Dinah	Rich	F	Mid-slope
Habugarama	Ndyomugyenyi Fred	Rich	M	Mid-slope gentle
Habugarama	Mugisha Frank	Rich	M	Upper slope - gentle
Habugarama	Bikangaga Joy	Rich	F	Lower slope - steep
Muguli B	Gandagara Miria	Poor	F	Mid slope
Muguli B	Salome Mugabirwe	Poor	F	Lower slope
Muguli B	Ngwabije Jackline	Poor	F	Mid slope
Muguli B	Ntamabyaliro	Poor	F	Upper slope
Muguli B	Hinja Alice	Poor	F	Mid slope
Muguli B	Kanyenzi Emmanuel	Rich	M	Upper slope
Muguli B	Habarwasha Geoffrey	Rich	M	Lower slope - steep
Muguli B	Nsekuya Feles	Rich	F	Mid slope
Muguli B	Kwehangana Nelson	Rich	M	Lower slope - gentle
Muguli B	Buryahika Herbert	Rich	M	Mid slope - gentle
Karambo	Kabuga	Poor	M	Lower slope-steep
Karambo	Tumwesigye	Rich	M	Mid slope - steep
Karambo	Tumwesigye	Rich	M	Lower slope-steep
Karambo	Adam	Average	M	Lower slope- gentle
Karambo	Adam	Average	M	Lower slope- gentle

3.1.4 Determining the wealth ranks of the selected farmers

A pre-existing database from a study done by AHI/CIAT was used to determine the wealth ranks of the selected farmers for the detailed studies so as to enhance analysis of soil loss by wealth rank.

The criteria used to classify the farmers was as follows:

The rich farmer has:

- Enough food with surplus for sale
- An iron-roofed/permanent house,
- Livestock (6 indigenous cattle on average),
- A bicycle/car,
- A radio,
- All his/her children in the school-going age group are at school
- Well over 6 plots of land under cereal crops

The average farmer has:

- Enough food but for subsistence,
- An iron-roofed house,
- Livestock (2-4 goats),
- Some children in the school-going age group schooling (due to UPE) but their attendance is irregular due to inadequate scholastic materials
- An average of 6plots of land under cereal crops

The poor farmer:

- Has a house not roofed with iron sheets,
- Offers labour for food,
- Has no rationale for family size,
- Has no livestock at all,
- Has some children in the school-going age group not schooling despite the existence of UPE
- Possesses only one plot of land where he/she has a house,
- Works on other people's farms,
- Rents land on the "sharing of harvests" basis.

3.2 THE TOOLS USED FOR DATA COLLECTION AND ANALYSIS

The study combined a range of participatory tools and detailed plot level studies to assess the extent of land degradation as detailed in sections 3.2.1 – 3.2.8 below.

3.2.1 Focus Group Discussions (FGDs)

This method was used to obtain farmers' perspectives about land degradation issues and NRM practice in the villages. Participants, both men and women (Plate 1), ranging in numbers between 12-14 brainstormed over issues relating to NRM including general land cover and use, livestock interactions, land degradation, band destruction, impacts of land degradation on production, new terrace construction, land fragmentation, wetland management, water management, bush-burning, soil conservation measures, woodlot planting, local policies, byelaws and institutional arrangement for their formulation and implementation. Farmers were also asked to suggest the best NRM practices they felt were suitable for controlling the land degradation problems in their area.

The strong point is using the FGDs was that the participants had in-depth knowledge of the issues in their villages. Other methods of data collection were then used to validate the data collected from FGDs. In all, 4 FGDs were conducted, one for each of the 4 selected villages.

Plate 1: Focus Group Discussion in Muguri B Village

Source: Field photo, January 2003

3.2.2 Participatory mapping

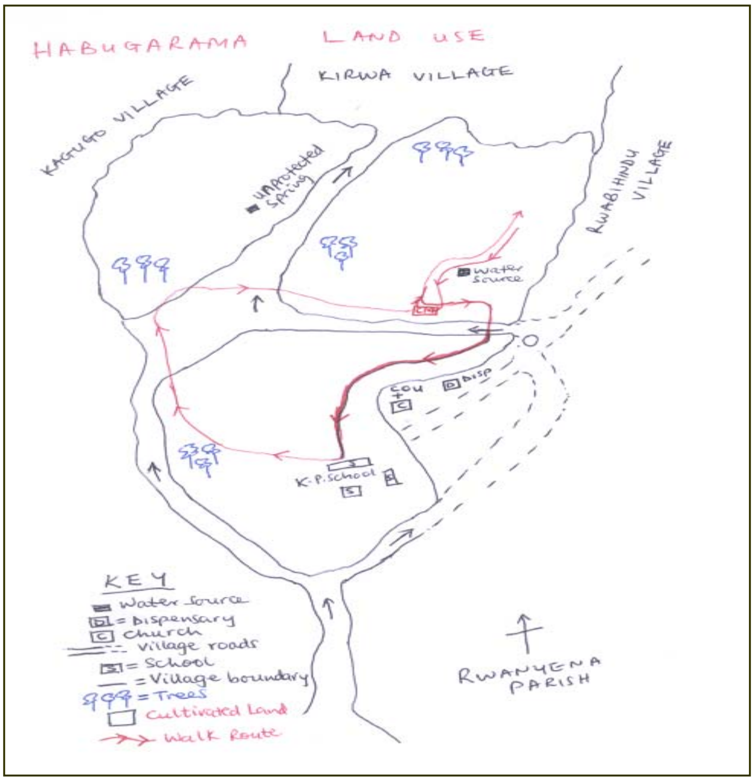
In order to get a clear picture of the extent of the problem, land degradation issues, geographical distribution of natural resources, current NRM practices and other related factors, participatory mapping with farmers in each of the four villages was facilitated. These maps generated a lot of qualitative data and enabled the farmers to perceive their natural resource situation. Farmers with good knowledge of the area and boundaries were selected to draw the maps and to a larger extent, efforts were made to ensure women and men participated equally in the exercise. The facilitators took notes of the debates that the map sketching exercise generated and guided the participants to ensure that the maps generated the required data. The maps were then presented to the participants in plenary sessions for them to confirm these maps were a true reflection of the land degradation and issues in their area.

The strength in this method is that the participants sketch the maps themselves, as they now better their community better, the distribution of natural resources and other issues in their area. This too, arguably built a sense of ownership of the study exercise among the participants/farmers. The disadvantage however is that in some cases, the method was time consuming as participants debated for long about correct location of certain issues/resources/items on the sketch maps.

3.2.3 Transect walks

These were systematic walks taken across the selected villages (Map 3) to observe community land use practices, land degradation and to compile any other relevant spatial information. They enabled the study team to get a fair view of the different land-uses in the village and carry out a mapping exercise that gave a cross-sectional view of the study area, the types of land degradation and NRM practices in the village.

Map 3: The red line: A transect route decided upon by farmers in Habugarama



Transect walks were taken on the days after the FGDs and participatory mapping exercises. The transect route for each village was agreed upon by the participants basing on the number of land degradation issues and land uses it would allow the team to walk through. The participants then indicated these routes on the maps.

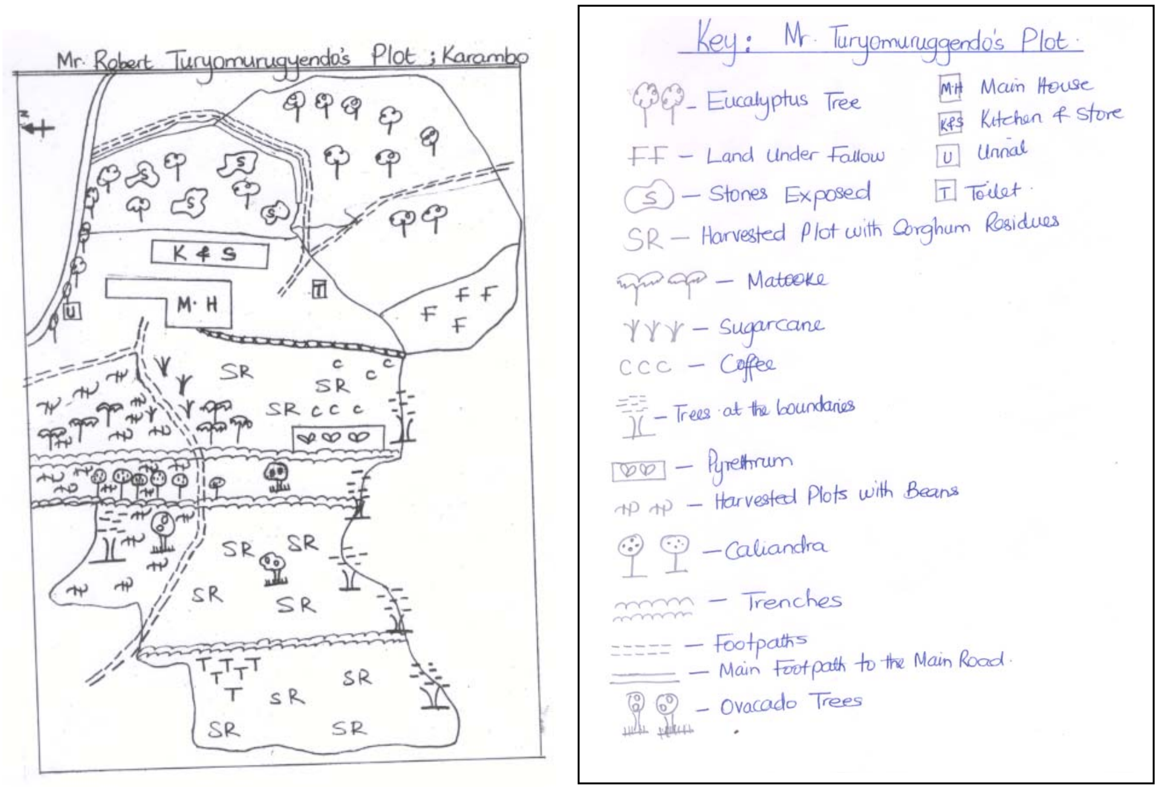
The transect walk teams included the participants (women and men) from the FGD and the facilitators. However, in some cases, other community members would join the walks (especially the land owners). The method is important in verifying location of what had earlier on been discussed and sketched on maps by the participants. Besides, more valuable data was generated through observation, field measurement, informal interviews and conversations along the transect routes e.g. vegetation cover, crop types, soils, rockiness, gully/rill size and current NRM practices in place.

The walks lasted on average between 6-8 hours and were pretty much tiring; especially bearing in mind this is a mountainous region with a steep terrain. There were a couple of high terraces to 'crawl' over. Nevertheless, the walks provided a valuable opportunity for the facilitators to develop close relationships with the farmers.

3.2.4 Field/ plot sketching

This gave a general overview of field plot situations (Map 4). It helped in identifying crop vegetation cover, slope, rocks, plot sizes, actual land use, land degradation issues, NRM practices and other observed biophysical aspects of the plots. The sketching was done during transect walks and during the periods of detailed field assessment.

Map 4: Mr. Robert Turyomurugendo's farm in Karambo Village



Source: Authors' Fieldwork, August 2002

3.2.5 Observation and photography

Observation was continuously used especially during transects walks to particularly assess and record the number of terraces with destroyed bunds and extent of band destruction. Aspects of particular interest, like woodlots, band destruction or collapse and root exposure, were photographed. Photographs on the other hand were taken through out the period of the field research.

3.2.6 Interviews

These were conducted after FGDs with selected men and women to gather information about certain aspects of NRM conflicts in the study area. This was done because the farmers could not freely discuss conflict issues during FGDs. In addition, interviews were conducted informally with farmers along transect routes about particular issues of interest that needed explanation which could not be got from simple observation. For example why a particular land use or NRM practice was in a given location and not the other.

3.2.7 Review of secondary data

This was an important source of information especially background information about study area (physical and socio economic information). It also generated information from related studies on land degradation earlier conducted in the area. Major source of such information included the district Environmental, Forestry, Agriculture, Water and Planning offices, ICRAF, AFRICARE, CARE and other NGOs and Community Based Organisations (CBOs).

3.2.8 Field measurements, recording and calculations

Some measurements were taken during transect walks for particular issues of interest and during days of detailed field study exercises conducted on selected plots.

Each of these was used where a particular land degradation feature existed. This method helped to generate quantitative data.

Many simple methods exist to calculate volumes of soil lost (e.g rill and gully method, root exposure, rock exposure and build-up against barriers) as assessment of the extent of land degradation on farms. However, in order to ensure uniformity so as to easily compare results from different farms/plots, calculations of volumes of soil lost were done only using the rill method on all farms (Stocking and Murnaghan, 2001).

This method uses cross-sectional areas of rills, assuming a triangular section, for a given contributing catchment area per rill, to determine the volume of soil lost. For example, considering a rill that measured 6.5m in length on Mr. Tumwesigye's farm in Karambo village (Table 11).

Table 11: Sample data sheet for recording data from a measured rill

Measurement No.	Width (mm)	Depth (mm)
1	100	50
2	90	40
3	120	40
4	100	40
5	60	30
6	170	50
7	280	70
8	100	20
Sum of all measurements	**1020**	**340**
Average (mm)	127.5	42.5
Length of rill 6.5m		
Contributing catchment area to rill 13m^2		

To derive the amounts of soil lost on this plot, the calculation was done as follows:

Average horizontal width of 127.5mm converted to metres
= (127.5x 0.001) m
= 0.1275m

Average depth of 42.5mm converted to metres
= (42.5 x 0.001) m
=0.0425m

Average cross-sectional area of rill, assuming a triangular cross-section
= ½ x width x depth
= ½ x 0.1275 x 0.0425
= 0.00271m^2

Volume of soil lost from the rill measuring 6.5m in length
= Cross-sectional area x length of rill
= 0.00271 x 6.5
= 0.0176m^3

Volume lost per square metre of catchment area measuring 13m^2
= 0.0176 ÷ 13
= 0.00135m^3/m^2

Therefore, volume lost in tonnes per hectare
= 0.00135 x 13,000 (conversion to ha)
= 17.6t/ha

Calculations of volumes of soil lost were also done using the gully method within the watershed (Michael Stocking and Niamh Murnaghan, 2001).

This method uses cross-sectional areas of gullies (assuming a trapezium section) for a given contributing catchment area per gully, to determine the volume of soil lost. For example, consider a long and wide gully that measured 1km in length, running from the top of the hill downwards to the valley bottom in Mugandu Parish, Muguli B village (Table 12).

Table 12: Sample data sheet for recording data form a measured gully

Measurement No.	Width at lip (W1) m	Width at base (W2) m	Depth (M)
1	3	2.9	4.0
2	3	2.2	1.8
3	2.4	0.5	1.7
4	2.7	1.1	1.8
5	1.9	0.5	1.7
Average(M)	**2.6**	**1.5**	**2.2**
Length of Gully 1km, contributing catchment area 1sq.km or 1,000,000sq.m			

Average cross-sectional area of the gully
= ½ (w_1 + w_2) x d
= ½ (2.6+1.5) x 2.2
= 4.51m^2

Volume of the soil lost from the gully measuring 1000 metres in length
4.51x 1000
= 4510m^3

Volume lost per square metre of catchment that measures 1 sq Km or $1,000,000m^2$
$= 4510 \div 1,000,000$
$= 0.00451m^3/m^2$

Volume lost converted to tonnes per hectare in the whole catchment area
$= 0.00451 \times 13,000$
$= 58.6t/ha$

3.2.9 Valuing the impact of land degradation

The choice of a particular economic valuation technique obviously depends on what is being measured and thus the data requirements and availability. In this study, the Effect On Production (EOP) method, which is a conventional market approach to the valuation of environmental impacts, was applied to determine the income lost by farmers due to land degradation. The yield gap between farmer and research station level was multiplied by market price to determine income lost by the farmers per hectare of each of the selected crops.

The EOP technique is based on the principle that the environmental impact of an activity can be represented by the value of the change in economic output it causes. Physical changes in production are valued using market prices for inputs and outputs or when distortions exist, appropriately adjusted market prices (NEMA, 1999).

To generate another picture for comparison purposes, the Replacement Cost Method (RCM) was also applied. It is a technique which is based on the principle that the environmental impact of soil loss can be represented by the cost of inputs a farmer would incur in order to replace the lost soil nutrients due to erosion.

3.3 FIELD ACTIVITY SCHEDULE

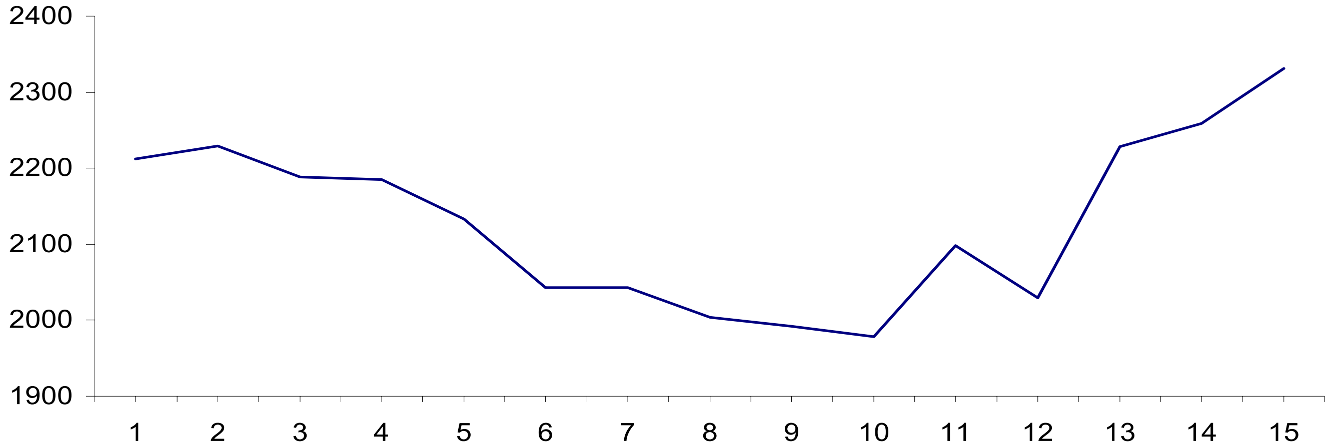
In total, the field research for each of the selected villages took 4 days. The schedule of the study's field activities was designed in such a way that for each of the four villages, day 1 was for reconnaissance and agreeing on dates for the study with farmer leaders and mobilizes. Day 2 was for focus group Discussion (FGDs), participatory mapping, interviews on conflicts in NRM and agreeing on the transect route. Day 3 was for conducting of the transect walks while day 4 was for taking detailed field measurements for land degradation (in the 2 selected villages where in-depth studies were done).

4.0 MAJOR FINDINGS

4.1 LAND USE/COVER

Within the Buramba-Mugandu and Kitooma watersheds, most cultivation is done on lower slopes and some cultivated patches can be seen on the higher slopes, which have been obviously highly degraded and have now been planted with mainly eucalyptus trees. A clear picture about the landscape, land use, resources and activities in the watersheds were generated during transect walks (Figure 2 and Maps 5-8).

Figure 2: A transect across Karambo village showing land use, resources, constraints and opportunities



Land use	Settlements, woodlot, cultivation	Settlements	Woodlot	Fish farming, bee keeping	Bee keeping	Sand mining	Woodlot, settlement
Water				Spring, swamp	Swamp, spring	Spring	
Livestock	Goats Cattle					Goats, cattle	Cattle
Crops	Sorghum, grass, bananas, tobacco, sweet potatoes	Bananas, tobacco, sweet potatoes, grass, sorghum, avocado,	Sorghum	Sugarcane		Beans	
Constraints	Soil exhaustion, erosion,	Gully, erosion, band destruction	Soil exhaustion, landslide,	Stone deposition, compaction		Stone deposition, erosion	Erosion
Opportunities	Fallowing, terraces, trenches, trees	Fallowing, trees		Gully infilling,	Craft and building materials		Fallow

Source: Authors' fieldwork, August 2002

Generally, the hill slopes are fairly steep and the gradient is only low towards the valley bottom. Cultivation is also done in the wetlands.

Map 5: Land use in the Buramba – Mugandu and Kitooma watersheds: An Example of Karambo Village

<u>Key (Translated)</u>
Boundary
Trees
Barren Land

Fertile Valleys
Grazing Land

Households
Streams
Roads

Church

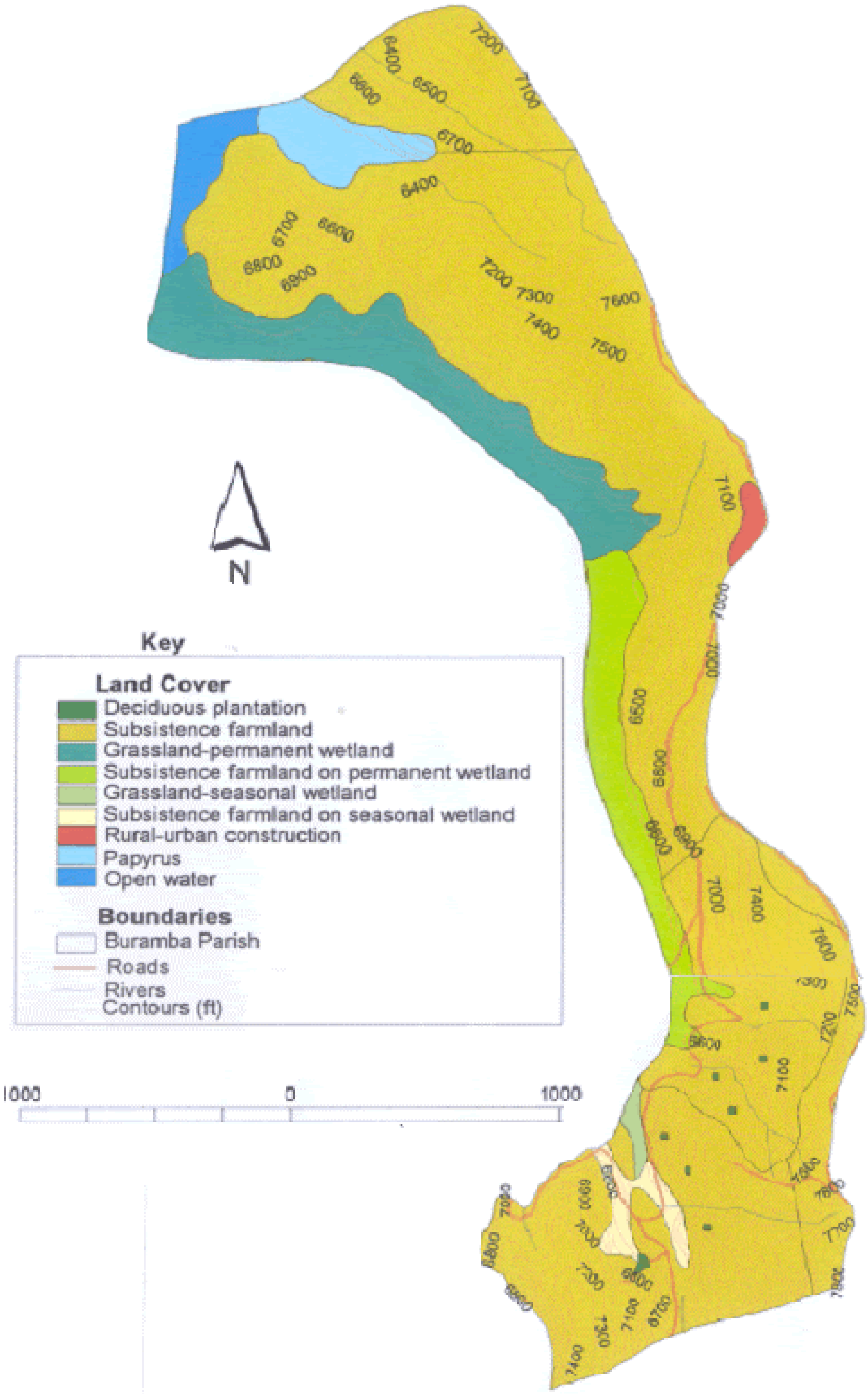
Wetlands
Water Channel
Cattle Track

Source: Participatory mapping, Karambo August. 2002.

The characteristic land uses highlighted in the Buramba – Mugandu watershed included:

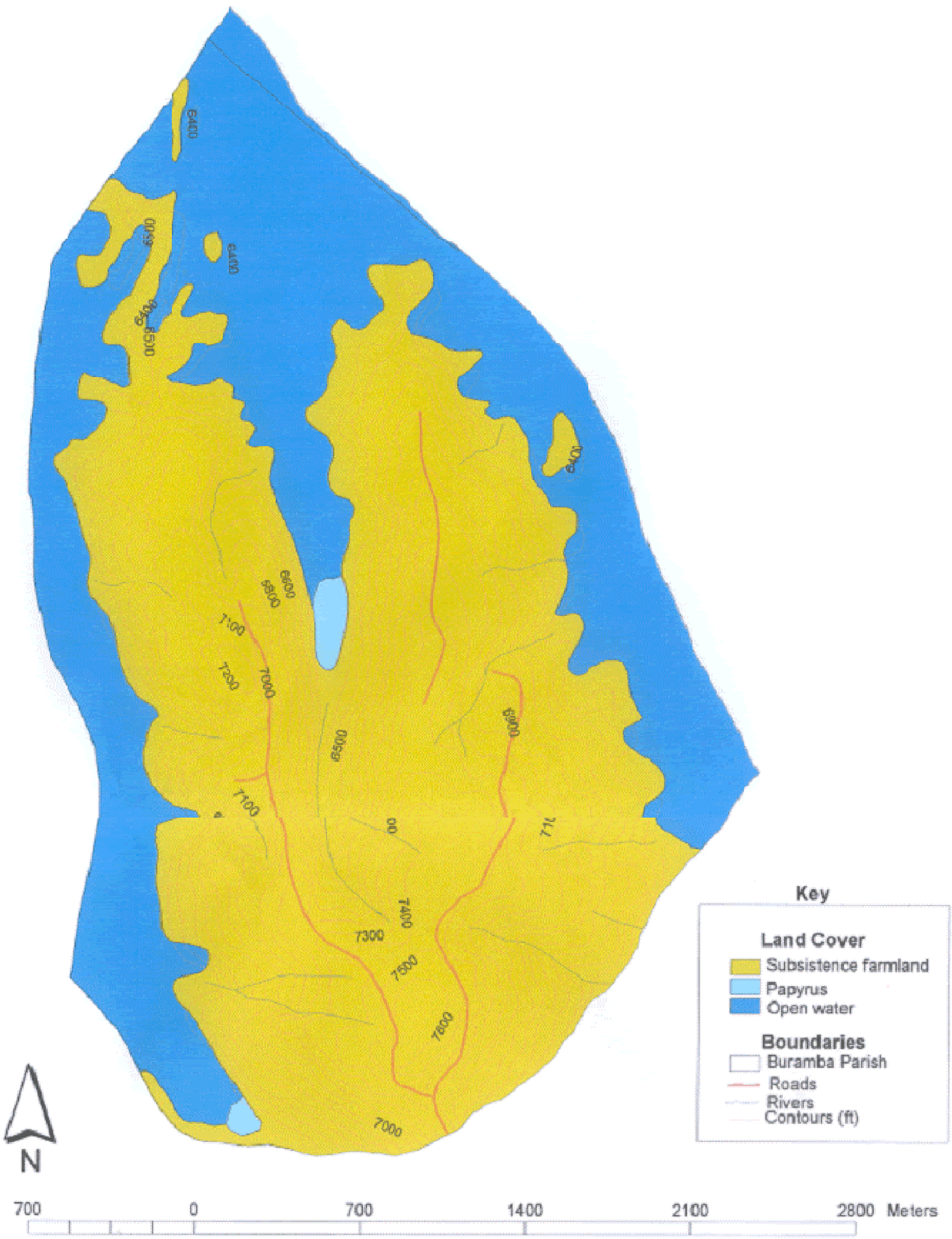
- Cultivation-usually on the slopes
- Fallow
- Woodlots
- Grazing areas
- Built up areas

Map 6: Mugandu parish land use and height contours



Map 7: Buramba parish land use and height contours

Map 8: Kitooma parish land use and height contours

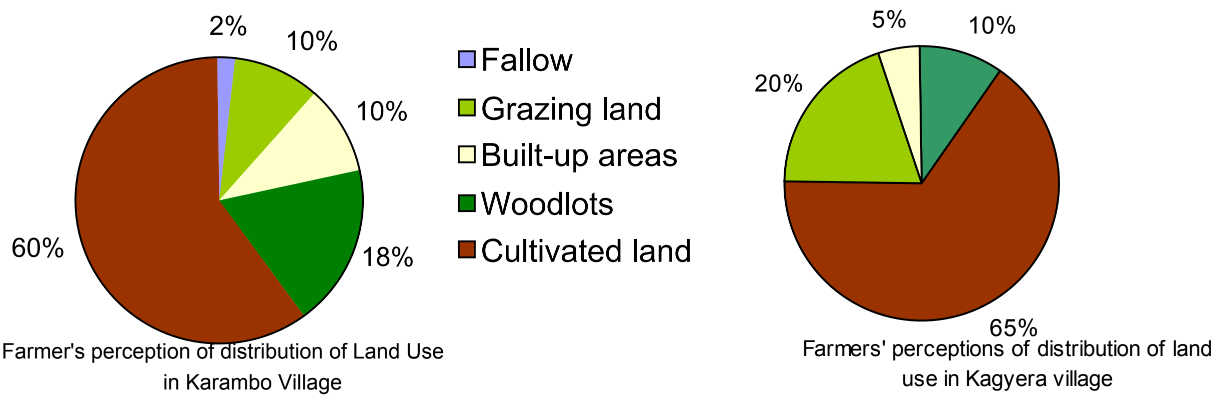


From the FGDs, it was indicated that approximately 60% - 65% of the land is used for crop cultivation while less than 2% is the land currently under fallow. It was further revealed that about 10% - 18% of the land is under woodlots, while grazing and built-up areas each constitute 10% - 20%. The field observations and estimations of land utilization types during transect walks confirmed these farmers perceptions.

4.1.1 Cultivated Areas

Much of the land in this area/watersheds is used for cultivation (Figure 3) and the type of cultivation practiced here is hill-slope rain-fed agriculture. The amount of land apportioned for the cultivation of a particular crop varies depending on the season. However, cultivated land has decreased in the past due to land degradation. A promising development pathway now lies in the intensification of agricultural production by adoption of appropriate NRM practices.

Figure 3: Farmers' perspectives of distribution of land use in Karambo and Kagyera villages



Source: Authors Fieldwork, August 2002

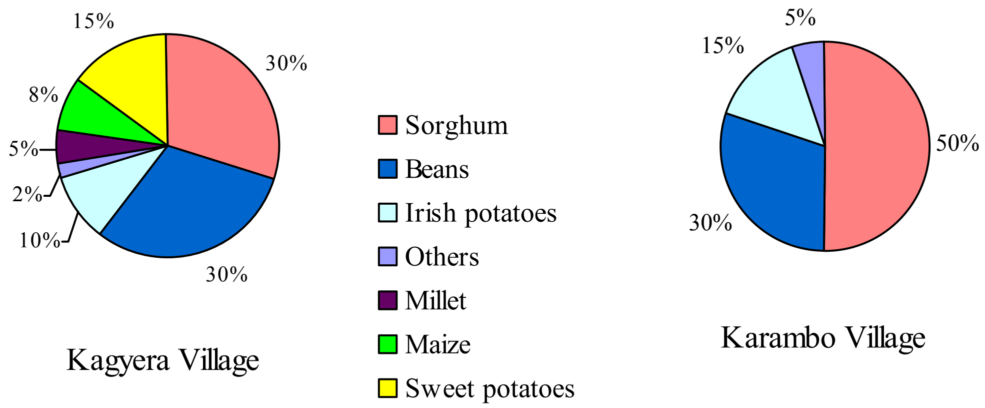
From the FGDs, it was clearly indicated that sorghum is the most widely cultivated crop in the area taking up approximately 30 - 50% of the cultivable land. The other crops grown include beans, which take up 30%, irish potatoes 10 - 15% and the rest of the crops namely peas, cabbage, wheat, pyrethrum, tobacco and sweet potatoes constitute between 2 - 15%. In Muguri B village it was noted that tobacco and cabbages are the crops preferred by men, because they are easier to sell in neighbouring Rwanda, hence quick cash.

Comparing with results from a study conducted by Raussen, *et.al* (2002), the total land area in Kabale district of 1827km^2, 92.8% is considered arable. However, only 55.7% of the total land area is cultivated. 2.6% of the land is covered by lake, 4.3% by wetlands and 4% by forests, both natural and planted. Menawhile, Zomer *et al.*, (2002) in a study conducted in Kabale found out that 8% of the land is under seasonal fallow, 14% under long fallow, 10% abandoned, 1% flooded and 67% cropped.

Cultivation normally occurs in areas with fairly deep and fertile soils such as the lower slopes and valley bottoms. In some areas, however, especially towards the shores of Lake

Bunyonyi, the swamp areas are not cultivated due to waterlogged conditions there. Rotational agriculture is practised and it is mainly Irish potatoes, sweet potatoes and beans that are cultivated (Figure 4) in the valleys. Sorghum is usually cultivated on the lower slopes.

Figure 4: Farmers' perspectives of distribution of cultivated crops



Source: Author's Fieldwork, August 2002. Note that these proportions may change with season

4.1.2 Land under Fallow

It was repeatedly mentioned that little land in the villages within this watershed is currently under fallow due to its scarcity and the need for families to grow more food. The Farmers indicated that this is largely because of population pressure. The estimated length of fallow period for the few plots under fallow was put to as low as four months. It was however mentioned that about twenty years ago, people could afford to leave their land under fallow for two years but this is currently impossible. Because of over-cultivation, soils are now exhausted of plant nutrients and are prone to soil erosion due to lack of plant cover.

The land on the hilltops is more or less abandoned and some of it is planted with woodlots consisting of mainly eucalyptus. Thorny weeds and ferns are evident in these areas indicating soils of low pH (acidity). It was mentioned that most of the abandoned terraces on the hill tops were last used 10 years ago, however due to lack of land, farmers have occasionally utilised the land for growing millet and sweet potatoes. In some villages like Muguri B and Karambo, such land has been reclaimed by farmers for pyrethrum growing. This could possibly offer some alternative use for the land. Crops grown in such places are notably poor due to shallow soils - farmers indicated they often turn yellow and dry up. Some of the land is not stony but is still very infertile. At the shoulder of the hill, the soil if fairly deep (> 30 cm) in most places.

Footpaths in some of these areas have developed into deep gullies, which has forced farmers to create other footpaths. Soils in most areas are thin and stony. All these have manifested into problems for land users who rely on the land for their livelihood. Cultivation during the dry seasons is shifted from hill slopes to the valley bottoms (Plate 2).

Plate 2: Land use in the Buramba-Mugandu and Kitooma Watersheds: A case of Karambo village

4.1.3 Woodlots

Tree planting is undertaken on the slopes, especially on areas that have been eroded and degraded, as well as hilltops. The most common types of trees grown in this watershed area are:

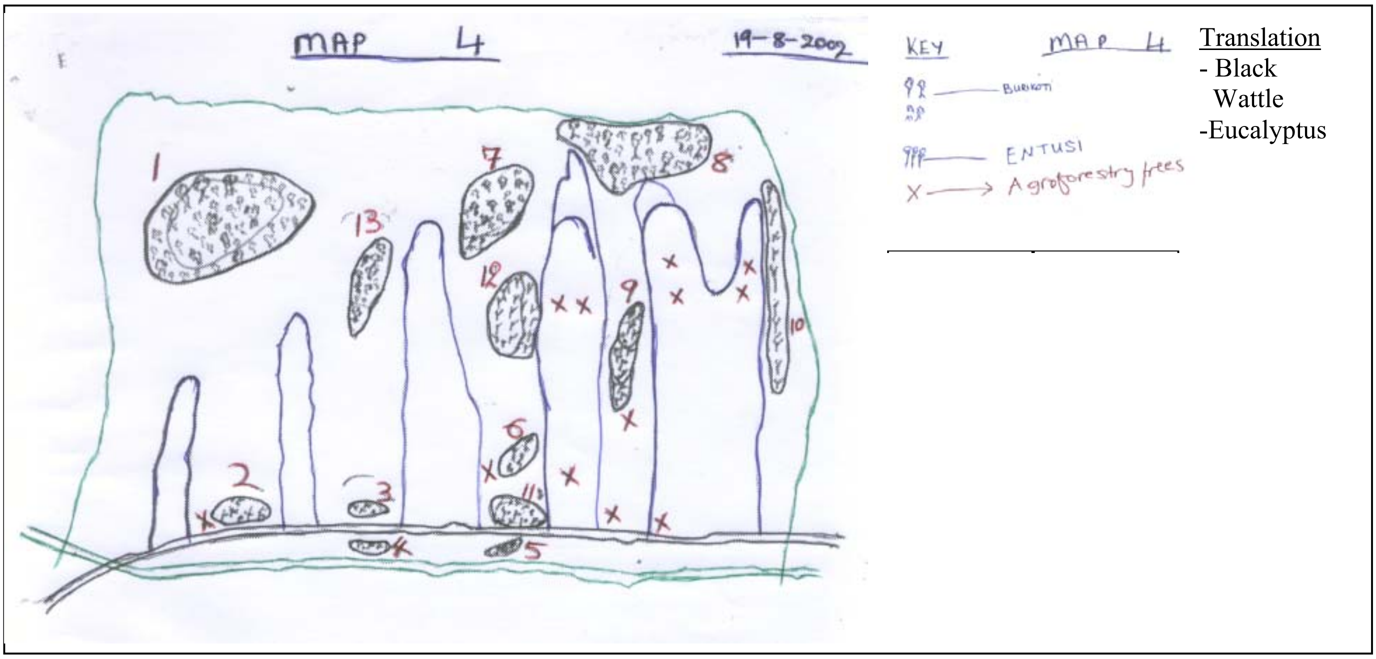
- Eucalyptus – *'Entusi'*
- Black Wattle – *'Burikoti'*
- *Calliandra*
- *Grevillea*

Calliandra and *Grevillea* have just been introduced and are therefore not widely grown.

Eucalyptus trees in particular, have widely been grown in areas where the land has been terribly degraded and no longer used for crop cultivation. The other tree species commonly planted is Black-wattle, which, unlike eucalyptus trees, allows undergrowths and hence conserves soils better.

In Karambo village, for example, there are 13 main woodlots (Map 9). The woodlots are in a number of cases owned by individual farmers, though in some cases by farmer groups. In Kagyera, for example, the *"ruhurwensi"* woodlot is owned by a farmer group there. The woodlots are either of a pure stand of eucalyptus, black wattle or a mix of both species. The products are used for poles, timber, fuel wood and stakes.

Map 9: Woodlot planted on degraded land and hilltops in Buramba-Mugandu & Kitooma watersheds: A case of Karambo Village



Source: Farmers' own map: FGD Karambo August 2002

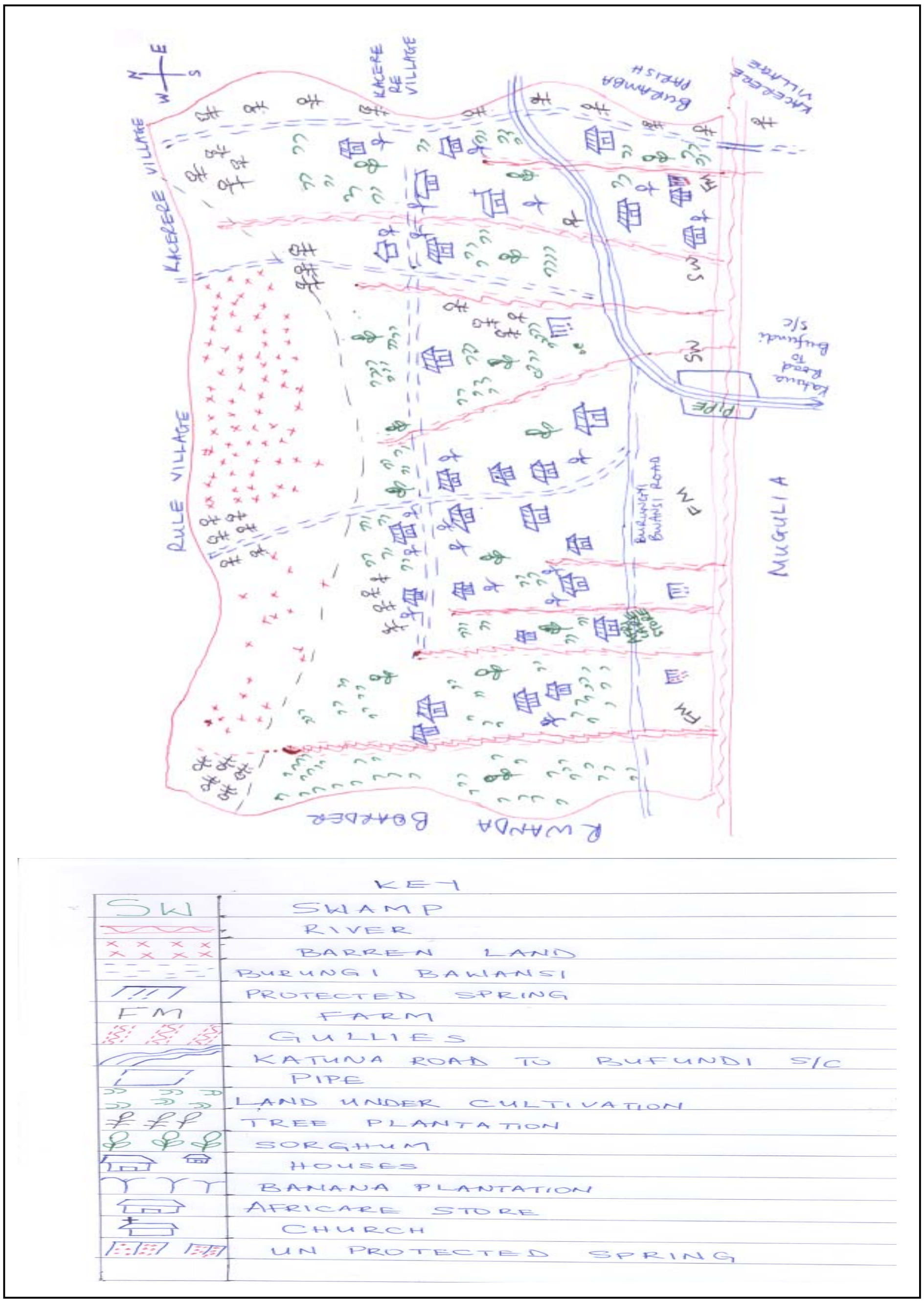
The farmers however revealed that AHI has been sensitising them about the low capacity of Eucalyptus trees to conserve the soils and how it tends to enhance erosion. They have been enlightened about the suitability of the other tree species and their capacity to reduce surface runoff and hence soil erosion. As a result of this new awareness, some farmers have started planting the new trees supplied through the farmer group, which include *Grivellia, Calliandra* and *Alnus.*

The farmers indicated that the other reasons for growing these tree species are: source of building materials, timber and firewood and to provide stakes for beans.

4.1.4 Built up areas

Most of the households are located on the mid-slopes (Map 10) for fear of flooding in the valleys. This spares the valley bottoms for cultivation during the dry seasons.

Map 10: Land use in Muguli B village



4.2 LAND FRAGMENTATION

4.2.1 Plot sizes and numbers

Most of the land in the area is highly fragmented forcing farmers to own several terraces in different villages within the watershed and neighbouring parishes. At times some of the farmers have to travel 2 – 5 Km to cultivate plots in other villages.

From field measurements, the average plot size in most of the villages in the watershed measures between 0.1 and 0.7 of an acre. Most households own 3 – 4 plots of land whose size is on average about 0.24 acre per plot. A sizeable number of households have on average 10 plots of land ranging in sizes between 0.4 and 0.7 of an acre. Very few residents have more than 20 plots in some of the villages like Muguri B and Kagyera for example 12 own ≥20 plots.

Farmers in Karambo further revealed that approximately 10 people in the village have 30 plots while 20 people have 5 plots and below. The majority of the residents in Kagyera have plots ranging between 5 and 20.

The situation is not any different for the entire district where land is seriously fragmented and an average household has 6 - 7 plots of land, each measuring between 0.1 and 0.7 of an acre (KDLG, 2002(a)).

Most of these plots are located on the lower slopes and valleys. The plots are located on different hillsides, while members of the Mugandu Muramba and the Rubaya vegetable-growers societies are allocated plots in the Buramba-Mugandu wetland in the valley bottoms for cultivation on a seasonal basis. Some farmers of a high wealth rank like Nyansio Babwekyeka and Habarwasha also applied for leases in the wetlands (though never had the offers extended) and use these valley bottoms for cultivation and livestock rearing.

4.2.2 Plot ownership

Most of the plots are owned according to customary laws (75%), except for a few sections of the wetlands which are under leasehold (section 4.6). However, it was revealed that many farmers have bought or hired plots from other fellow farmers. For some of the farmers, the land they now own was given to them as a present from their wives' parents. It was also further established that a sizeable number of fragmented plots had been bought by local farmers in the villages, necessitating travelling over some distance. Several farmers also indicated that they hire some of the plots they are cultivating as the land they own is not enough or not productive enough.

For the purchased plots, the average prices are as follows:

- Big plots of approximately 1 acre and above cost approx. 1 million Uganda shillings (U.Shs)
- Medium plots of approximately 0.5 to 1 acre cost approx. 500,000 U.Shs
- Small plots less than 0.5 acres cost approx. 100,000 – 150,000 U.Shs
- For the degraded plots, these range from 10,000 – 50,000 U.Shs depending on the plot size.

Those interested in emigrating in search of more productive and larger pieces of land elsewhere commonly sell off their plots. Farmers of higher wealth rank in the area buy off these plots and annex them onto their existing ones.

Fees charged for pot hire vary considerably. Apart from plot size, the other reasons behind the differences in amounts of fees for the hired plots include level of fertility as measured by yearly amounts of harvests, position on the slope and distance from the households. Plots are cheaper on steeper slopes that are more prone to soil erosion.

Obviously, less fertile plots are equally cheaper; valley land tends to be the most expensive as it is relatively fertile while hill-tops cost the least.

Plot hire is mostly by cash and the rates are:

- Big Size (approximately $100m^2$) – U.Shs 100,000/=
- Medium Size (approximately $50m^2$) – U.Shs 50,000/=
- Small Size (Less than $50m^2$) – U.Shs 20,000/=

However it was established that hiring of plots in the villages is no longer as common due to the decline in soil fertility and the fear by the farmers of the failure to realise enough produce to pay back the landowner. It is only the farmers who have learnt how to use manure and are able to use it, that can afford to hire plots locally and cultivate even the barren areas (*Ebishija*). Those who have to hire plots to cultivate do so in other villages where they know the land is still productive.

The reasons given for people hiring plots to cultivate are essentially increases in population and the resultant scarcity of land by certain families. Most of these plots are hired for a particular planting season though the larger ones may be hired for a period of one full year. It is mostly those farmers who have large pieces of land and therefore fairly well-off that can afford to hire out pieces of land to other locals for cultivation.

4.3 GRAZING AND LIVESTOCK INTERACTIONS

4.3.1 Grazing

Free range grazing of animals is practiced in Buramba–Mugandu watershed although it was mentioned that only a few cattle are kept; most of the families in the area rearing goats and sheep. Communal grazing land does not exist in the watershed, except for the un-cultivated/abandoned but individually owned plots of land at the hill tops which are used for grazing by all farmers owning livestock. The most common grazing areas are thus the hilltops and along footpaths. After harvesting period however, cattle and other livestock graze freely in the harvested plots. Livestock at this time utilise residues such as maize and sorghum stovers. In Kagyera village & Muguli B it was reported that some farmers have ventured into zero grazing of cattle and paddocking especially in wetlands. A few farmers indicated that they had started growing fodder, like elephant grass (locally known as *'Orubingo'*) and *'Setaria'* from Rwanda, to feed their livestock.

Livestock are not allowed to graze in the cultivated lower valleys and byelaws are in place to effect this in some villages like Kagyera & Muguri B. Farmers in such villages indicated that the local residents are aware of this byelaw and have tended to respect it by and large. It was further reported that the local leaders are very particular about this and are strict in ensuring that anyone who contravenes this law is brought to book.

4.3.2 Livestock types and numbers

The types of livestock kept in the Buramba–Mugandu watershed include:

- Goats – with every household owning two goats on average
- Cattle – with variations in numbers by village
- Sheep – quite plenty compared to goats

- Chicken (the local breed) – which are also quite plenty.

Out of the approximately fifty households in the Karambo village for example, about thirty households keep livestock. Most people in the Buramba – Mugandu watershed do not own cattle and one of the reasons given was that it is rather difficult to get herdsmen to look after them as all the children go to school now with the recent introduction of Universal Primary Education (UPE). Besides, the available labour in the home is often required for cultivation in the fields as the activities undertaken are labour intensive. Lack of grazing land was indicated in all the villages as one of the limiting factors to keeping cattle and so was poverty. In Muguli B, however, it was noted that the limited grazing land available is accessible to everybody for free. Some farmers have converted wetlands into cattle grazing paddocks (Plate 3).

In Kagyera, one farmer has ventured into zero-grazing of cows. It was reported that the said farmer has four cows and he has planted elephant grass and *Calliandra* to feed his cows.

It was evident that in some villages like Kagyera and Habugarama, there are more cows than most of the other villages in the watershed though the households that own these cows are only a few. It was however indicative that generally the households here are better off. The number of cattle range from 5 to 20 cattle per village while goats, sheep and chicken were estimated at between 50 to 80, 60 to 90, 80 to100 in total per village respectively.

Plate 3: A cattle paddock in a reclaimed wetland in Muguli B village

Source: Field photo, August 2002

4.3.3 Conflicts related to livestock grazing

Conflicts resulting from livestock interactions and destruction of crops were mentioned as being common in the area. In some villages like Muguri B & Kagyera, permission has to be sought before a farmer can graze his/her livestock in someone's plot.

It was mentioned that at times cattle destroy bunds after rains and that there are many cases of livestock destroying the crops on neighbours' plots. It was also pointed out that the tracks created by cattle and goats normally develop into gullies, compounding the problem of soil degradation (Plate 4). Sanginga P and Kamugisha R (2003) in their study on minimising conflicts in the same study area had findings that concur with these.

4.3.4 Manure usage

Only households that have livestock are able to use manure on their plots but still this is not widely done. Manure is often applied to plots close to the homesteads, as it is difficult to carry over long distances. Some of the farmers who had utilised manure on their plots revealed that this had resulted into better yields in terms of quantity and quality.

In Karambo and Habugarama villages where some farmers use farmyard manure, higher crop yields for these farmers are reported. It was also indicated that some types of manure is used for plastering houses.

Plate 4: Degradation of land along a livestock track in Kagyera

Field photo, August 2002

4.3.5 General Impact of Livestock on Vegetation

Because of the small numbers, the impact of livestock on the vegetation in the watershed as a whole was rather minimal though the farmers in some villages indicated that cattle often destroyed bunds and crops in addition to compacting the soils in some plots making cultivation difficult.

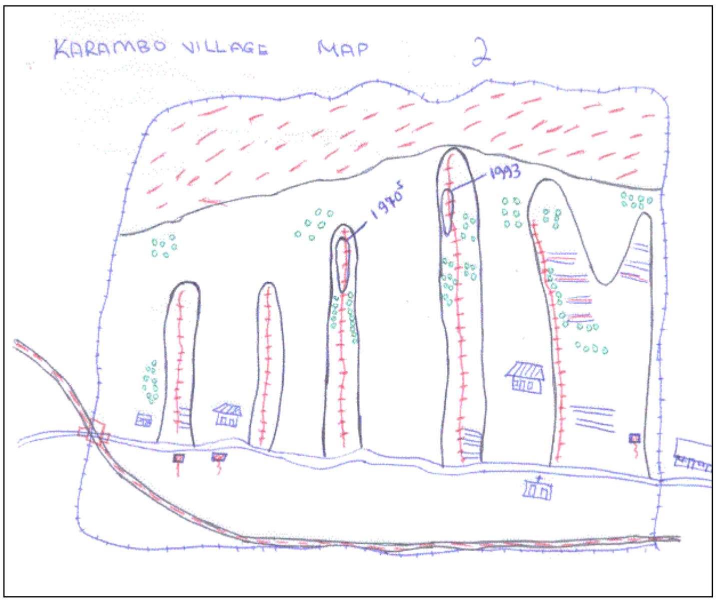
However in some villages like Kagyera & Muguli B, the farmers indicated that the livestock is increasing soil erosion in the village as overgrazing reduces the vegetation cover on the hilltops where much of the free-range grazing of livestock takes place. The cattle tracks *Ebihandagazi by'ente* to/from watering points have also developed into deep gullies and were clearly evident along the transect route.

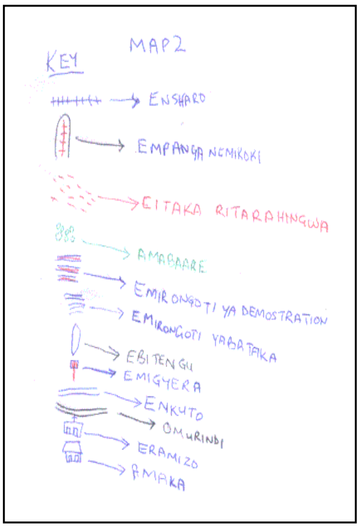
4.4 LAND DEGRADATION

4.4.1 Farmers' perspectives about percentages of land that has been degraded

From the FDGs, it was indicated that there is acute land degradation in the area largely due to soil erosion which has ultimately led to a reduction in soil fertility. Based on the farmer's rough estimation of the prevailing situation, only 30% of the cultivable land in the watershed is still arable, as the other 70% has been degraded. Of the land that has been degraded, it was further revealed that 50% is still being cultivated while 20% has been abandoned (Map 11 and Figure 5).

Map 11: Areas that are prone to bush-burning, soil erosion and band destruction in the Buramba–Mugandu and Kitooma Watersheds: The Case of Karambo village





Translation

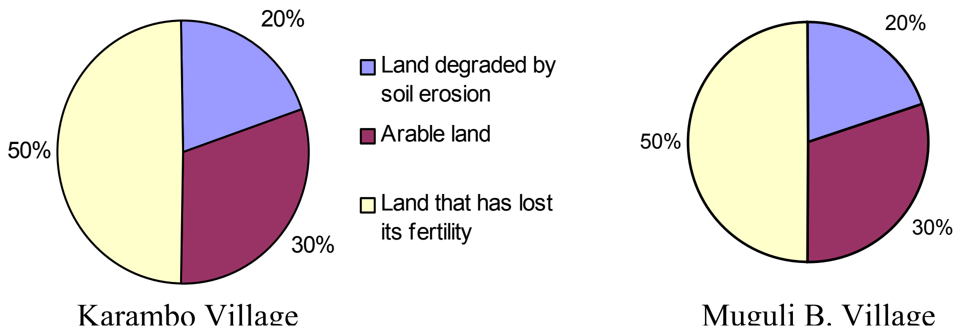
-Boundary
- Valleys & Gullies
- Barren Land
-Stones & Bolders
-Demonstration Trenches
- Resident's Trenches
-Landslides
-Protected Springs
-Road
-Stream
-Church
-Homesteads

Source: Participatory mapping, Krambo village, August 2002.

The farmers revealed that there has been a general decline in soil fertility even in the valleys due to over cultivation and soil erosion. After sensitisation got from AHI and the increased application of manure on easily accessible plots (especially for those farmers keeping livestock), it was reported that several plots had been rejuvenated and as a result their crop yields had increased due to improvements in soil fertility.

The big percentage of degraded land clearly indicates the gravity of the situation and justifies the need for urgent intervention to prevent a potentially disastrous situation likely to emerge as the residents continue over-cultivating their plots and failing to adopt NRM techniques. The suggestions generated from this study, it is hopped will aid in informing both the farmers and organisation assisting them on how to improve NRM in the area for sustainable livelihood for the residents.

Figure 5: Farmers' perspectives of amounts of degraded land in Buramba-Mugandu and Kitooma watersheds



Source: Author's Fieldwork: August 2002

It was interesting to note that the lowland (swamp) areas within some of the villages in the watershed like Kagyera and Habugarama are not currently cultivated due to pronounced sedimentation and waterlogging. In some of these areas, soil depth due to sedimentation is at least 1.5 metres and above. There has been increased stoniness and rock cover as a result of land degradation on the hilltops and slopes. During heavy down pours, stones and rocks are usually brought down to the lowlands with the surface run-off.

4.4.2 Types & causes of land degradation

The types of land degradation in the Buramba – Mugandu watershed include soil erosion and soil exhaustion. According to the farmers, the major causes of land degradation in the area are:

- Overpopulation and hence over-cultivation
- Heavy rains
- Over grazing
- Lack of vegetation cover in some places
- Poor cultivation methods
- Short Fallow Periods/No fallow; hence land is 'exhausted'.

It was often observed during transect walks that many large plots had no soil conservation methods or barriers in place to protect the soil. At times a farmer decides to combine his/her neighbouring plots / terraces and cultivate them as one field, destroying the bunds in between and this has accelerated soil erosion.

4.4.3 Soil erosion types

The types of erosion that farmers described to be evident in the Buramba – Mugandu Watershed are:

- Gully erosion
- Sheet erosion
- Rill erosion

Much of the land that has been eroded is on the hill slopes with steeper gradients and the soil has been transported down to the swamps, at times blocking the water channels *(emirongoti).* A lot of stones are evident in eroded places like the gullies and hilltops and in the valley bottoms where deposition normally occurs (Plate 5).

Plate 5: Stone/rock depositions in Karambo village

Field photo, August 2002

Generally, throughout the transect walks, it was observed that crops in the fields of farmers with improved technologies were more healthy than those without. During the FGDs, the farmers had lamented about the declining crop yields over the recent years. In Muguri B farmers noted that there are plant indicators for exhausted soil which included *Mukazi murofa, Orusiru, Okeza Ntakizire* (Plate 6) and *Banuka* while those for medium soil fertility included *Empunika, Eitija, Eshwiga* and *Orubingo.* Most of these plants were clearly evident along the transect route especially *Orusiru* and *Banuka.*

During the transect walks, observations were made to determine the prevalence of such plants. The ferns locally known as *"orusiru"* were most dominant on the upper slopes and tops of the hills in the Buramba-Mugandu and Kitooma watersheds, indicating least soil fertility there.

It was also clearly evident that there was limited adoption of improved technologies. Much of the farming practices are based on the technologies that have been used in the last ≥30 years.

Few successful adoptions relate to such activities like:

- Raising tree seedlings
- Planting improved seeds which are at times given out free e.g Irish potatoes
- Response to disasters like flooding
-

Plate 6: The "Okeza Ntakizire" weed, an indicator of soil infertility

Field photo, August 2002

Many crops have consequently failed to thrive in the degraded areas and these areas are now predominantly used for the cultivation of millet and pyrethrum though some have been planted with trees as earlier indicated. One female participant during the FDGs indicated that in her plot of a quarter of an acre, she was only able to harvest half a tin (*debe*) of millet (approx. 10 kilos) in the last season. Impact of land degradation is discussed in section 4.7.

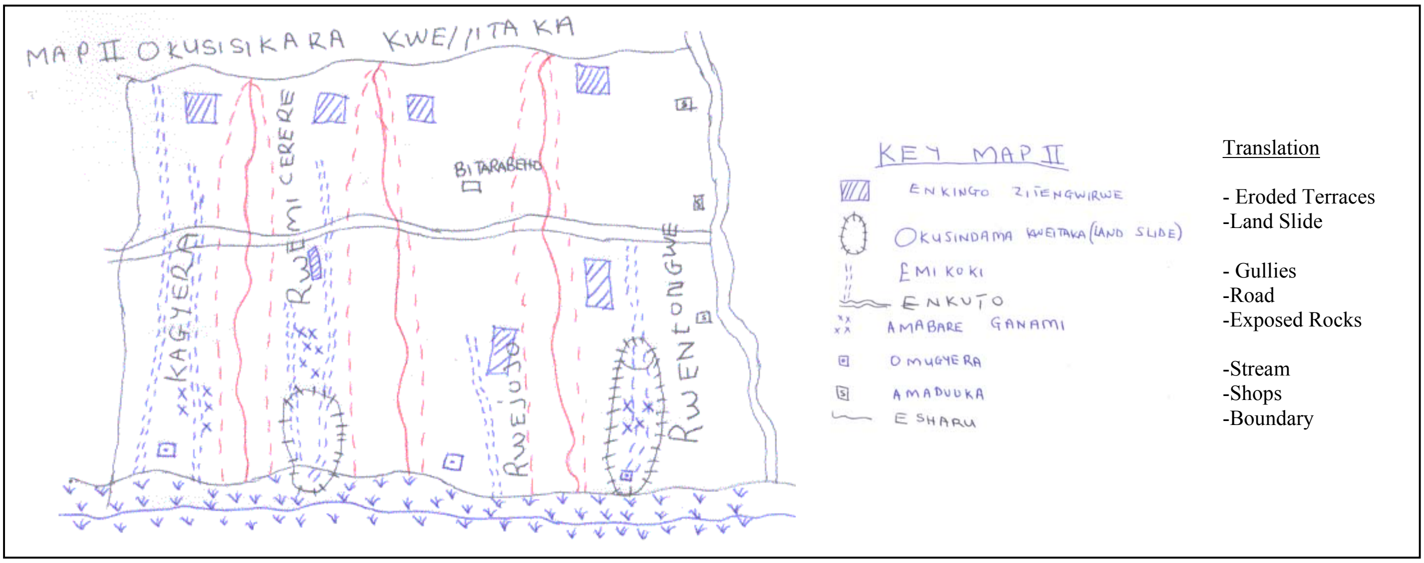
Gully erosion, *Emikoki*, is evident in the watersheds (Plate 7). Gullies are more pronounced on the mid-slopes, at times stretching from the top to the bottom of the hills as well as in the valley bottoms. Only a few farmers have started making trenches to protect their soil from being eroded. The 'massive' water runoff that passes through these gullies during the rainy season tends to collapse the conservation structures like bunds and terraces that the farmers have attempted to put in place.

Plate 7: Measurement of soil loss through gully erosion in Karambo village

Field photo, August 2002 (cover page)

In Kagyera village, there are six major gullies, with three of them running straight from the hilltops downwards through the fields in the mid slopes to the valleys (Map 12). In Habugarama, gully erosion is not all that pronounced. Only two short gullies are evident in the northern parts of the village. The terrain here is not as steep as in the other villages.

Map 12: Degraded land in Buramba–Mugandu and Kitooma watersheds: a case of Kagyera



Source: Participatory mapping, Kagyera, August 2002

In Karambo village, farmers indicated that there are five major gullies *(emikoki)* in the village, located in each of the five valleys. In Muguli B, farmers indicated that there are only three major gullies out of the major eight originally existing. This is because they have intensified the digging of trenches in the latter area. These gullies are most pronounced in the valleys where the land is most fertile and have hence washed away the fertile land in these areas, reducing the size of arable land in the village. In Kagyera and Kitooma the situation is much the same.

Measurements were taken from different points along selected gullies to illustrate their sizes (Table 13).

Table 133: Measurements taken from different points along selected gullies

Gully no.	Village	Estimated length of gully (m)	Average width at lip (m)	Average width at base (m)	Average depth (m)
1	Muguli B	1000.0	2.60	1.50	2.2
2	Karambo	12.3	2.50	1.54	0.4
3	Karambo	1500.0	2.29	0.70	1.3
4	Muguli B	800.0	1.70	0.80	0.7

Source: Authors' fieldwork, August 2002

4.4.4 Bund destruction

According to the farmers, bunds *enkingo* are mainly destroyed by rains and livestock grazing. In some cases it is by mutual agreement between neighbours due to the need to utilise the often fertile land alongside the band. This is more so when farmers want to cultivate larger plots for a cash crop like sorghum, destroying the bunds to attain a larger piece. When it is purposefully done however, some sensitised farmers make sure a new band is put in place to preserve the soil before the next rains.

It was further noted that farmers who destroy bunds on their own plots, are mostly those who own several terraces. People with less land cannot possibly afford to destroy their land by removing their bunds as this may result into their losing the little piece of land that they have to survive on.

In Habugarama village, highly raised bunds are disliked by farmers due to high chances of collapse when the rains come. It was indicated that a sizeable number of farmers in this village are reducing band heights by replacing the high ones with short ones planted with grass.

In general, at the time of the study, at least 3.4% of the plots within the selected villages in the watershed had their bunds destroyed (Table 14).

Table 14: Percentage of bunds destroyed by village

Village	Number of HH	Average number of plots per HH	Total number of plots	Field estimates of number of plots with destroyed bunds	Percentage of plots with destroyed bunds
Karambo	50	10	500	30	6.0
Kagyera	68	12	816	30	3.7
Habugarama	61	10	610	18	3.0
Muguli B	72	08	576	06	1.0
Mean		10			3.4

Source: Authors' fieldwork, January 2003

The average number of plots per household was generated from the focus group discussions at village level and estimates made during the transect walks for verification purposes. Much as average figures may hide differences between household, they were used to enhance calculations that would generate the general village situation. There is no significant difference between the average number of plots owned per household in Rubaya sub-county and the district's average, which stands at 7 plots per household (KDLG, 2002(b)), Rubaya being most densely populated with land highly fragmented notwithstanding. The total number of households per village was obtained from village and sub-county records and multiplied by the average number of plots per household to estimate the total number of plots per village.

Field estimates of the number of plots with destroyed bunds per village were made during the transect walks and observations and used to calculate the percentage of plots per village with bunds destroyed. An important assumption made was that the number of plots owned by non-residents in a particular village is approximately equal to the number of plots owned by the residents of that village in other villages.

It was found that Karambo had the highest number of plots with destroyed bunds, with less effective soil conservation byelaws (Plate 8). The village differences were attributed to the presence and effectiveness of local byelaws. Muguli B has a strong byelaw that discourages such practices that cause soil erosion and thus registered fewer cases of band destruction. It is therefore necessary to strengthen the capacity of local leaders to enforce these byelaws if the situation is to be improved.

Plate 8: Bund destruction in the Buramba-Mugandu and Kitooma watersheds: a case of Karambo Village

Source: Field photo, August 2002

In some villages like Muguli B, trenches have been constructed alongside some bunds but these are still generally few in the entire watershed. Because Muguri B village was the area most affected by floods and landslides in the recent past, local leaders and NGOs have tended to work more closely with the farmers in this village and have even established a byelaw requesting farmers to dig trenches. This has means that more local farmers have been able to adopt soil conservation measures like digging trenches in this village. It was established from the transect walks and focus group discussions that over 94 trenches (of varying lengths, depending on plot sizes) have been constructed in this village to reduce surface run-off. These trenches are often constructed individually. However, in cases where a farmer is defiant, local leaders in collaboration with the neighbours ensure that such a farmer complies by digging it collectively. The farmers appreciate the fact that it is useless to dig trenches in isolation of other neighbouring farmers, especially those neighbouring on the upper slopes. Running water from the upper slopes tends to destroy conservation structures on the lower slopes.

Besides, the other driving force behind the construction of many trenches in Muguli B compared to other villages in the watershed is the presence of a strong and effective soil conservation byelaw enforced by a well organised and committed village farmer group.

4.4.5 Landslides

In general, there have not been any incidents of major landslides of recent in the watershed. The farmers indicated that the last major landslide incident occurred about ten years ago and prior to that, the most deadly one occurred in the early 1970s when several people died. Within the last five years two minor cases were registered in the northern parts of Habugarama and two others in the southern parts of Kagyera. They revealed that elephant grass (*orubingo*) planted in these affected areas has helped to curb the problem of landslides in the area.

During the FGD in Kagyera, it was revealed that the last landslide event occurred in 1998 when a large piece of land collapsed burying an entire household. This has forced farmers not to build in lowlands. Households are currently located on mid slopes.

4.4.6 Bush-burning

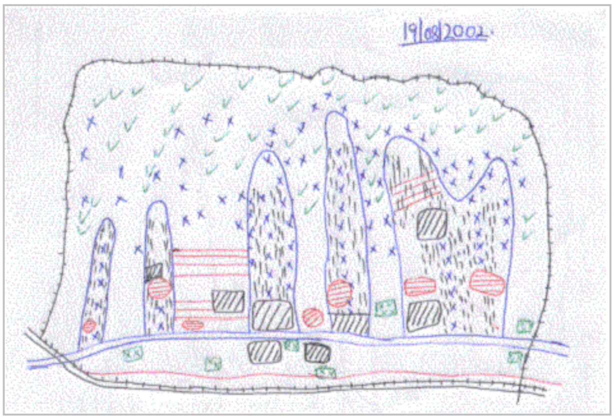
The farmers indicated there was a lot of bush-burning in the villages of this watershed, especially on the hilltops but also in the valleys during land clearing. As clearly revealed, more than 80% of the hilltops are affected by bush-burning (Map 13).

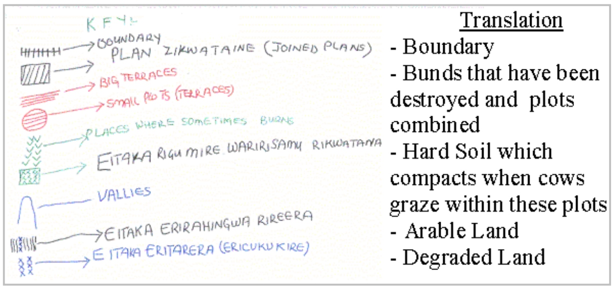
The reasons given for burning included:

- To increase soil fertility
- To destroy pests, diseases and vermin like snakes
- To clear the land for easy cultivation
- Need for fresh grass for livestock
- Accidentally (at times by children and smokers)

Most of farmers indicated that they burn the bush to rejuvenate pastures for livestock. This is often done towards the end of the dry season when the rains are about to come.

Map 13: Areas that are prone to bush-burning, soil erosion and band destruction in the Buramba–Mugandu and Kitooma Watersheds: The Case of Karambo village





Source: Participatory mapping, Karambo Aug. 2002

Several farmers indicated that they burn their plots at least once every two years. The consequences have been that many trees have been burnt and a lot of the soil has been washed away when it rains destroying the land cover and causing floods in the valley bottoms.

However in Kagyera village farmers reported that there is not much bush-burning as the burning is normally controlled to avoid destroying a lot of vegetation. The farmers here recalled that the last major fires in the village occurred 2 years ago. Farmers have since organised themselves to prevent indiscriminate burning of bushes or residues, which leaves the soil bare, ultimately resulting into soil erosion by water and wind. However the farmers raised concern about the lack of a byelaw to prevent the re-occurrence of indiscriminate burning that is destructive. The farmers further reported that most of the previous burning was due to malice or children burning grass out of fun which would become wildfire destroying a lot of crops and vegetation. Some of the effects of this burning highlighted were trees and crops getting burnt and bee hives too getting destroyed. As a result, honey production has declined partly because of destroyed beehives but also as a result of lack of forage/flowers.

In Habugarama, farmers have begun discouraging burning of weeds to allow decomposition to occur so as to increase soil nutrients.

In Muguri B village however, the sub-county byelaw is well enforced and bush-burning was stopped in the year 2000 especially after the awareness created by AFRICARE and CIAT.

4.5 SOIL CHARACTERISTICS AND LOSS

Much of the soil is acid loam but nutrient supply is generally good and productivity is medium to high. Erodability of the upland soils is very low and where as erosivity is moderate, erosion potential is high and evident due to long slopes.

4.5.1 Soil fertility

From the FGDs, it was established that soil fertility is generally rated as very low and in some cases good in the valleys (Table 15). This is where all the still fairly fertile land was identified. The soil fertility level on foot slopes was rated low while that of the back slopes and shoulder was ranked very low. On the hilltops, the soil fertility was rated extremely low.

The valleys were indicated as the most fertile areas though also highly degraded. The degradation in valleys is mainly due to soil exhaustion and infertile soils and stone debris being deposited from the hill slopes. The lowlands and valleys are also prone to flooding in the rainy season.

Table 15: Farmers' perceptions of soil fertility and depth in Buramba-Mugandu and Kitooma watersheds

Slope	Farmers' rating of soil fertility	Farmers' description of soil depth	Estimated soil depth
Hilltops	Extremely low	Shallow	30 cm
Back Slopes	Very low	Shallow	15 – 20 cm
Shoulders	Extremely low	Very shallow	10 cm
Foot Slopes	Low	Fairly deep	50 - 80 cm
Valleys	Medium/Good	Deep	Greater than 1 meter

Source: Author's Fieldwork, Aug 2002

4.5.2 Soil depth

In terms of soil depth, the higher slopes or shoulders are very shallow with most areas being 10 cm deep due to frequent soil erosion. This was clearly evident during the transect walks. Farmers correlated vulnerability of soil to erosion with the slope - the steeper the slope, the higher the vulnerability of the soil to be eroded and vice-versa. Soils on slopes greater than 5% are more susceptible to soil erosion by surface run off.

On the hilltops however, with less soil erosion, the soil is deeper, approximately 30cm in depth. The soil here tends to be very porous and therefore friable. Clay is more common in the valleys and lowlands receiving depositions and debris from hilltops.

The farmers indicated that soil compaction is common in the watershed area and this is mainly caused by cattle tracks and stampedes (when cattle roam around in the fields) as well as fellow farmers going to cultivate their plots.

In all the villages it was further observed that the soils on the back slopes were stony due to frequent soil erosion.

From field estimates and measurements, it was established that the average soil depth ranges from 10 – 75 cm on the hill slopes, while on the hilltops it ranges between 0 – 30 cm, as evidenced by the pronounced stones exposed. This is very similar to the farmers' estimates as discussed above. In the valleys, and other places where there is frequent soil deposition, the soil depth is 1 meter and above.

4.5.3 Soil loss

In order to ensure uniformity so as to easily compare results from different farms/plots, calculations of volumes of soil lost were done only using the rill method on all selected farmers' plots (Table 16).

Table 166: Summary data of amounts of soil lost through rill erosion: wet season, 1st rains, May 2003 and dry season, August 2002

Village	Farmer	Wealth Rank	Gender	Slope	m^3/m^2 $(x10^{-5})$	t/ha	t/acre	Rank by loss
Habugarama	Kenama	Average	M	US - gentle	1.10	0.14	0.06	**15**
Habugarama	Nzarwahabi	Poor	M	LS - steep	6.98	0.09	0.04	**18**
Habugarama	Mugisha	Poor	M	MS - gentle	0.51	0.07	0.03	**19**
Habugarama	Mashakarugo	Poor	F	MS - gentle	1.77	0.23	0.10	**13**
Habugarama	Kikomo	Poor	F	LS - gentle	0.92	0.12	0.05	**17**
Habugarama	Kaburabuza	Poor	M	US - gentle	1.14	0.15	0.06	**14**
Habugarama	Rwehobuganzi	Rich	F	MS - gentle	0.00	0.00	0.00	**20**
Habugarama	Ndyomugyenyi	Rich	M	MS-gentle	1.04	0.14	0.06	**16**

Habugarama	Mugisha	Rich	M	US - gentle	2.63	0.34	0.14	**12**
Habugarama	Bikangaga	Rich	F	LS - steep	3.12	0.41	0.16	**11**
Muguli B	Gandagara	Poor	F	MS - steep	250.61	32.58	13.19	**2**
Muguli B	Mugabirwe	Poor	F	LS – gentle	46.58	6.06	2.45	**9**
Muguli B	Ngwabije	Poor	F	MS - steep	147.15	19.13	7.74	**7**
Muguli B	Ntamabyaliro	Poor	F	US - steep	251.34	32.67	13.22	**1**
Muguli B	Hinja	Poor	F	MS – steep	157.12	20.43	8.27	**5**
Muguli B	Kanyenzi	Rich	M	US - steep	156.36	20.33	8.23	**6**
Muguli B	Habarwasha	Rich	M	LS - steep	193.92	25.21	10.20	**3**
Muguli B	Nsekuya	Rich	F	MS - steep	180.41	23.45	9.49	**4**
Muguli B	Kwehangana	Rich	M	LS - gentle	139.10	18.08	7.32	**8**
Muguli B	Buryahika	Rich	M	MS - gentle	17.99	2.34	0.95	**10**
Dry season, August 2002								
Karambo	Kabuga	Poor	M	LS - steep	85.60	11	4.45	**3**
Karambo	Tumwesigye	Rich	M	MS - steep	161.50	21	8.50	**1**
Karambo	Tumwesigye	Rich	M	LS - steep	135.00	17.6	7.12	**2**
Karambo	Adam	Average	M	LS - gentle	30.00	4.1	1.66	**4**
Karambo	Adam	Average	M	LS- gentle	20.00	2.9	1.17	**5**

4.5.4 Byelaws and soil loss

Despite the existence of a strong soil conservation byelaw in Muguli B, highest levels of soil erosion were recorded in this village compared to other villages like Habugarama and Karambo. Out of the 20 farmers whose farms were studied, the top 10 farmers experiencing the highest amounts of soil loss were registered in Muguli B.Soil loss in Mugulu B ranged between 0.9t/acre – 13.2t/acre, while that in Habugarama ranged between 0t/acre – 0.16t/acre.

This byelaw therefore seems not to have had impact yet on ground. Two main factors may explain this situation:

- The byelaw being a new development, has probably not taken firm root on ground,
- Other factors e.g. steeper slopes may explain higher soil loss in Muguli B.

4.5.5 Differences in wealth levels and soil loss

In Muguli B, soil loss was highest among the poor. The 1st, 2nd and 5th highest figures were registered among the poor farmers, i.e. 13.2t/acre, 13.1t/acre and 8.2t/acre respectively. However, some high figures were also recorded among the rich. The 3rd, 4th and 6th highest amounts of soil lost were recorded among this wealth category i.e. 10t/acre, 9.5t/acre and 8.2t/acre respectively. The least amounts of soil lost, 0.9t/acre, was recorded among the rich too.

In Habugarama where amounts of soil loss were much lower than in Muguli B, the situation was almost uniformly spread among the rich and the poor. However, interestingly, the first two highest figures were recorded among the rich, i.e. 0.16t/acre and 0.13t/acre respectively. The least amount of soil lost/no soil loss was recorded among the rich though low figures, 0.026t/acre and 0.036t/acre, were also recorded among some poor farmers.

In Karambo, high soil loss figures, 8.4 and 7.1 t/acre were registered among rich farmers simply because these farmers rent out this plots to other farmers who may not have the personal initiative to care for and conserve such land.

The general picture is therefore that soil erosion is almost uniformly spread among the rich and the poor, though higher among the poor.

4.5.6 Gender differences and soil loss

Soil erosion was experienced among both female-headed and male-headed households. Out of the 25 farmers whose farms were used for detailed assessments, the 1st, 2nd, 4th and 5th highest figures (13.2, 13.1, 9.4, and 8.2t/acre respectively) were recorded among the female-headed households. So, 4 out of the first 5 highest amounts of soil lost were recorded among female-headed households and 6 out of the top 10 were recorded among female-headed households.

The general picture is therefore that soil loss is experienced higher among the female-headed households. Probably, putting in place soil conservation structures is energy demanding; yet many may not afford to hire labour.

4.5.7 Seasonal differences and soil loss

Soil loss estimates for the dry season were not done for some villages. However, results taken during a fairly dry season in August 2002 from Karabo village indicate a lower soil loss, 8.5, 7.1 and 4.5t/acre, compared to 13.2, 13.1 and 10.2t/acre registered during the rainy season in May 2003

Season probably affects amounts of soil loss in such a way that more soil is lost during the rainy season since surface run-off is the main medium through which the soils are washed down slope.

4.5.8 Position on slope and soil loss

An attempt was also made to assess which parts of the hills are more affected by land degradation and declining yields. Not much detail could be obtained to analyse the impact of slope on soil loss due to lack of equipment. However, an attempt was done to simply categorise position on slope as upper slope, mid slope and lower slope for a simple analysis. Even then localised variations in gradient existed within each of the broader categories, affecting conclusions. Therefore, each broad category was generalised as steep or gentle, depending on the gradient so as to come up with correct conclusions.

Upper slopes, mid slopes, lower slopes-steep, mid slope-steep and mid slopes ranked 1st (13.2t/acre), 2nd (13.1t/acre), 3rd (10.2t/acre), 4th (9.4t/acre), and 5th (8.2t/acre) respectively in soil loss recorded. The least amounts of soil lost (0t/acre and 0.2t/acre) was registered on mid slopes with gentle gradient.

This implies that position on slope had an impact on the amounts of soil loss and productivity, highest soil loss is experienced on the upper and mid slopes, which tend to be steeper and also on lower slopes with steep gradient.

4.6 WETLAND AND WATER RESOURCE USE AND MANAGEMENT

Burambu – Mugandu and Kitooma watersheds is drained through valleys, which are clearly evident in all the lowlands. The drainage system consists mostly of seasonal streams. All runoff originates from the hills and flows to the wetlands in the valley bottoms and finally into Lake Bunyonyi. Fluctuation over the years has not been quite evident. However, there are some seasonal streams that dry up at the end of the rainy season.

Wetland cultivation is only done through societies or farmers' groups, as there has been a ban against free cultivation of swamp areas in the entire sub-county. These swamp areas are drained in the dry season to create more land for crop cultivation especially Irish potatoes which is a major food and cash crop in the area. Other crops grown in the drained wetlands are cabbages, beans, maize and carrots.

Traditionally, wetlands were considered as public resources. Every community member had the same access rights to wetland resources like craft materials, game meat, fish and water. However, due to population growth and the resulting pressure on land, people started draining these wetlands for growing crops. Those who had the means drained the wetlands on large scale and started dairy farming. After realising the benefits from the converted wetlands, people started applying for leases in early 1970s. Since that time, wetland ownership and management has been either under lease, customary or public systems. Leasing of wetlands, however, denied many people access to wetland resources. This prompted some communities to form farmer co-operative societies to apply for the leases too. However, farmers in Rubaya never sought for extension of their leases after the expiry of the initial 5-year interim periods of the offers (Table 17).

Table 17: Status of land leases in sections of wetlands in Rubaya

Parish	Lease holder	Size (ha)	First lease	Interim period	Date extended	Purpose of lease
Buramba	Nyansio Babwekyeka	40	09/75	5	-	Grazing
Buramba	Mugandu-Buramba Co-op society	102	10/84	5	-	Mixed farming
Mugandu	Habarwasha G	12	09/80	5	-	Farming
Mugandu	Rubaya vegetable growers co-op society	40	09/76	5	-	Farming

Source: Wetlands Inspection Division, MWLE, 2000.

The national policy for the conservation and management wetlands (Ministry of Natural Resources, 1995) and legislation have provisions for ensuring that the wetlands are conserved. Wetlands are protected by the 1995 constitution of the Republic of Uganda, the 1998 Land Act and the 1995 National Environment Statute. According to chapter 15, article 273, of the constitution, "…the Government or local government as determined by parliament by law, shall hold in trust for the people and protect natural lakes, rivers, wetlands,………for ecological and touristic purposes for the common good of all citizens".

Part VII, Section 37 of 1995 The National Environment Statute states that:

No person shall:-

i. Reclaim or drain a wetland;
ii. Erect, construct, place, alter, extend, remove or demolish any structure that is fixed in, on, under or over any wetland;
iii. Disturb any wetland by drilling or tunnelling in a manner that has or is likely to have an adverse effect on the wetland;
iv. Deposit in, or under any wetland any substance in a manner that has or is likely to have an adverse effect on the wetland;
v. Destroy, damage or disturb any wetland that has or is likely to have an adverse effect on any plant or animal or its habitat;
vi. Introduce or plant any exotic or introduced plant or animal in a wetland, unless he/she has the written approval from the Authority, given in consultation with the lead agency.

Despite these provisions, wetland degradation continues to go on unabated in Rubaya and Kabale as a whole due to population growth against the limited resource base, lack of awareness about dangers of wetland drainage, poverty and lack of enforcement among other reasons. However, Rubaya sub-county council has now banned further encroachment on the intact wetland near the shores of Lake Bunyonyi.

National policy and legislation on wetland conservation and management thus considers drainage and conversion of the wetlands as forms of wetland degradation. This is because it causes destruction of wildlife habitats & centres of biological diversity and the water table and increases extremes of flow and chances of flooding. It also causes decrease in amounts of plant products, fish, water and other products harvested by communities to meet their socio-economic needs. Besides, some methods of cultivation applied by the farmers in already converted sections of the wetlands are also considered unsustainable and can cause degradation.

For example, farmers cultivating wetlands:

i. Rarely leave the land to fallow for long and thus increase chances of soil exhaustion,
ii. Burn the peat soils,
iii. Don't apply good cropping rotational plans,
iv. Don't spare protection/buffer zones along steam banks,
v. Dig deep drainage channels that may cause water scarcity,
vi. Inappropriately apply herbicides and pesticides and are likely to pollute the waters
vii. etc

According to the findings of this study, the farmers' perceptions of the National policy and legislation on wetland conservation and management are mixed. Much as they feel that the wetlands would rather be converted into farmland, they also recognise the need for intact patches of wetlands to provide them with both direct and indirect goods and services.

Individuals or co-operative societies manage the already reclaimed patches. They are responsible for de-silting the drainage channels on a seasonal basis. Co-operative societies use labour provided by members to de-silt the channels. They are also responsible for allocation of plots for cultivation on a seasonal basis and can thus provide a good mechanism through which farmers can be given guidelines for better/sustainable cultivation methods in the already reclaimed wetland sections.

Besides de-silting, other major management practices include the use of controlled burning to remove trash and other debris, the use of the ridge and furrow system, traditional cropping rotational plans, seasonal fallowing patterns related to amounts of water in the wetlands, rotational grazing patterns in paddocks and inter-cropping. Only members of the co-operative societies and registered individuals can access the wetlands for cultivation, while members, registered individuals and non-members can harvest wetland products from the intact patches of the wetland.

In all, there are 3 major wetland cultivation co-operative societies in Rubaya sub-county and these are:

i. Mugandu-Buramba co-operative society, registered in 1982 and currently with 200 members,
ii. Rubaya vegetable co-operative society, registered in 1965 and currently with 190 members, and
iii. Kihira-Buramba co-operative society, with 65 members,.

According to their byelaws, a person eligible for membership should posses the following qualifications:

i. An ordinary resident with farm land within the society's area of operation,
ii. Pay in full his/her entrance fee and one share in the society,
iii. Over 18 years of age,
iv. A good farmer and of good character.

The roles and responsibilities of each of the members are to:

- Abide by byelaws of the societies,
- Patronise the society by selling produce only through it,
- Participate collectively with other members, especially in de-silting of the drainage channels on a weekly basis, especially during the rainy seasons, or risk being fined 1,000-1,500 Uganda shillings per meeting missed and
- Attend meetings

It is possible for both husband and wife to register as members of the co-operative society for more benefit in terms of land size allocated for cultivation. A member can also rent out his/her plot of land (but only to members) if he/she is unable to cultivate it, say, due to lack of seed, money or labour. Non-members are not allowed to cultivate on the society's wetland.

The Mugandu-Buramba co-operative society pays an annual ground rent of 50,000 Uganda shillings to the district lands department, whereas the Rubaya vegetable co-operative society pays 30,000 Uganda shillings, and Kihira-Buramba co-operative society 20,000 Uganda shillings. The differences in ground rent are explained by variations in wetland size.

The objectives of these farmers' co-operative societies are to:

- Encourage improved methods of agriculture and supply expert advice,
- Increase quantity and improve quality of members' crops by better land utilisation and better farming,
- Market and process agricultural produce of members,
- Purchase the agricultural and building requirements of members,
- Encourage members to save money through deposits,
- Provide loans to members for productive purposes on the security of their agricultural produce,
- Encourage self-help initiatives among members.

Some wetland areas within the watershed as earlier indicated are not cultivated for instance in Kagyera and other sections near lake Bunyonyi. Kagyera farmers are members of the Mugandu-Buramba society, which manages the main swamp in the watershed. The farmers instead have to go to neighbouring villages like Karambo where the cultivation of wetlands is possible under a society. However, some resources like weaving materials for mats are accessed from these wetlands.

Problems faced by members of these societies include:

i. Flooding/silting: most of the plots in the swamps over the recent past have been affected by floods, the worst having been experienced in the year 2000. The farmers indicated that at times the big channel *(omurindi)* within the swamp which is approximately 2 meters deep is silted particularly during the rainy season, yet it is the channels that are used to drain away water from the wetlands to enable cultivation take place.
ii. Fees: farmers also lack money to pay to the societies (3,000 U.Shs per mound/strip per season) before they are allowed to cultivate.
iii. Quality seeds: farmers also reported that the lack good quality seed as it is expensive.
iv. Storage and transportation of produce to the roadside is also difficult as there are no good roads or stores within the wetlands.
v. Prices of the produce also commonly fall as all members produce similar crops at ago.

As regards water source management, clearing of spring water sites is done once every week with well organised committees in place and a spring attendant to ensure proper maintenance. There are 42 protected springs, 3 tanks, and 11 gravity flow scheme taps. Other water sources include streams and L. Bunyonyi and associated wetlands.

In Karambo village the 2 protected springs include:

- Rushabo Community Protected Spring (constructed by Diocese of Kigezi)

- Karambo Protected Spring (constructed by UNICEF)

Most of the families in this village have access to free water within ½ a mile distance. There have been no major incidents of complete water scarcity in the past but it was noted that water tends to reduce at the source during the dry season. It was also noted that hard pans occur during the wet season resulting in underground seepage (Plate 9).

Plate 9: Underground seepage in the Buramba – Mugandu and Kitooma watersheds: A case of Karambo village

Field photo, August 2002

In Kagyera there are three major water sources, namely:

- Rwentongwe (protected spring)
- Rwenjojo (pump)
- Kagyera (pump)

These water sources are within vicinity of most households except for the problem of the steep slopes. The springs are well maintained, in a well-organised arrangement, by a caretaker. If need arises, the whole community convenes once in a while to clear the bush around the spring and repair any damages.

The spring area often gets silted during the rainy season. During such times, farmers use rainwater harvested from the roofs of their houses. It is very probable that in the rainy season, water is most likely to get contaminated.

In Kitooma, there are springs and water tanks located at the boundary of Habugarama and Rwabindu. The distance of the furthest household to the water point is 1 km. The amount of water reduces during the dry spells and the water committee consisting of men and women monitors water sanitation.

4.7 THE IMPACT OF LAND DEGRADATION

The impact of the acute land degradation experienced in the Buramba-Mugandu and Kitooma watersheds have been especially pronounced in the amounts of crop reductions realised over time.

4.7.1 Consequences on crop yields and farmers' incomes

Soil samples were taken from the study area and were tested to determine their nutrient composition (Table 18).

Table 18: Average soil nutrients in selected sites

Village	N (%)	P (mg/kg)	K (me/100g)
Muguri B	0.35	5.8	0.25
Habugarama	0.29	7.8	0.40
Karambo	0.26	5.7	0.10
Average	**0.30**	**6.4**	**0.30**

Source: CIAT Kabale, 2002

For a given acre of land, therefore, (approx. 2,000,000kg of soil), there would be an equivalent of 2,428.14kg of nitrogen (N), 5.2kg of phosphates (P) and 94.7 kg of potassium (K).

For the degraded lands and at the time of this report, a farmer therefore loses the equivalent of 2,428,140 Uganda shillings (US $ 1,219) per acre in lost nitrogen (N), 5,200 Uganda shillings (US $ 2.6) per acre in lost phosphates (P), 94,697 Uganda shillings (US $ 47.6) per acre in lost potassium (K) and a total of 2,528,037 Uganda shillings (US $ 1,272) per acre in lost NPKs per season, considering an average market price of 1,000 Uganda shillings(US $ 0.5) per kilo of each of the NPKs. These, in a way, can also be looked at as the cost that would need to be incurred by a farmer in efforts to restore the land to its original state, using the Replacement Cost Method (RCM) to the valuation of environmental impacts, which is based on the principle that the environmental impact of soil erosion and nutrient loss can be represented by the costs of inputs required to restore the land that has been degraded.

However, looking at it from another perspective, a farmer would probably only be willing to restore nutrients to a level that crops need to grow productively. Using only a single element, phosphates (P) for example, crops would need a total of 12.14kg of phosphates (P) per acre. At the current nutrient levels of 5.2kg of phosphates (P) per acre, a farmer would thus need to top-up with 6.3kg of phosphates per acre for crops to grow productively. The top up/replacement cost would thus be equivalent to 6,300 Uganda shillings (US $ 3.5) per acre for only a single element of phosphates (P).

Crop yields have reduced in the recent years in all areas including the valleys. As an illustration, one farmer indicated that his plot of 0.42 ha was only able to yield 50 kg of sorghum this year whereas the same plot in the 1970s used to yield 200 – 300 kg of sorghum on average per season. Another farmer pointed out that in the 1980s, ½ an acre of land could yield five bags of beans but to-date the same piece of land cannot yield even one bag. This clearly shows that soil fertility has declined overtime and illustrates the extent of decline in productivity of the land in the Buramba - Mugandu and Kitooma watersheds.

During the FGDs, farmers mentioned and it was confirmed during transect walks that crops, especially beans, tend to become yellow and eventually dry out especially in the dry period. Beans planted in the fields tend to develop yellow coloration signifying deficiency of nutrients in the soil. They normally become stunted especially on the upper parts of the terrace and their yields are normally poor, not reciprocating the efforts put in during cultivation.

Land degradation concerns farmers mostly in its effect on production. Most responses from land users to changes in soil quality are tied to some aspect of agricultural production: reduced yields, greater difficulty in maintaining yields, more weeds, and stones on the surface making ploughing difficult. The farmers' perspective is, therefore, most often articulated through how production is changing and the way in which plants, soil, water supplies and natural vegetation have deteriorated, making production more problematic (Stocking, 2001).

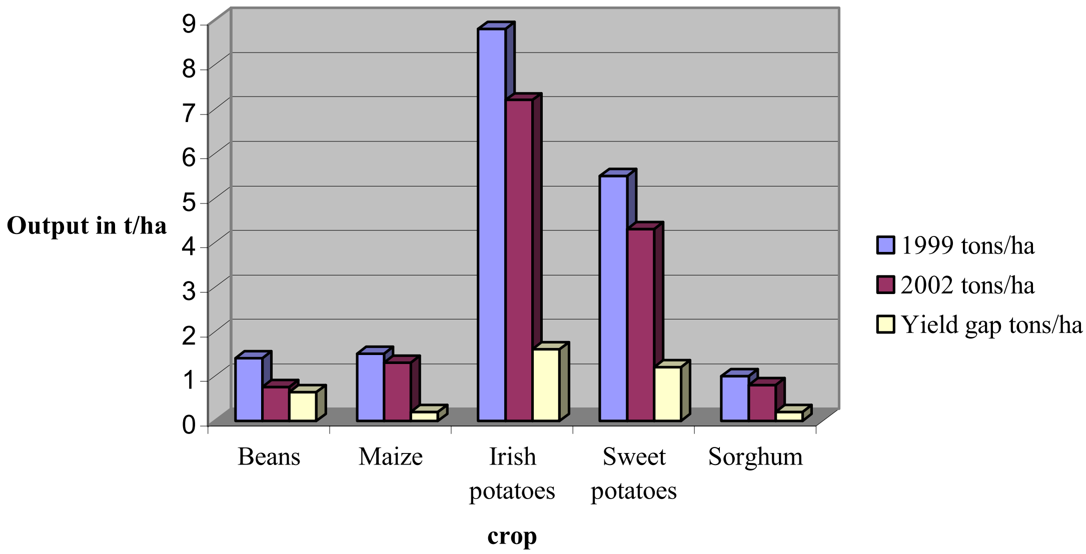
Much as the farmers themselves are the primary source of information, it was difficult to obtain data to illustrate the general picture of declining yields over the years in entire villages since not many individual farmers in this area keep such crop production data. Generating this information needed more time than could be allocated within the time frame for this study. However, attempts were made to obtain data from the district production department and ICRAF (Table 19 and Figure 6) to assess changes in yield for major selected crops in Kabale.

Table 19: Crop yields at farmer level for 1999 and 2002

Crop	1999 tons/ha	2002 tons/ha	Yield gap tons/ha
Beans	1.4	0.76	0.64
Maize	1.5	1.3	0.2
Irish potatoes	8.8	7.2	1.6
Sweet potatoes	5.5	4.3	1.2
Sorghum	1.0	0.8	0.2

Sources: KDLG, Production department, (1999) and Raussen et al, (2002)

Figure 6: Crop yields at farmer level for 1999 as compared to 2002



Crop yield is dependent, in part, on the productivity of the soil. Seed quality, climate, pests, crop diseases and management by the farmer also affect it. The assessment of trends in crop yield, in association with farmers, may show that crop yields have fallen which, in turn, may indicate that land degradation has taken place (Stocking, 2001). Describing the relationship between land degradation and low crop yields per unit area in Kabale, KDLG (2002) states that:

"…as a result of land shortage, there is intensive cultivation with little fallow period, fertility decline and …… cultivation on marginal lands, on steep slopes. This, coupled with other poor farming practices, has resulted into increased soil erosion and low yields per unit area..."

Raussen.T, *et.al* (2002) from a study conducted in the highlands of SW Uganda including Kabale noted that: "…. farmers, professionals and local leaders in all districts are concerned about soil degradation. Wherever environmental concerns were ranked, declining soil fertility and erosion ranked among the top three…..This finding is not surprising in an area where steep and long slopes foster erosion despite relatively low erodibility of the soil and the low to moderate erosivity of the rains. Much of the fertile top soil has been lost and replenishment of soil nutrients leaving the fields through the harvested products, is only taking place through limited organic inputs in some fields of the farms. Only a handful of farmers use fertilizers …."

Bearing in mind that with recent output from research stations, seed quality among farmers has not changed for the worse and on the basis of arguments above, land degradation should be largely responsible for declining yields in this area.

The Effect On Production (EOP) method, which is a conventional market approach to the valuation of environmental impacts, was applied to determine income lost by farmers due to land degradation. The yield gap between 1999 and 2002 was multiplied by the average market price to determine income lost by the farmers per hectare of each of the selected crops to gain a fairly good qualitative view of how far land degradation may have affected production and farmers' incomes (Table 20 and Figure 7).

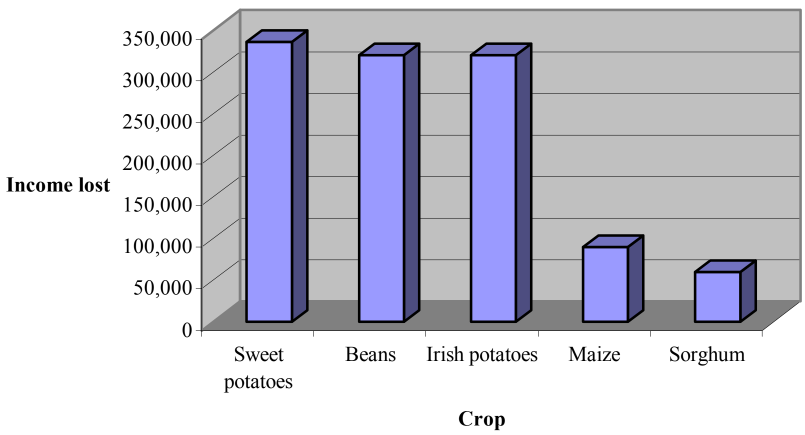
Table 20: Income lost by farmers due to declining crop yields

Crop	Output in 1999 t/ha	Output in 2002 t/ha	Yield gap t/ha	Yield gap t/ha	Average market price/ Kg	Income lost by farmer/ha (U.Shs)	Income lost by farmer/ha (US $)
Beans	1.4	0.76	0.64	640	500	320,000	161.0
Maize	1.5	1.30	0.20	200	450	90,000	45.3
Potato	8.8	7.20	1.60	1600	200	320,000	161.0
S. potato	5.5	4.30	1.20	1200	280	336,000	169.0
Sorghum	1.0	0.80	0.20	200	300	60,000	30.2

Source of output figures: KDLG production department (1999) & Raussen T, et.al (2002)
Source of prices: IITA, Foodnet & KDLG Co-operatives department, September 2003.

The highest amount of income lost by the farmer is where he/she grows sweet potatoes, beans and Irish potatoes, recorded at 336,000/= (US $ 169), 320,000/=(US $161) and 320,000/= (US $ 161) per hectare respectively, while the least is where the farmer grows sorghum, calculated at 60,000= (US $ 30.2) per hectare.

Figure 6: Income lost by farmers due to decline in crop yields (U.Shs/ha)



During FGDs, farmers indicated & confirmed that as a result of increasing land degradation in the watershed area and consequently, a decline in crop yields in terms of quality and quantity, household incomes have declined. Poverty has been on the increase and hunger and famine are always loaming in the area.

In order to generate a comparative picture, the Replacement Cost Method (RCM) was applied. The technique is based on the principle that the environmental impact of soil loss can be represented by the cost of inputs a farmer would incur in order to replace the lost soil nutrients due to erosion. Calculated losses, considered as replacement costs in terms of NPK, from rill erosion are tabulated below (Table 21). The calculations were based on soil nutrient properties from field experiments presented at the beginning of this section (4.7.1) and measurements in section 4.5.3.

Table 21: Replacement costs in terms of NPK lost due to rill erosion

Village	Farmer	Rank	Gender	Soil loss (t/acre)	Replacement costs/acre (U.Shs)	Replacement costs/acre (US $)
Habugarama	Kenama	Average	M	0.06	72.95	0.04
Habugarama	Nzarwahabi	Poor	M	0.04	46.40	0.02
Habugarama	Mugisha	Poor	M	0.03	33.93	0.02
Habugarama	Mashakarugo	Poor	F	0.09	117.83	0.06
Habugarama	Kikomo	Poor	F	0.05	61.01	0.03
Habugarama	Kaburabuza	Poor	M	0.06	75.89	0.04
Habugarama	Rwehobuganzi	Rich	F	0.00	0.00	0.00
Habugarama	Ndyomugyenyi	Rich	M	0.06	68.84	0.04
Habugarama	Mugisha	Rich	M	0.14	174.70	0.09
Habugarama	Bikangaga	Rich	F	0.16	207.40	0.10
Muguli B	Gandagara	Poor	F	13.19	16,665.60	8.38
Muguli B	Mugabirwe	Poor	F	2.45	3097.80	1.56
Muguli B	Ngwabije	Poor	F	7.74	9,785.14	4.92
Muguli B	Ntamabyaliro	Poor	F	13.22	16,713.98	8.41
Muguli B	Hinja	Poor	F	8.27	10,448.20	5.26
Muguli B	Kanyenzi	Rich	M	8.23	10,397.80	5.23
Muguli B	Habarwasha	Rich	M	10.20	12,895.80	6.49
Muguli B	Nsekuya	Rich	F	9.49	11,997.30	6.03
Muguli B	Kwehangana	Rich	M	7.32	9,249.90	4.65
Muguli B	Buryahika	Rich	M	0.95	1,196.10	0.60
Karambo	Kabuga	Poor	M	4.45	5,626.89	2.83
Karambo	Tumwesigye	Rich	M	8.50	10,742.20	5.40
Karambo	Tumwesigye	Rich	M	7.12	9,003.00	4.53
Karambo	Adam	Average	M	1.66	2,097.30	1.05
Karambo	Adam	Average	M	1.17	1,483.40	0.75

Considering the highest loss/replacement cost since it is the worry, a poor farmer would lose/need to replace NPK worth U.Shs 16,713 (US $ 8.4) per acre per season in these watersheds. Considering the current situation where most farmers earn less than 1 US $ per day, this replacement cost would be quite difficult to afford, implying that the land would most probably be abandoned by the farmer with time.

Losses, (considered as replacement costs in terms of NPK) from gully erosion are tabulated below (Table 22). Calculations were again based on soil nutrient properties from field experiments presented at the beginning of this section (4.7.1) and measurements in section 4.5.3.

Table 22: Replacement costs in terms of NPK lost due to gully erosion

Gully no	Village	Gully length* (m)	Lip width* (m)	Base width* (m)	Depth* (m)	Soil lost (t/acre)	Replacement cost (U.Shs/acre)	Replacement cost (US $/acre)
1	Muguli B	1000.0	2.60	1.50	2.2	23.72	29,976	15.08
2	Karambo	12.3	2.50	1.54	0.4	8.46	10,691	5.38
3	Karambo	1500.0	2.29	0.70	1.3	10.52	13,300	6.70
4	Muguli B	800.0	1.70	0.80	0.7	10.52	13,300	6.70

*Parameters presented as averages obtained from different points along the gullies

The huge gullies run across many crop fields belonging to many different farmers, from hilltops to valley bottoms. Calculations were thus not based on individual plot/farmer level. Due to gully erosion, it was found that farmers lose/need to replace NPK worth a maximum of U.Shs 29,976 (US $ 15) and a minimum of U.Shs 10,691 (US $ 5) per acre per season in these watersheds.

4.7.2 Changes in land-use

The land that has lost fertility over the past is gradually abandoned. A study by Zomer *et.al* (2002) indicated that in Kabale in general, about 10% of the land has been abandoned. However, in a few cases, degraded areas have been left for grazing and woodlot planting. One good example of such a woodlot is the *ruhurwensi* in Kagyera. This does not necessarily imply that land under woodlots and grazing has increased since many farmers either still continue to till the already degraded land or simply abandon it.

It was further revealed that due to cases of landslides on steep slopes, many households have moved from such points to gently sloping mid-slopes. During the transect walks, traces of sites where homesteads were once located could easily be identified in Kagyera.

4.8 SOIL CONSERVATION MEASURES PRACTICED BY FARMERS

4.8.1 General soil conservation practices

The soil conservation methods currently practiced in the watershed include the "traditional" practice of terracing, digging trenches, planting agroforestry trees like *Grivellia* and C*alliandra*, planting elephant grass (*ekibingo)* and use of fertilizers which is rather still not widely used (Map 14). Agroforestry trees are associated with the reduction of rain impact on the ground reducing splash erosion while elephant grass is associated with better band stabilisation.

Map 14: Soil conservation practices in Muguli B village

Source: Participatory mapping, Muguli B Village, 2003

In Muguri B, farmers indicated that because of increased awareness, there has been widespread adoption of digging trenches by all farmers to conserve their soils. This was because of the sub-county byelaw put in place since May 2002, supported by better enforcement in this village. NGOs like AHI and AFRICARE are helping farmers to dig these trenches. Quite a few farmers in the Kagyera and Karambo villages have begun to dig trenches or channels in their fields. The trenches reduce the speed of surface run off as they allow water to percolate through the soil. However farmers pointed out that there is a problem of siltation in the trenches. Group members often dig the trenches. The size of the trenches is 1 m wide and ½ m deep. This technology is spreading to other farmers in the villages despite the fact that only 5 members of the farmers group in Habugarama are practising this methodology on their own

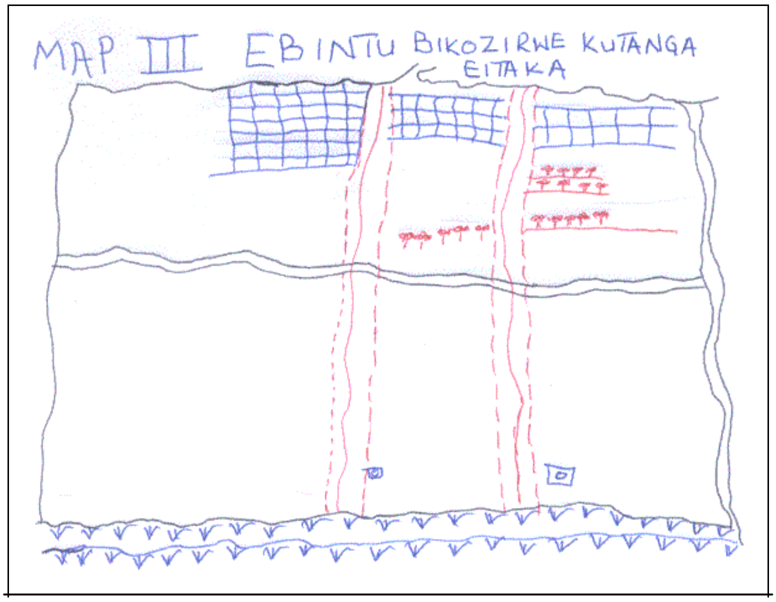
The farmers indicated that they practice confined cattle grazing away from cultivable land to avoid band destruction and allow grass to grow. When this grass is fully grown, it is harvested and transferred as organic fertilizer to areas considered less fertile. At times this grass is cut and fed to the animals. Only one farmer in one of the villages Kagyera, is growing elephant grass for his zero-grazed animals. This farmer also gets enough manure for his crops since he has confined the cows in one place. He is also able to utilise the remains of forage as manure. The manure is further enriched with urine, which contains plant nutrients like potassium and nitrogen which are also the most limiting nutrients in these highlands.

The use of manure is mostly confined to plots close to the homesteads and/or on plots located on gentle slopes where the surface run-off is very minimal. Farmers however pointed out that though they have been applying manure on their plots, they were not aware of the quantity needed to improve their crop yields significantly and were just applying it haphazardly on the soil surface.

A few farmers are also beginning to use inorganic fertilizers (approximately 10 farmers at most in each village). The inorganic fertilizers are usually applied when cultivating Irish potatoes. The application (use and frequency) of the chemical fertilizer is very low due to the high costs attached. It is also not available within the watershed and farmers have to go to Kabale town to buy the fertilizers. Agricultural lime on the other hand is not available in Kabale town, leaving soil acidity largely unchecked. Despite this, some good NRM practices have been attempted in the area (Map 15).

Map 15: Areas with good NRM Practices in the Baramba – Mugandu and Kitooma Watersheds: The case of Kagyera village

Source: Participatory mapping, Kagyera, Aug. 2002



Translation
- Arable
Cultivated
Valleys
- Elephant Grass
to along bunds
- Agro-forestry
trees

Crop rotation is also practiced by some farmers and the crops in the rotation include Irish potatoes, wheat and sorghum. It was established that little emphasis is put on legumes, yet these could improve soil fertility faster through nitrogen fixation.

In general, most of these conservation measures have been introduced or re-introduced in the last 5-10 years and as such have not had as much impact as would be desired. Technologies require some time for farmers to analyse and adopt. However, it should be mentioned that historically, the people of Kigezi have always practiced terracing as a means of protecting their soils from erosion, which arguably was introduced by the colonialists in the 1950s, but because of population pressure some farmers, as indicated earlier, are destroying the bunds resulting into increased erosion.

The farmers felt that expansion of area under agroforestry trees and the planting of elephant grass on the bunds would be the best measures to conserve their soils. Leguminous trees, shrubs, as well as herbaceous legumes which could improve soil fertility, especially nitrogen balance, should be encouraged.

4.8.2 Woodlot planting

There are several woodlots in the watershed as mentioned earlier. These are mainly located on uncultivated hilltops and mid-slopes, which had been severely eroded (Plate 10). The oldest woodlots are slightly over 20 years while others are about 7 years old (minimum) with the rest range in between. Woodlots are largely of eucalyptus trees and some limited number of black wattle (Plate 10), which ranges in age between 2 – 15 years. Trees like *Grivellia* and *Alnus* are also being planted but these are still on a small scale.

Most woodlots are second or third generation as they have been harvested for wood fuel and timber and have now regenerated.

The undergrowths within these woodlots are used for grazing which retards the rate of growth of the woodlots

Most of the woodlots are individually owned although some of them are owned by community groups such as *Bataka Twezikye.* The local term for such community woodlots is *Entusi za Ruhu-Rwitaka*. Most of these community woodlots were planted in 1990 and the community group sells trees when they mature and get money, which they share amongst themselves.

Plate 10: A woodlot in Karambo village

Source: Field photo, August 2002

The reasons the farmers gave for planting these woodlots were:

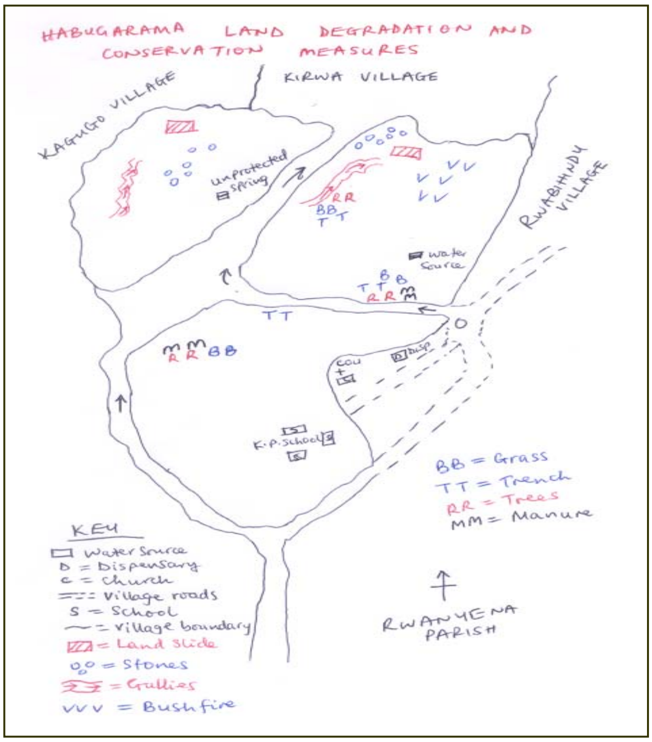
- Avail the community a cheap and convenient source of firewood for household use particularly cooking
- Avail the community of cheap wood for burning on night vigils when a family has lost a loved one as is the custom in this part of Uganda
- Avail the community with cheap poles and timber for building
- Modify the weather conditions
- Get timber for sale in neighbouring Rwanda
- Get stakes for beans
- Provide firewood for baking bricks
- Provide wood for making Charcoal
- Provide timber for boat construction

4.8.3 New terrace construction

A few new terraces have been constructed over the recent past. These are formed through soil accumulation behind bunds through collective or individual efforts. In Karambo, for example, the most recent terraces were constructed on Mr. Tumwesigye's farm in 1975 after a serious landslide there. According to the farmers, the British first introduced terraces in the 1950s and since then farmers have cultivated their land using terraces. It was further noted that the construction of these new terraces has not caused any boundary conflicts as these are often done systematically with the approval of neighbours. In areas where farmer's groups are well established, terrace construction is done collectively, planting mostly elephant grass along the bunds to stabilize the terraces. In other cases however, some farmers do the terrace construction individually, having agreed with the neighbours. Agroforestry trees and elephant grass are used to stabilise the bunds.

When the terrace band increases in height, farmers decide to reduce or break the old band and construct new ones. This is done every new season, likewise for the bunds that get destroyed. However the farmers indicated that the new and old terraces are all mixed up and it was difficult to distinguish the two for quantification purposes. Besides, new terrace construction is only a smaller component of many other soil conservation practices that farmers are attempting to adopt in response to the land degradation problem (Map 16).

Map 16: Land degradation and conservation measures in Habugarama village



Source: Participatory mapping, Habugarama 2002

4.9 BYELAWS IN PLACE

The evolution of byelaws seeking to regulate management and use of natural resources in Uganda can be described in three phases: the pre-independence, post-independence up to 1986 and the post-1986 recovery phase under the National Resistance Movement government (Muhanguzi, 2002). Currently, there are basically 6 byelaws in place (with several regulations) within this area. They are enforced by the sub-county authority and, in some cases like in Muguli B, organised farmer groups.

These are the:

- soil and water conservation,
- food security,
- tree planting,

- bush-burning,
- controlled grazing, and
- swamp reclamation byelaws.

- The soil and water conservation byelaw requires that farmers to:
  - construct bunds across the slope parallel to the contour,
  - plant appropriate vegetation on the bunds,
  - construct barriers guided by extension workers,
  - plant only perennial crops on steep slopes,
  - plant crops along the contours,
  - demarcate two agricultural plots with mark stones, and
  - protect paths, cattle tracks and access roads against erosion.

- The food security byelaw requires that households/farmers:
  - have food stores/granaries built in rat-free and water-proof conditions,
  - don't sell all food harvests to ensure enough food reserves,
  - have at least 0.25 acre of potatoes, 50kg of beans or peas and 100kg of sorghum,
  - keep away from consuming alcohol before 2.00 pm and after 10.00 pm and
  - avoid being idle, disorderly and unproductive.

- The tree planting byelaw has regulations which require that
  - persons who cut a tree plant two and ensure that the planted ones are protected and well looked after.
  - owners of private woodlots on hills must seek advice from foresters,
  - appropriate tree species be planted on both sides of feeder roads and
  - only agroforestry trees be planted at boundaries or trenches of neighbouring plots.

- The bush-burning byelaw regulates the setting of bush fires without authorisation and requires that in the event of fire outbreak, all able-bodied members of the community participate in extinguishing it.

- The byelaw on controlled grazing requires that any farmer who owns livestock shall ensure that livestock:
  - are only grazed when herded,
  - are grazed in his/her own piece of land or where the owner of the land has consented,
  - do not drink water from the same point used by people for domestic use.

  It requires that:
  - watering points for livestock should be demarcated,
  - pigs should not graze with other animals,
  - animals should be immunised against disease,
  - cattle owner ensure consistent control of ticks,
  - movement of livestock be stopped in cases of disease outbreak and
  - no grazing on crops should be allowed.

  Farmers whose crops are destroyed by animals are meant to be compensated.

- The swamp reclamation byelaw places restriction on what crops can be grown in the swamp and requires that advice be sought by farmers from the agriculture department.

  It requires that:
  - plot boundaries be demarcated with posts/trees but not enclosed hedges that interfere with water flow and
  - a strip of 3 and 1 feet grass be left on the sides of the main channel and along subsidiary channels respectively.
  - the depth of the subsidiary channels must not exceed 50 cm or go beyond the peat layer and
  - the landholder must ensure water channels are kept clear of earth, rubbish and other obstruction.

According to a study on NRM byelaws and local policies in Kabale, (Muhanguzi, 2002), the levels of farmers' knowledge about and effectiveness of these byelaws varies with byelaw and regulation. The effectiveness and strength of a byelaw is largely attributed to strength in enforcement and levels to which the byelaw involves community members. Among others, the major reason explaining why some of the byelaws were weak and ineffective was weak enforcement. It was recommended that for success to be registered, community members themselves needed to be trained in byelaw compliance, monitoring and enforcement.

During the land degradation study, farmers indicated that the grazing byelaw is the most respected while the one on bush-burning is often disregarded and the culprits are rarely brought to book.

According to the farmers, arbitration of conflicts by elders or local residents and neighbours is very often practiced especially in issues to do with boundaries and band destruction. The farmers suggested that these byelaws and community agreements need to be spread over wider areas so that more people see them as credible, which will increase their being adhered to. They all felt that the Local Council III should continue and tighten their enforcement.

The farmers believed that with such byelaws in place and with better enforcement by government and the local authorities, the highland areas would be in better position to produce enough food and cash crops for improved livelihoods, while maintaining the quality and quantity of the natural resources base in the area. They felt this could best be effected through a strengthened partnership between government, the different NGOs existing in the area and the local farmers.

4.10 GENDER ANALYSIS AND IMPLICATIONS TO NRM

This analysis (Table 23) increases our understanding of the gender-based division of labour, resource access, control and ownership, and participation in activities within the area of study with respect to NRM.

Men and women interact with natural resources for different activities based on gender division of roles and responsibilities. It is thus possible that they may contribute differently to land degradation and are affected differently by it. Sound NRM practices can thus be suggested basing on a critical assessment of this situation.

Within the Buramba-Mugandu and Kitooma watersheds, both men and women on a daily basis closely interact with, and make use of, the trees, grass, water, wetlands and the soils for their livelihoods. They do this to varying extents and for different activities, based on gender division of roles and related activities.

4.11.1 Access and management of the land

Men own and control the use of the dryland, much as the women access it. However, the women do most cultivation and weeding. The men are mainly involved in land clearing and crop harvesting. They also control the use of the proceeds from sale of the products. The men thus benefit more from this situation than the women. Only a few women for example, widows and those with some little money to buy land do own land. It was stated that even if a wife buys a plot of land, she has to register it in the names of her husband.

However, the land gets degraded due to over-cultivation; and women do most cultivation, yet they may not have the personal initiative to conserve it, for they do not own it. Besides, certain conservation structures are almost permanent in nature and can rarely be established on land that one does not own. Yet, the women are most affected as they still have to till this already degraded land, or else walk long distances to cultivate other pieces of land 2-5 km elsewhere.

During this study, it was found out that 4 out of the first 5 highest amounts of soil lost were recorded among female-headed households and 6 out of the top 10 were recorded among female-headed households. The general picture is therefore that higher soil loss is experienced among the female-headed households. Probably, putting in place soil conservation structures is energy demanding, yet many may not afford to hire labour. Arguably, if women owned land, their fields would probably be less likely to be degraded, as they would have the resources and personal initiative to conserve it. Men and women's perceptions of land degradation undoubtedly differ, as they use the land resources for different activities and are affected by its degradation to varying degrees.

Table 23: Resources, activities, and benefits gender analyses for the Buramba-Mugandu and Kitooma watersheds

Resources	**Activities**	**How Used**	**Who Does**	**Resource Control**	**Access**	**Owner-Ship**	**Who Benefits from Cash**	**Who Decides on use of Cash**	**Who Degrades**	**How Degraded**	**Who Affec-ted**	**Opportu-nities**	**Constraints**
Trees / Wood lots	-Cutting -Firewood collection	-Timber -Charcoal -Poles -Firewood	♂ ♂ ♂ ♀/Child	♂♀	♂	♂	♂	♂	♂	-Reduced tree cover -Soil erosion -Scarce products	♂ ♀ Child	-Agro-Forestry -NGOs -Farmer Groups	-Limited Access to Seedlings -Poverty
Grass	-Grazing -Harvesting	-Grazing -Mulch/Thatch	♂/Child ♂♀	♂	♂♀ Child	♂	♂	♂	♂	-Over – Grazing	♂ ♀ Child	-Fallow land -Grass on bunds	-Limited land
Water	-Fetching -Watering Livestock	-Domestic -Watering Livestock	♀/Child ♂/Child	Committee of ♂♀	♂♀	♂♀	---	---	♂	-Dirtening by livestock	♂ ♀ Child	-Committees -Protected Sources, -H_2O Harvesting, -Gov't & NGO Efforts	-No cooperation among community members during clearing
Wetlands	-Cultivation -Craft Material Harvesting	-Crop growing -Craft Making	♂♀ (mostly♀) ♀/Child	-Society & -Gov't	♂♀ Child	Gov't	♂ ♀	♂ ♀	♂	-Drainage -Scarcity of pdts	♂ ♀ Child	-Gov't guidelines on wise use	-High pop. growth -Lack access to guidelines
Soils/ Land in general	-Clearing -Cultivation	-Crop Growing	♂ ♂♀ (mostly♀)	♂	♂♀	♂	♂	♂	♂ ♀	-Overcult-ivation -Erosion	♂ ♀ Child	-NGOs -Farmer Groups - New techs	-No coopera-tion, -Costly techs, Poverty

4.10.2 Woodlots

Much as both men and women access tree resources, more men own woodlots than women. From the focus group discussions, it was established that it is often the men who own these woodlots though they are for the benefit of the whole family. It is mostly the men who plant the trees but of recent, with the introduction of agroforestry trees, women too have started planting trees. The reason it is men who mostly plant these woodlots is that women are mostly concerned with growing food crops while men want trees and wood to sell and are hence more inclined to do the planting.

Although men own the woodlots, they do not prevent their wives from using the wood products. Men harvest trees for timber, charcoal & brick burning (for sale) and poles for construction, while the women daily collect firewood to meet household energy needs. Both sexes thus benefit from this resource but may also contribute to its degradation if not sustainably used.

However, women are the most affected by tree loss in the short and long run when firewood becomes scarce, because they will have to walk long distances in search for it. In fact, many women in this watershed now use crop residue as fuel for cooking. When tree products are sold, the men largely benefit from the cash and control its use. Women cannot sell tree products without the consent of their husbands.

4.10.3 The use and management of grass cover as a resource

Whereas men utilise the grass for livestock grazing, the women harvest certain grass species for handcrafts. Both use *Cyperus* species (*Obukangaga)* for thatching. Much as they both access the grass, control and ownership belongs to the landowners who are often the men. It is the men who are contacted by neighbours or other farmers who would wish to graze on the land. Livestock grazing, except for goats and sheep which at times involve girl children, is the men's/boy's activity, and contributes most to loss of grass cover and thus land degradation. When livestock compact the land as they graze, it is the women that still have to till it.

4.10.4 The use and management of wetlands and water resources

Where husbands are members of the wetlands co-operative societies, wives can access the wetlands for cultivation. Non-members may not access the resource, except through hiring plots from the society. Women too harvest wetland resources for handcraft materials. However, these have become scarce where intact wetlands are rare, for example in Karambo village (unlike Habugarama and Kagyera villages). Wetland drainage may also lower the water table where the drainage ditches exceed the recommended 0.5 m, making surface water scarce (especially for livestock) during dry seasons (NWP, 1998). This largely affects the men who take livestock for watering. During the rains, floods destroy crops in the wetlands, affecting both men and women. Crops grown in the wetlands are largely cash-crops (cabbages and potatoes) and these are often controlled by men although women cultivate them. Men de-silt channels, as this was described to be a pretty tiresome job.

Men mostly use the water for watering livestock and brick making while women frequently collect it for domestic purposes. Both therefore access it and ownership and control are open/communal (through water management committees in the villages, composed of men and women). However, when the water sources are not cleared or are contaminated by livestock, the women are most affected, as they have to search elsewhere for clean/safe water. It is men who are responsible for ensuring that water sources are cleared and kept in good condition. During the dry season when water is scarce, it is the women and children who bare the brunt of water collection from longer distances. At times they walk as long a distance as 2 km, often having to queue for many hours.

4.10.5 Opportunities

- Priority NRM practices could build on these differences so as to target the right stakeholders,
- Various agroforestry tree species now exist and can best suit this watershed where land for cultivation and woodlot planting is scarce,
- Well organised farmer groups (men and women) exist through which sound NRM practices can be introduced,
- Strong village water management committees exist ,
- Various NGOs exist alongside government. They have introduced new and sound NRM practices and provide training to both men and women,
- Government has developed wetland wise use guidelines for application by wetland resource users countrywide (both men and women).
- Grass planted on bunds and land under fallow can be used for feeding/grazing livestock

4.10.6 Constraints

- Women may have less time to invest in land conservation activities due to many other domestic roles and responsibilities,
- Lack of cooperation especially from farmers who do not belong to the farmer groups in adopting new NRM technologies,
- Lack of access to the new 'wetland-use guidelines' from government as they have not yet been disseminated to these areas to guide farmers,
- Men often go for paid labour and abandon their families. This has caused lack of sufficient labour force in the area especially with regard to establishing soil conservation structures. In Muguri B for instance, it was highlighted that many men have gone to the urban areas and the tea estates in Kabarole, in search opportunities to be hired causing a shortage in labour force required for digging trenches,
- Limited access to some NRM technologies like Agroforestry tree seedlings (*Grevellia*) and Elephant Grass (*Guatemala*) for planting on bunds and alongside trenches.
- Poverty among both men and women limits access to new NRM technologies, which need resources and investment by farmers.

5.0 THE WAY FORWARD FOR IMPROVING NRM IN THE HIGHLANDS OF KABALE

5.1 COMMUNITY NRM ACTION PLANNING

It is proposed that the findings herein be presented to farmers and other stakeholders for the development of community NRM action plans. Basically, the action planning process targets a participatory way through which the magnitude of land degradation identified in this study will be presented to farmers so that they can appreciate the need to plan for remedial action. A suggested matrix of a logical framework (Table 24) can then be developed and completed together with the farmers.

Table 24: Structure of the suggested community NRM action-planning matrix

Issue/Problem identified	Objective	Strategic action(s)	Activities involved	Person responsible	Required inputs	Budget	Time frame

This is a simple tabulated form of objective analysis that will guide farmers to derive problems from issues/problems identified during this study. The proposed action planning process can take about two days per village/parish in all (depending on resource availability). Day 1 would be basically utilised for presentation and discussion of study findings so that farmers and other stakeholders can internalise and appreciate the magnitude of the land degradation problem and its causes. Day 2 would then be used for actual planning and budgeting, development of implementation structures and monitoring and evaluation strategies

It will be vital that during action planning, the farmers appreciate that most of the actions should be implemented by themselves, except for cases that may require technical backstopping and introduction of new technologies currently not accessible to them. The farmers ought to clearly indicate what their own input will be in the effort to solve their own land degradation problems. This will enhance easy lobbying for support from elsewhere.

5.2 RESEARCH, DEVELOPMENT AND POLICY IMPLICATIONS

The findings herein generate a number of research, development and policy implications. It will be interesting if more detailed economic valuation of how the current and future cost of land degradation will impact on farmers' livelihoods and development of the area. A system thus needs to be developed through which the farmers (groups/individuals) can store information on, for example, cost of inputs geared towards rehabilitation of degraded land. This would enhance the application of the replacement cost method in valuing the impact of land degradation in the area. Besides, farmers will also need to be encouraged to keep records on crop output, against which any changes in status and product activity of the land (and impact/effectiveness of land conservation measures) can be measured over time. These are simply examples of research gaps that can be identified at this stage. Any other research gaps identified and studies done in future will further enrich the stock of information that planners and policy makers need in order to make informed decisions for the development of this area.

Information generated from this study and from any other research gaps identified and studies done in future can be used to guide decision-making processes among farmers, development planners and policy makers so that land degradation issues can find a position among priority areas that require urgent address in development planning processes in the area. An economy that largely depends on productivity of the land will only develop where sound land use and management issues are at the centre stage of the development planning process.

Issues identified in this study would obviously best be translated into meaningful and effective action through a clear set of guidelines in form of land use and management policies and action plans. However, even at the national level, a land use policy is still only under stages of being developed. Thus, attempts are only made to address land use and management issues under general environment, agricultural and other related policies. The same scenario applies to Kabale's case. The district environment policy has a sectoral policy objective that seeks to "promote good farming methods and appropriate soil and water conservation practices."

Existing policy guidelines, objectives and suggested actions related to land use and management in Rubaya and Kabale at large, have only to a small extent, been translated into effective action due to limited farmer participation in policy guideline and action plan development among other reasons. Besides, land degradation issues will only be fully addressed through a clear and implicit policy that specifically seeks to address land use and management issues. The implications are that farmers will need to participate fully in the development of policy guidelines and action plans. Particularly, such policy guidelines and action plans should explore chances of building on technologies & management options that are, according to the study, already indicating chances of being acceptable among the farmers in the area.

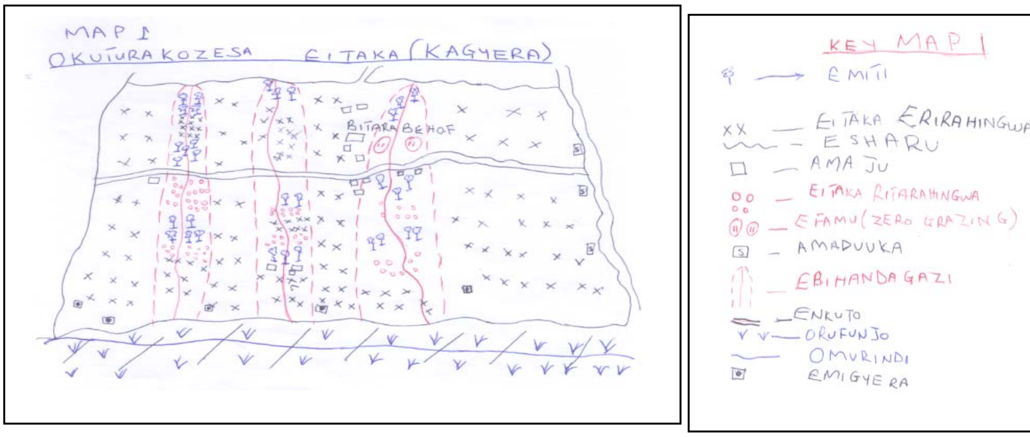
These include among others:

- Intensification of agroforestry and the planting of other high value trees,
- Rehabilitation of the already degraded lands e.g filling up of the gullies,
- Consolidating the construction of trenches and stabilising their banks while trapping silt,
- Strengthening the enforcement of community byelaws relating to NRM,
- The continued use of contour hedges and terraces,
- Applying organic/inorganic fertilisers, and,
- Energy saving techniques to reduce rates of biomass loss through energy inefficiency.

Once done, these can be integrated into the current sub-county and district policies and development plans for sustainability purposes. An evaluation of the current and planned NRM policies will then need to be done if more lessons are to be learnt for improvement in future.

APPENDICES

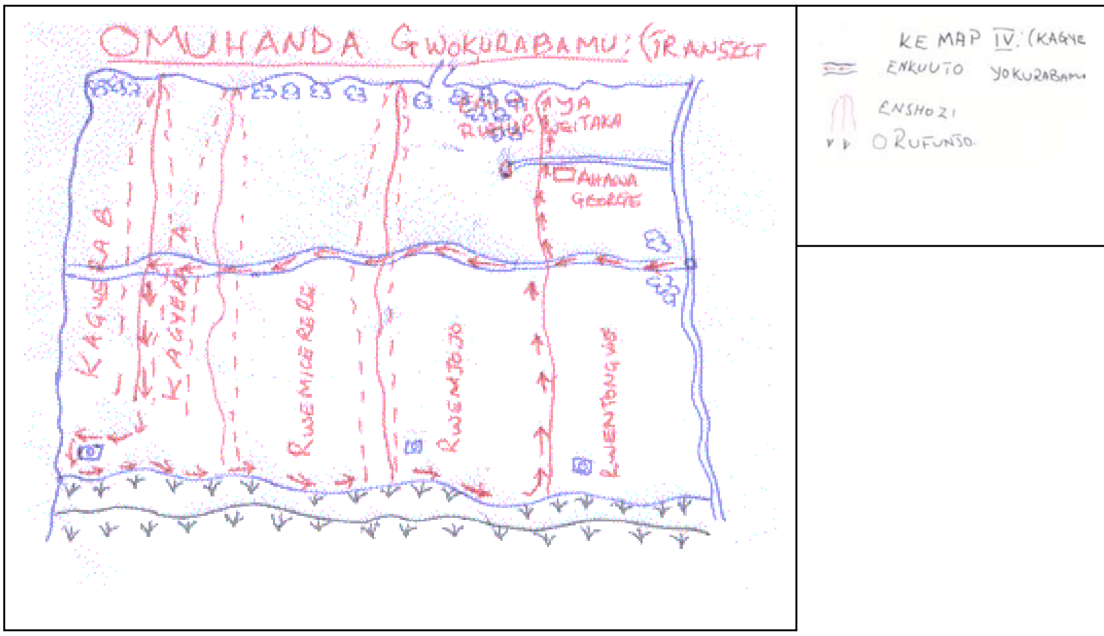
Appendix 1: Map showing land use in Kagyera



Translated key
-Trees
-Cultivable land
-Boundaries
-Houses
-Barren land
-Zero grazing units
-Shops
-Cattle tracks
-Roads
-Wetland
-Stream
-Springs

SourceParticipatory mapping, Kagyera, August 2002

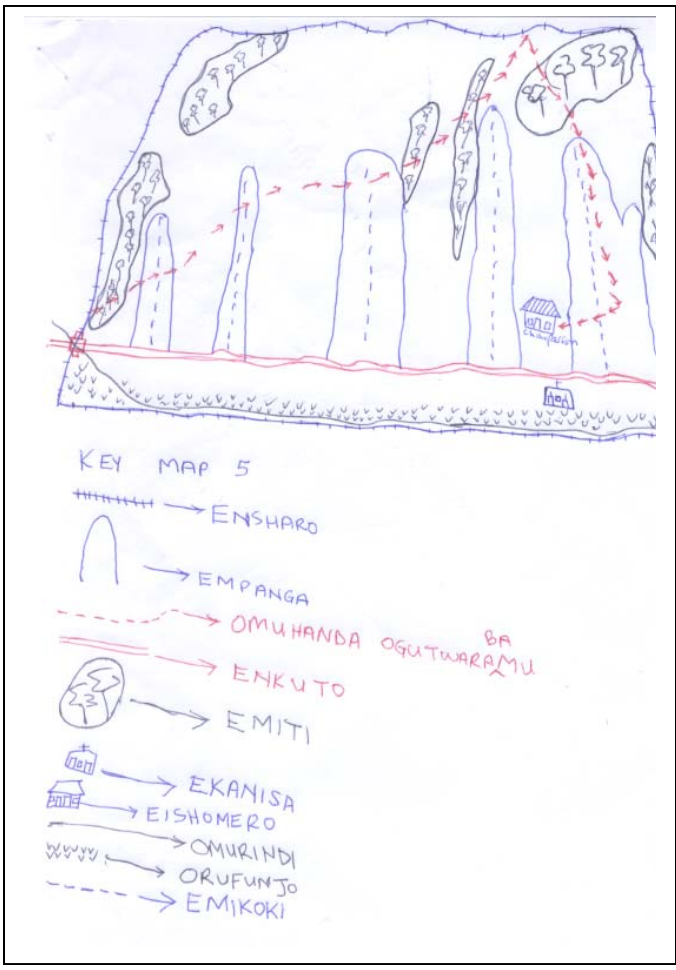
Appendix 2: Map showing the transect route through Kagyera village



Translated key
-Route
-Hills
-Wetland

Source: Participatory mapping, Kagyera, August. 2002

Appendix 3: Map showing transect route through Karambo village



Translated key
- Boundaries
- Valleys
- Transect route
- Roads
- Trees
- Church
- School
- Stream
- Wetland
- Gullies

Source: Participatory mapping, Karambo Aug. 2002

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