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Farming in Tsetse Controlled Areas

FITCA

E M M C
Environmental Monitoring and Management Component

Project Number : 7.ACP.RP.R. 578

Assessment of land Use, Vegetation and Human Perceptions on Environmental Changes in Bubaka Village, Iganga District Western Uganda

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December 2003

Natural Resources Institute

CIRAD

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Acknowledgement

We would like to thank the following people who assisted in various ways toward this project.

GPS Mapping Team Iganga:
Kibuga Ibrahim,
Joy Grace Achira,
Tangonzah Sarah,
Kagoda, Sam,
Otim Alfred,
Lorry Saviour,

Field Guides:
Balyokusaibwe Joseph,
Leeya Nabongo,
Buinzu Fred,

Botanist:
Wanyama Olivia,

Sociologist:
Annah Rutebuka,

Drivers:
Kamau
Mugume

OVERVIEW: FITCA Report

The regional project FITCA (Farming in Tsetse Controlled Areas) has a general objective to integrate tsetse control activities into the farming practices of rural communities such that the problem of trypanosomosis can be contained to the levels that are not harmful to both human and the livestock and environmentally gentle and integrated into the dynamics of rural development and are progressively handled by the farmers themselves. The Inter-African Bureau hosts the project for Animal Resources of the African Union (AU-IBAR) and covers areas with small scale farming in Uganda, Kenya, Tanzania and Ethiopia.

EMMC (Environmental Monitoring and Management Component) is the environmental component of FITCA. It is implemented by ILRI in collaboration with CIRAD (as member of SEMG, Scientific Environmental Monitoring Group). This regional component has been charged with the responsibility of identifying of monitoring indicators and methodologies, as well as the development of an environmental awareness among the stakeholders. It contributes to propositions of good practices and activities mitigating the impacts and rehabilitating the threatened resources likely to result directly or indirectly of tsetse control and rural development.

The FITCA EMMC project was written by Dr. Robin Reid of the International Livestock Research Institute (ILRI) a future Harvest Centre supported by CGIAR (Consultative Group for International Agricultural Research).

The present report has been prepared under the responsibility of the leading group of EMMC:

- Dr Bernard Toutain, agronomist, coordinator
- Dr Joseph Maitima, ecologist

This report and others produced by FITCA-EMMC are available in the web at the following address: www.fitca.org

General Introduction

During the FITCA EMMC project conceptualization period, it was decided to base site selection on different landscape patterns in the project areas in order to capture different land use practices and ecological scenarios as much as possible. In Uganda wetlands are a major feature of the landscape. Iganga was selected due to its prominence in wetlands among the FITCA Uganda project districts. During this project conceptualization period however, no specific site was selected in Iganga but a recommendation was made to consult with FITCA Uganda and other stakeholders to select a site within the wetland areas where tsetse are present and trypanosomosis is prevailing.

In consultation with FITCA Uganda we selected Bubaka village for land use mapping and other FITCA EMMC studies. Reasons for this selection include.

- *FITCA project activities*

  Activities being implemented by FITCA Uganda include; pasture development, introduction of grade animal breeds, oxen and ploughs. These are implemented in addition to other tsetse control activities aimed at reducing both tsetse densities and trypanosomosis prevalence.

- *Landscape patterns*

  The selected site traverses a large swamp and the mapped area includes both sides of the swamp. The swamp is used for cultivation and grazing for most of the year.

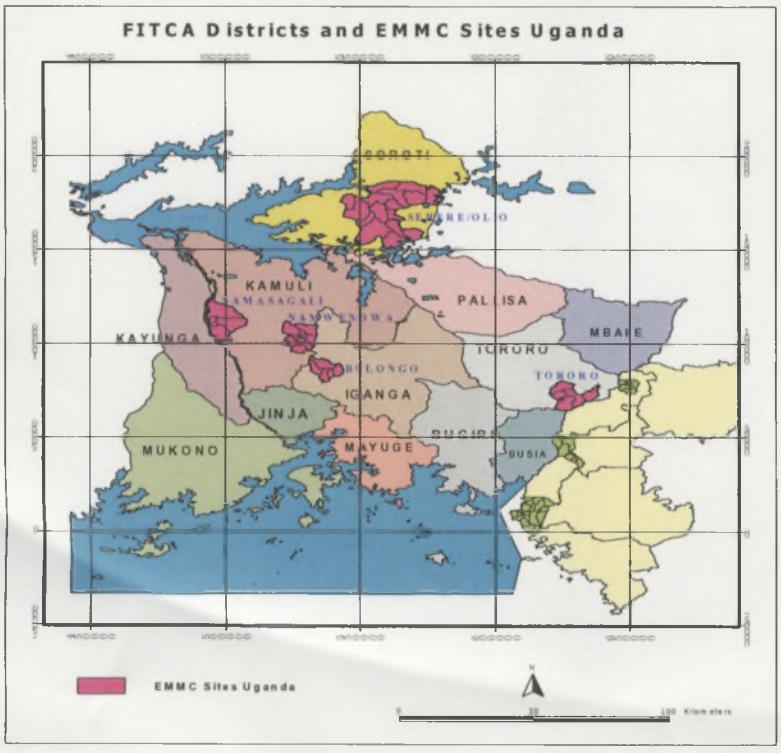
- *Land use practices*

  Land use in the selected area is under continuous cultivation with numerous perennial and annual crops that rotate in different plots season after season. Ulike Kamuli and Soroti land use in this study site has more perennial crops than annual crops. Farm sizes are much smaller than in any other Ugandan EMMC site, perhaps due to its close proximity to Iganga town a district headquater.

People and Occupation

Like in Kamuli people in Iganga belong to the Basoga tribe, one of the major ethnic groups of Uganda. They occupy several other districts neighboring Iganga and all speak Busoga and are close relatives of the Baganda the most dominant tribe in Uganda. Basoga people practice mixed farming, cultivating crops and raring livestock but more as cultivators than livestock keepers. It is not known whether the less dependence on livestock is due to the problem of trypanosomosis or it is a cultural adaptation. Although poverty rate is high, comparatively the Basoga are relatively better placed economically than most other FITCA sites in Uganda

Map 1: FITCA districts and EMMC sites Uganda



Objectives

The overall objective of FITCA project is to promote farming activities in tsetse controlled areas so that land use activities would maintain the flies to low densities and the prevalence of both animal and human trypanosomosis low. Tsetse infested areas are marginal areas where ecologically productive systems operate at very narrow ranges and are very susceptible to disturbance. Most tsetse control areas especially those with animal trypanosomosis, are characterized by low and unreliable rainfall, poor vegetation cover, poor soils, and generally degraded lands. These areas have generally been neglected as low potential areas by governments and as such there are no proper guidelines on land use. Land use and settlement in these areas require an environmental monitoring in order to detect changes as they occur and a management programme to mitigate the negative impacts.

EMMC is therefore designed to fulfill this role. The initial objective of EMMC was to understand the environmental settings of FITICA project areas in the participating countries, design an approach to conduct environmental analysis in selected sites to provide baseline information for scaling up to landscape level analysis. This exercise is also aimed at providing data from which ecological constraints to agricultural production can be identified and communicated to the land users (farmers) in a format that they can understand in order to monitor and manage changes in their farms.

Hypotheses

This study is based on FITCA philosophy of using livestock as an entry point to rural development. In general FITCA promotes livestock development to improve food security keep reduce poverty along with other farming activities. FITCA operates in tsetse-infested areas where either or both human and animal trypanosomosis are prevalent and are a considerable constraint to farming. These tsetse and trypanosomosis infested areas are usually marginal lands where land based production systems operate within narrow ecological ranges beyond which environmental degradation prohibits realization of the expected economic benefits. This study is therefore designed to test several hypotheses. Some of these hypotheses are shown below:

1. Availability of animal traction will increase farmer's ability to till the land and therefore increase the cultivated area, reduce vegetation cover and change the composition, distribution and structure of plant species.

2. Increase in the number of livestock under zero grazing will increase demand for fodder and therefore more land will be used in feed production.

3. Improved profitability of livestock keeping will attract more people to keep livestock and therefore increase competition on the use of natural resources (land, plants, water and soil).

4. Since tsetse abundance is linked to specific habitats, successful trypanosomosis control measures will discriminately reduce those habitats thus depriving the ecosystem some of the goods and services derived from those habitats.

PART I

GPS Mapping Report

Bubaka Village

Bulamagi Sub County

Iganga District

Uganda

EMMC/FITCA Study site

Uganda

INTRODUCTION TO LAND USE MAPPING

The objective of Environmental Monitoring and Management Component (EMMC) is to develop an information system and methods for monitoring the direct and indirect effect of farming in tsetse controlled areas (FITCA). One way of monitoring is through mapping using available methods for change detection especially on land use land cover over time. Maps can be created or derived using either ground survey or remote sensing methods.

The main objective in this ground GPS mapping is to capture the area and the distribution of various land use land cover at farm level. This will lead to deriving the required baseline indicators of land use change for the monitoring and management purpose. The information will also be used in training and classification of high-resolution satellite images for mapping the wider EMMC and FITCA study areas.

Bulamagi is one of the four EMMC study areas in Uganda located in Iganga District of Uganda (Map 1). It is highly settled and widely cultivated with the natural areas consisting of swamps and young fallows. The area that had been identified earlier for EMMC survey work in Iganga district was Bulongo Sub County. We later changed to Bulamagi after realising that FITCA work had not started in Bulongo but some project work was going on in Bulamagi. FITCA efforts in Uganda are mainly targeting reduction of Human trypanosomosis rather than livestock's (EMMC Report 2002). The area has very low incidences of human sleeping sickness. FITCA is encouraging farmers to keep cattle for milk products as well as for animal traction. The major indicators of change expected are the conversion of existing land use and cover types to fodder crops and grazing lands.

STUDY AREA

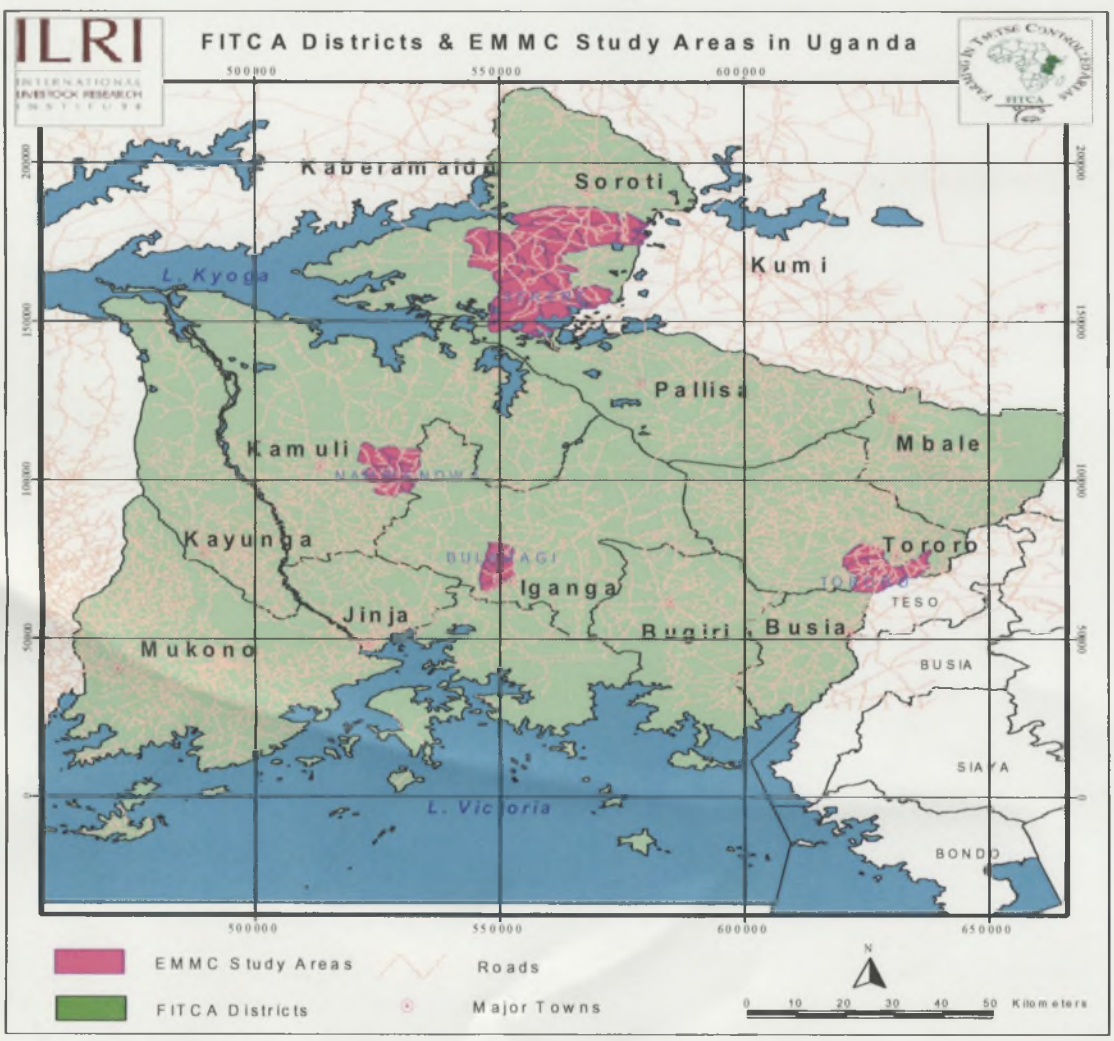
Bubaka Village mapping site is located in Bulamagi parish, Kugulu county of Iganga district Uganda (*Map I -2*). Some parts of the site are also to be found within the neibouring parishes of Nawanyingi and Bunyiro It is situated about 10 Km north west of Iganga town near Bulamagi shopping center. Due to it is proximity to Iganga town the population density is high at about 237 people per Km^2 (*Table I -1*).

Table I -1: Human population numbers in Bulamagi and neighboring parishes

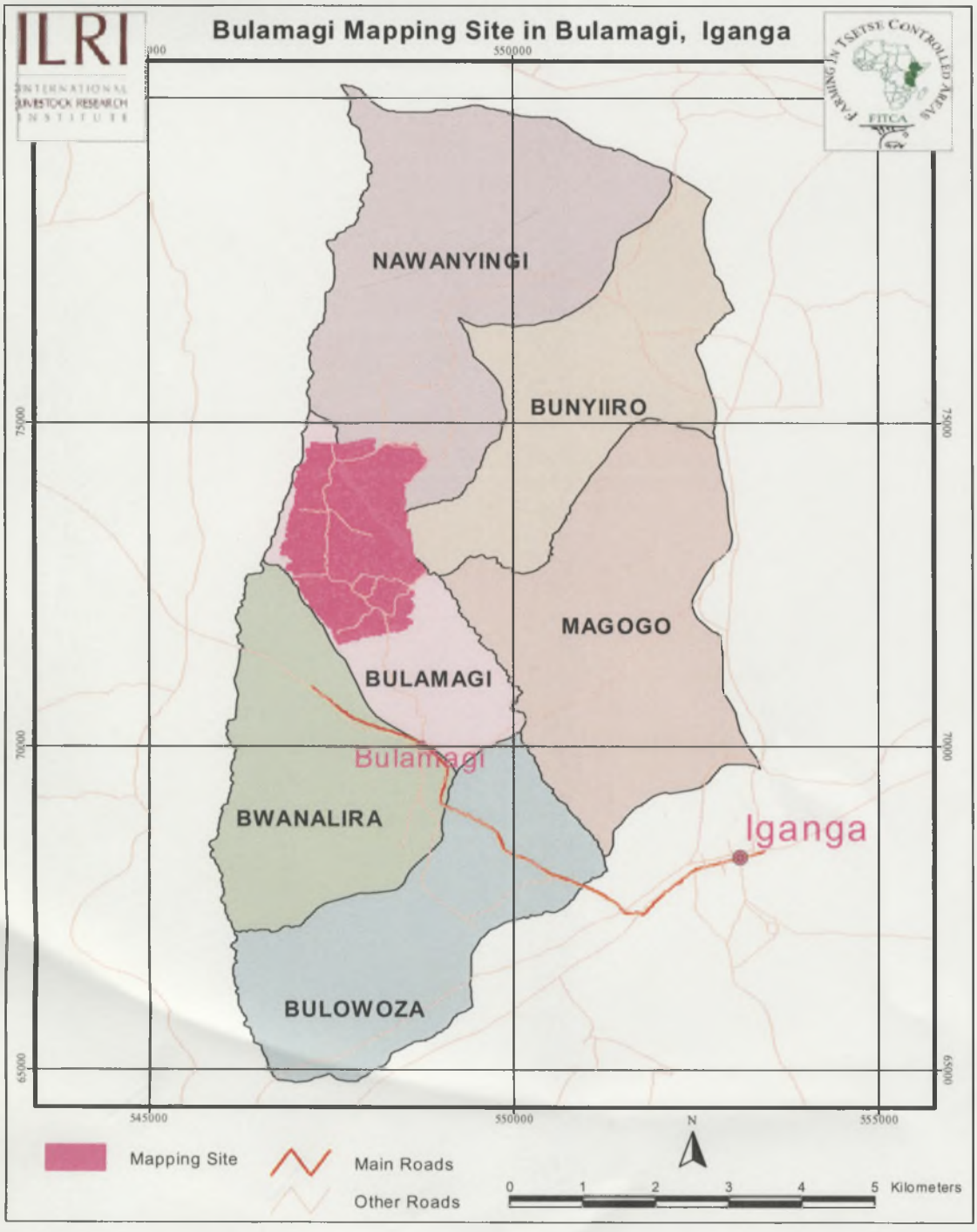
Parish Name	Area Km^2	Male	Female	Totals 1991	Density / Km2
Bulamagi	8.15	932	1005	1937	237.67
Bulowoza	12.23	1667	1797	3464	283.24
Bunyiiro	11.58	1399	1501	2900	250.43
Bwanalira	11.24	1373	1530	2903	258.27
Lwaki	11.71	1380	1535	2915	248.93
Magogo	15.46	1872	1939	3811	246.51
Nawanyingi	18.28	1846	1982	3828	209.41

Source: Population census Uganda,1991

Map I -1: EMMC Study Areas Uganda



Map I -2: Mapping Site Bulamagi



Fieldwork

The mapping was accomplished by the use of a hand held Global Positioning Systems (GPS) as explained in the method report (Njuguna, 2003; Maitima et al. 2003). Seven people including six locally recruited trainees for ten days between 26th Aug and 5th Sept 2003 did the work. The first two days were used for training the recruited assistants on GPS application and manipulation in land use mapping. The remaining days were used for actual data capture and storage. Monitoring and verification maps were being printed using a portable printer every evening after the work in the sites. This reduced delays experienced in previous fieldworks where maps had to be printed commercially every morning before the start of work.

There was mobile phone network and communication was very easy in contacting each other within the site. We operated two vehicles for transporting personnel within the site.

Fieldwork took place during the months of August-September when farmers had just harvested their first season maize crops. Maize was the dominant crop where some farms were already planted with the second season's crop while others were being prepared for the second season's crops. The visibility was good although the possibility of misclassifying crop land into fallow or grazing land was high unless it is was already ploughed. The presence of previous years crop remnants assisted in identifying the possible crop whenever there was confusion.

RESULTS

An area of 4.5 Km^2 was mapped within Bulamagi parish of Iganga. A total of 365,353 (365 Km) were walked to map a total of 1465 polygons of various land use and cover types within. The main classes identified included cultivated areas, built up areas, swamps and other natural areas.

The major land use classes are shown in (*Table I-2 and Figure I-1)* and the detailed cover classes are shown in (*Table I-3 and I-4*) and the corresponding maps.

Cultivated areas or Cropland (76 %)

Bubaka and entire Bulamagi parish was highly cultivated where this class covered over 76 % of the total. The dominant crop was maize with over 30% cover of the total. Maize was intercropped with many of the other crops but mainly with the perennial crops of banana, coffee and cassava. The perennial crops dominated covering over 42%. Coffee was widely grown and well tended covering over 15 % of the total. Sweet potato was the next main food crop after maize and it was also widely grown with 10 % cover of the total. There were several swampy areas within which rice (both upland and swampy varieties) was grown. It was difficulty to access most of the rice fields within the swamps and the percentage cover should be higher than the 1% shown (about 2%). Vegetables such as cabbage were also grown near the swampy grounds. Very few farms had any fodder crops although this is one of the FITCA project objective of encouraging farmers to grow more of it.

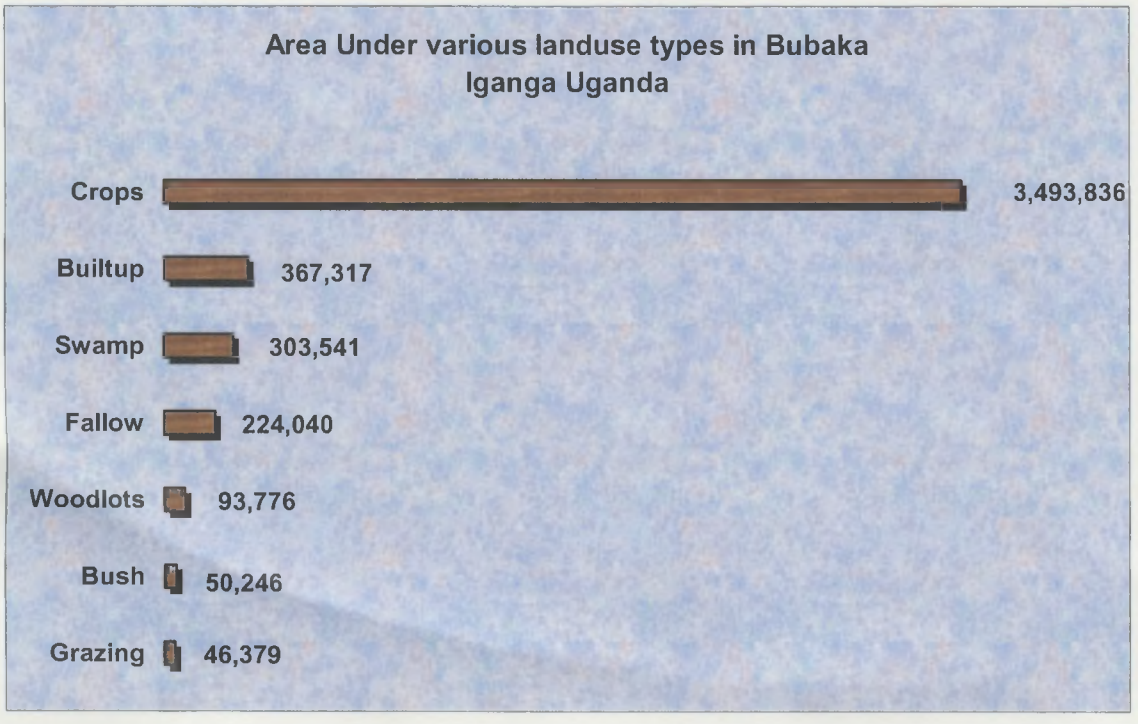
Built up Areas (8 %)

Bulamagi is a highly settled area due to its proximity to Iganga town and the Bulamagi shopping center. The built up areas were mainly made up of homesteads contributing over 7 % of total. The rest was made up of a single school and a church. The homesteads consists of houses, coffee, woodlots, bananas and a mixture of many other food crops such as maize and sweet potato. Just like in many parts of rural Basoga in Uganda, homesteads are distributed along the main tracks, which is a more efficient way of utilizing land. This causes less land fragmentation leaving most of the other land for cultivation. There were no fences or hedges around the homesteads or the farms making the mapping work easier.

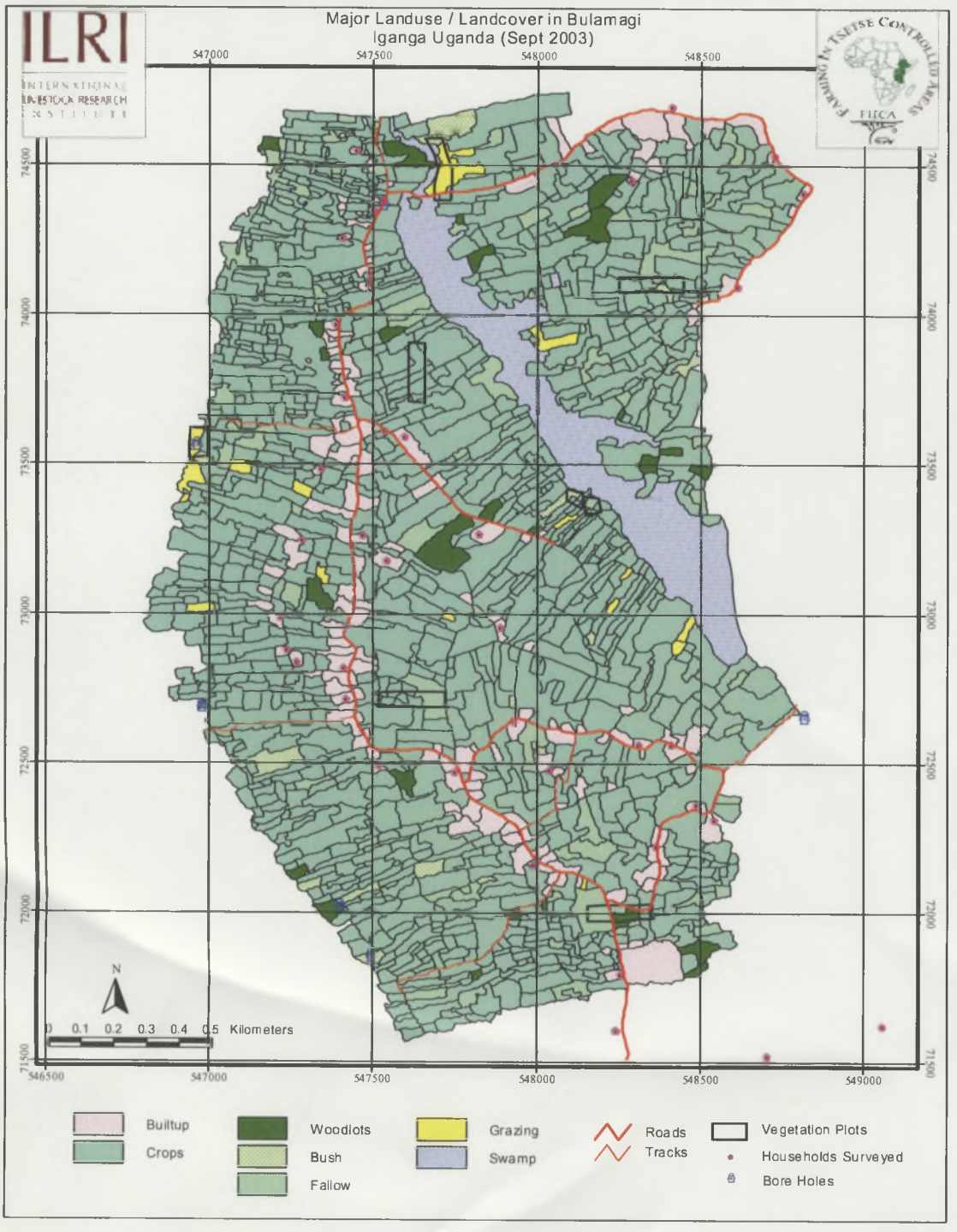
Table I -2: Major Land use area cover in the mapped area in Iganga

Class	Count	Area (Meters)	Ratio of total	Percent of total
Grazing	15	46,379	0.0101	1.01
Bush	18	50,246	0.0110	1.10
Woodlots	26	93,776	0.0205	2.05
Fallow	76	224,040	0.0489	4.89
Swamp	2	303,541	0.0663	6.63
Builtup	180	367,317	0.0802	8.02
Crops	1,148	3,493,836	0.7630	76.30
	1,465	4,579,135	1.0000	100.00

Fig 1 -I : Bar graph of area cover of major land use types



Map I -3: Major Land use Classes in Bubaka



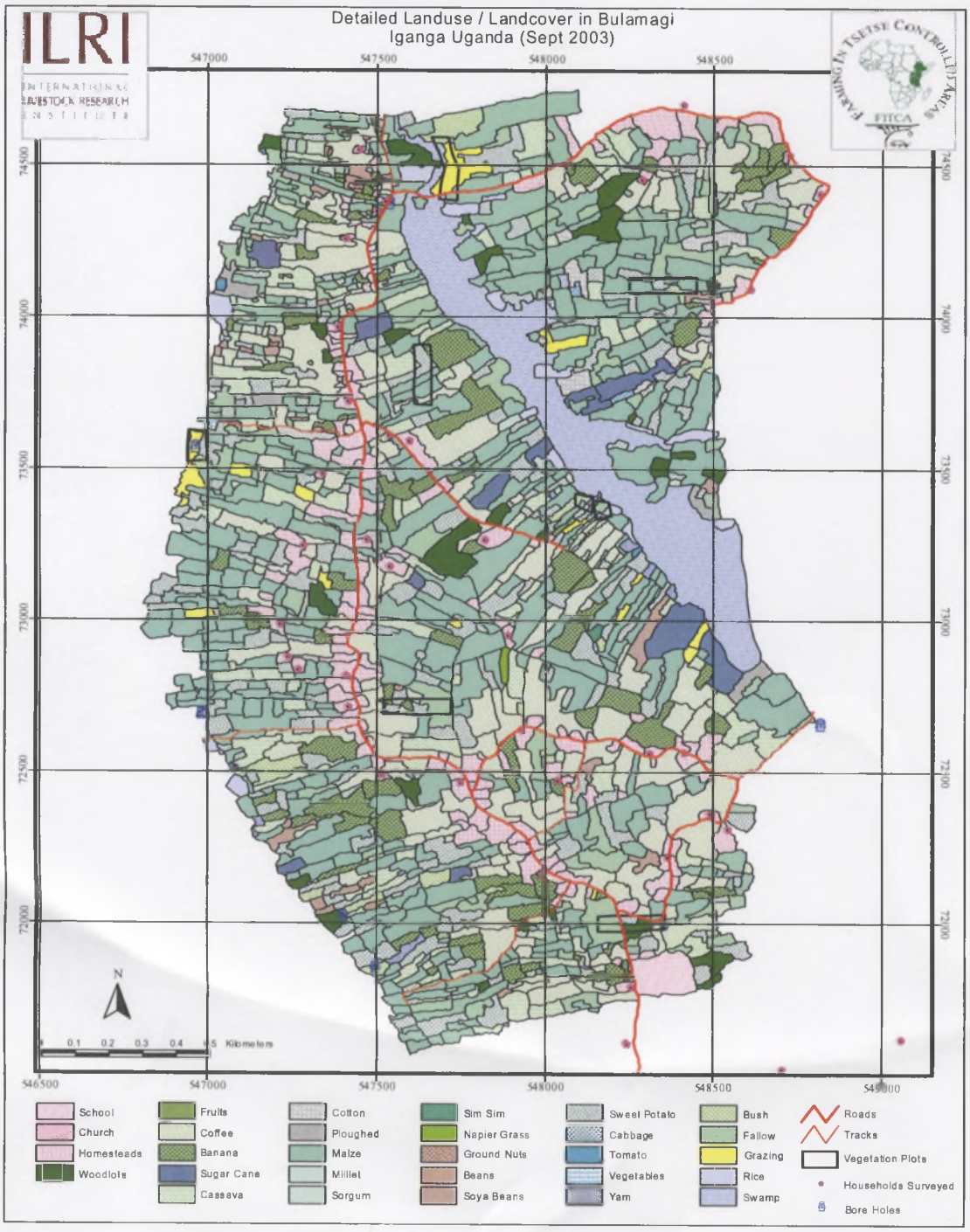
Natural areas (15 %)

Natural areas were dominated by the swamps and related vegetation of the swamp covering about 7 % of the total. Rice growing fields were found within the swamps although they were not easily accessible during this period. There were also cocoyam or arrow root crops grown within the swampy places. Other natural areas consisted of fallows and woodlots with very few bush and grazing areas. Some of the bushes near the swamps were being cleared through the assistance of FITCA project to create grazing areas.

Table I -3: Detailed Land use area cover Bubaka

Landuse Class	Count	Area (Meters)	Percent of total	Average Area	Minimum Area	Maximum Area
Church	1	295	0.01	295	295	295
Sorgum	1	949	0.02	949	949	949
Fruits	2	992	0.02	496	164	828
Sim Sim	1	1,674	0.04	1,674	1,674	1,674
Tomato	3	2,083	0.05	694	279	1,171
Napier Grass	1	2,703	0.06	2,703	2,703	2,703
Vegetables	6	3,207	0.07	534	156	1,183
Cabbage	3	3,217	0.07	1,072	385	1,558
Ground Nuts	6	3,262	0.07	544	320	772
Soya Beans	1	3,523	0.08	3,523	3,523	3,523
Milllet	5	7,450	0.16	1,490	453	2,203
Yam	10	10,042	0.22	1,004	173	3,205
School	1	23,440	0.51	23,440	23,440	23,440
Ploughed	12	27,065	0.59	2,255	453	7,124
Cotton	8	30,500	0.67	3,813	1,236	7,736
Beans	28	41,201	0.90	1,471	257	8,794
Rice	17	43,834	0.96	2,578	509	6,290
Grazing	15	46,379	1.01	3,092	238	13,636
Bush	18	50,246	1.10	2,791	236	12,501
Sugar Cane	11	80,315	1.75	7,301	1,998	19,413
Woodlots	26	93,776	2.05	3,607	556	17,321
Fallow	76	224,040	4.89	2,948	282	15,142
Banana	92	288,403	6.30	3,135	248	15,754
Swamp	2	303,541	6.63	151,771	1,249	302,292
Homesteads	178	343,582	7.50	1,930	169	11,535
Cassava	144	349,037	7.62	2,424	181	10,098
Sweet Potato	249	487,084	10.64	1,956	73	12,969
Coffee	152	720,617	15.74	4,741	278	23,212
Maize	396	1,386,675	30.28	3,502	156	29,012
	1,465	**4,579,135**	**100.00**	**8,198**	**73**	**302,292**

Map I -4: Detailed Land use Classes in Bubaka



Ground Survey Change indicators

The important parameters that can indicate change over time include the variation in terms of percentage cover between; natural areas/cultivated areas; area under perennial crops/annuals; size of farm fields and acreages or areas planted with different crops. These indicators combined with other complementary indicators derived from remote sensing and vegetation surveys are to be used to evaluate the environmental change over time (EMMC Report 2002). In this baseline survey, the total land area mapped was 4,579,135 m^2 (4.5 Km^2). The cultivated areas, which include annual and perennial crops, occupy about 76 % with annual and perennials crops occupying 34% and 42% respectively (*Table I -4).* The natural areas occupy about 15 % with the remaining 8 % for settlements and other infrastructures.

Table I -4: Ratios of Natural and Cultivated areas

Land use Class	Area (Meters Square)	Percent of total	Re-class
Church	295	0.01	Built up
School	23,440	0.51	Built up
Homesteads	343,582	7.50	Built up
Builtup	**367,317**	**8.02**	
Grazing	46,379	1.01	Natural
Bush	50,246	1.10	Natural
Woodlots	93,776	2.05	Natural
Fallow	224,040	4.89	Natural
Swamp	303,541	6.63	Natural
Natural	**717,982**	**15.68**	
Sorgum	949	0.02	Annual
Fruits	992	0.02	Annual
Sim Sim	1,674	0.04	Annual
Tomato	2,083	0.05	Annual
Vegetables	3,207	0.07	Annual
Cabbage	3,217	0.07	Annual
Ground Nuts	3,262	0.07	Annual
Soya Beans	3,523	0.08	Annual
Milllet	7,450	0.16	Annual
Yam	10,042	0.22	Annual
Ploughed	27,065	0.59	Annual
Cotton	30,500	0.67	Annual
Beans	41,201	0.90	Annual
Rice	43,834	0.96	Annual

Maize	1,386,675	30.28	Annual
Annuals	**1,565,676**	**34.19**	
Banana	288,403	6.30	Perennial
Coffee	720,617	15.74	Perennial
Napier Grass	2,703	0.06	Perennial Semi
Sugar Cane	80,315	1.75	Perennial Semi
Cassava	349,037	7.62	Perennial Semi
Sweet Potato	487,084	10.64	Perennial Semi
Perennials	**1,928,160**	**42.11**	
Cultivated	**3,493,836**	**76.30**	
Grand Totals	**4,579,135**	**100.00**	

Table I –5: Calculated X and Y Shifts

Sample way points	X Before Y Download	Before X Download	After Y Download	After X Download	X shift	Y shift
1	547,619.00	74,404.00	547,700.51	74,096.84	-81.51	307.16
2	548,395.00	68,377.00	548,476.59	68,071.18	-81.59	305.82
3	548,270.00	71,853.00	548,351.69	71,547.12	-81.69	305.88
4	547,236.00	70,895.00	547,316.91	70,588.80	-80.91	306.20
		Average Shift			**-81.42**	**306.27**

PART

II

Analysis of vegetation structure, composition and abundance in Bubaka village Iganga

Uganda

INTRODUCTION TO VEGETATION ANALYSIS

Unlike all other EMMC sites in Uganda, Iganga was selected as district for environmental monitoring and no specific village was selected. The sole reason to implement EMMC activities in Iganga was to capture changes in land use in the wetlands (Stephanie *et. Al.* and Maitima *et. Al.*). Bubaka village was selected as the study site for several reasons some of which are: i) the prevalence of human sleeping sickness in the village, ii) presence of a large wetland within human setllement areas. This selection was also guided by a decision by Uganda FITCA project to put more emphasis on human trypanosomosis, as it was a big threat to livelihoods.

One reason for not selecting a specific village at the time of project conceptualization was the need to link EMMC activities with FITCA project activities that had not been formulated by that time. By the time EMMC consultants report on site selection was prepared, FITCA Uganda was in the process of designing activities for different regions.

During the period for this survey, consultations and discussions were made on the activities underway in all the sub-counties of Iganga in order to identify areas to implement EMMC activities. At the same time a reconnaissance survey was done within the sub county to identify environmental situations and assess areas where tsetse control interventions may have a most severe environmental impact. Within Iganda Bulamangi parish had been earmarked for two interventions that require environmental monitoring. These two interventions are: 1) pasture and animal feed development; 2) promotion of animal traction.

PURPOSE OF STUDY

Like in other EMMC sites the purpose of this study was to develop an ecological basis upon which an environmental monitoring system can be developed to sustain farming activities after tsetse control. Buyuba Busiri is highly cultivated and after FITCA interventions changes may lead to intensification of land use activities.

Ecological changes associated with land use intensification include loss of soil fertility as land is not allowed to fallow, and loss of above ground biodiversity. These changes affects productivity in a gradual process such that a farmer will realize the negative impacts only when it is too late for an economical intervention. This is in deed the case in semi-arid areas like FITCA regions where environmental processes operate under narrow ecological limits of economic viability.

The long-term objective of this study is therefore to identify and define these limits with a view of developing a framework for ecological interventions to maintain and sustain agricultural production in FITCA areas. In more short terms this study is aimed at developing an ecological baseline or an environmental profile upon which future changes can be assessed.

METHODS

The location of sampling plot for vegetation and landscape analysis was selected on site based on landscape form, land use characteristics and the distribution of natural vegetation in the region.

A total of six sampling plots comprising of two in natural non grazed habitats, two in natural grazed habitats and two in cultivated habitats, were selected each consisting of 1 hectare in area. The plots were selected at random and nested in land cover categories.

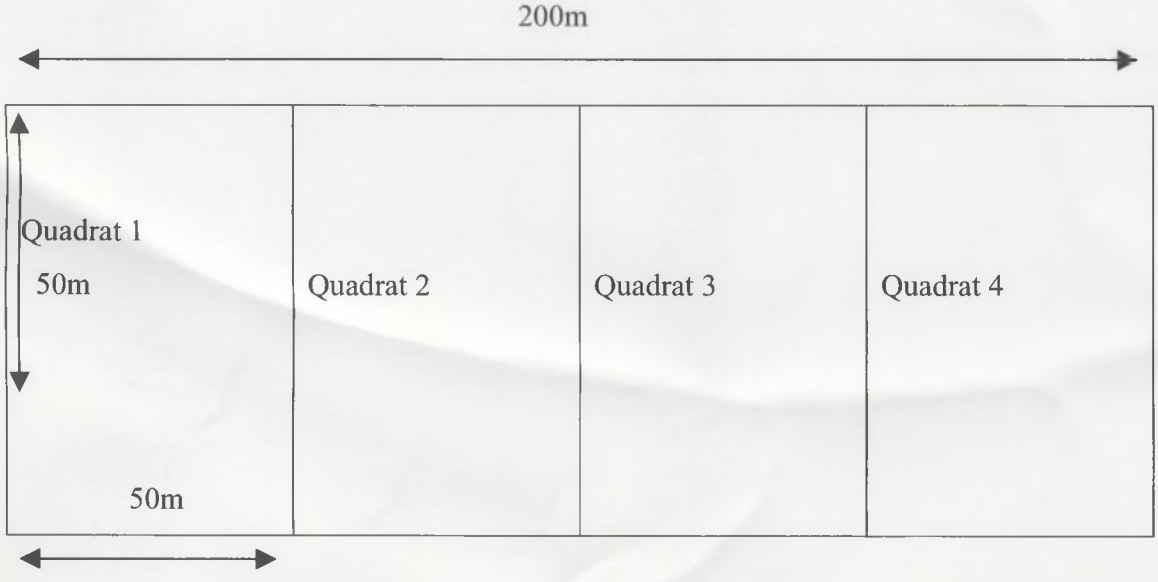
Each plot was further divided into four (4) grids in a row each measuring 50x50m giving rise to a plot measuring 50x200m. Vegetation characteristics in the form of species types, composition and abundance in each of the three life forms (trees, shrubs and herbs) were analyzed and recorded in standardized field data sheets.

Study on plant species diversity was done using standard quadrat sampling methods. The study was done in the three life forms and canopy stratifications i.e., tree, shrubs, and herbs. Sampling of trees was done using 50x50m quadrats, shrubs by use of 25x25m quadrats and herbs by use of 1x1m quadrats.

All the four 50x50m quadrats in the plot were analyzed for tree species. In each of the four grids / tree quadrats one 25x25m quadrat was sampled for shrub species. The ten 1x1m quadrats were sampled two in each of the four quadrats and the remaining two were made on the dominant land cover or land use in the area. In each of the quadrats studied information on species present was collected as per life form. Estimates on percentage cover per quadrat for each species present was made by visual observation and expressed as a percentage of the total quadrat area. The above ground height of each individual plant in the quadrat was estimated visually.

Sampling Plan

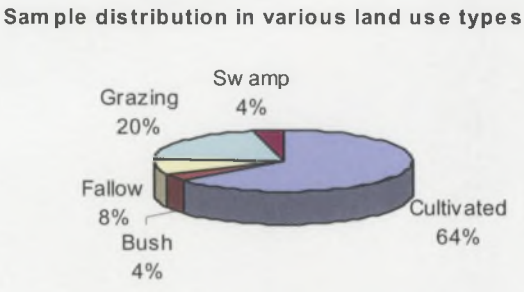
Plot 1



RESULTS

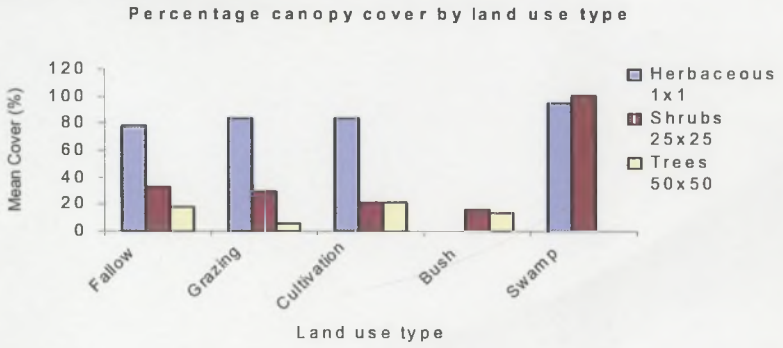
Data from the field was used to create a database on vegetation in Bubaka village of Iganga district using SPSS. The database will be stored and for future references on various aspects of vegetation in the study area. The analysis presented here is part of the information that can be obtained form the database.

Fig. II –1: Sample distribution in various land use types



This diagram (fig *II –1*) shows the distribution of samples in different land use types in the study area. Cultivation is by far the highest sampled as 64 % of the quadrats were made in the cultivated areas. From the detailed GIS mapping of the area cultivated area was 76% swamp, 6% fallow 4%, grazing and bush were each only 1 % of the total area mapped in the village. Except for the grazing that was over sampled the rest of the land use types were sampled close to their proportions in the landscape.

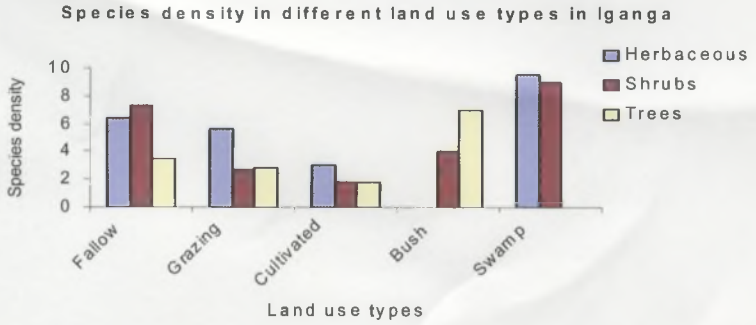
Fig. II –2: Percentage canopy cover by land use type



Herbaceous plant covers appear to be almost the same in all the land use types but with a slight increase within the swamps. Trees appear to have been absent in the swamps. Presence of trees in the grazing areas was very low indicating that they were overexploited. Cutting of trees in the grazing areas was done to create space for grass. In the field we noticed freshly cleared areas meant to be grazing areas for the FITCA animals to be used in animal traction.

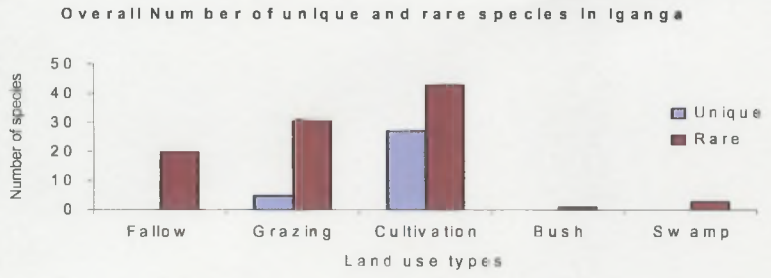
Shrubs show a very interesting variation in canopy cover. The lowest cover is in the areas designated as bush while the highest shrub cover is in the swamps. Despite the fact that 4% of the areas sampled and only 1 % of the area is under bush, results indicate that there were very low canopy covers for shrubs and trees in the bushed areas.

Fig. II –3: Species density in different land use types



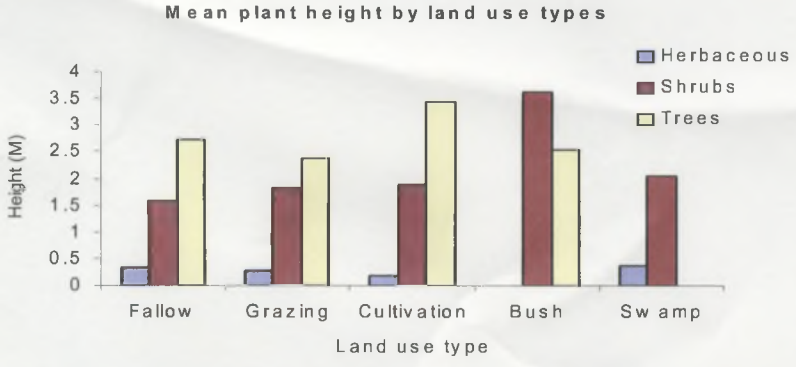
Species density for shrubs and herbs is highest in the swamps. Trees have the highest density in the bush. Fallows are second to swamps in importance on species density in shrubs and to a lesser extent the herbaceous life forms. Cultivated areas have the lowest density of species.

Fig. II –4: Overall number of unique and rare species in Iganga



This diagram (*Fig II –4*) show that it is only in the cultivations and to a less importance in the grazing that species distribution show a uniqueness or appear to be more evenly distributed. Within the fallows, bush and swamp there is absence of unique or more common species. Presence of rare species is highest in the cultivation, grazing and fallows.

Fig. II –5: Mean plant height by land use types



A general observation in this diagram (Fig. II –5) is that plants are much shorter than would be expected in an environment like that of Iganga. The mean height for trees ranges only from 2.5 to 3.5 meters in all the land use types. Height of shrubs range from 1.5 to 3.5 meters. In environments like Iganga trees should grow to 5.0 meters and above but because of harvesting they are not let to grow into maturity. Similarly the mean height for shrubs is also low and could be for the same reason of excessive harvesting.

PART

III

Human Perceptions on Environmental changes

HOUSEHOLD INFORMATION

Age of Household Head

The most common age class for the household heads was 36-40. The other age classes were, 26-30, 31-36, and 41-50, 46-50 years, with each category constituting less than three households. There were no male household heads in the age class of 46-50, no female household heads in the age categories of 56-60, 66-70 and over 70 (*Figure III -1*). In general, there were more male-headed households than female-headed households. At national level, the majority of household heads are in the age group of 26-49 (Uganda Bureau of Statistics, 2003).

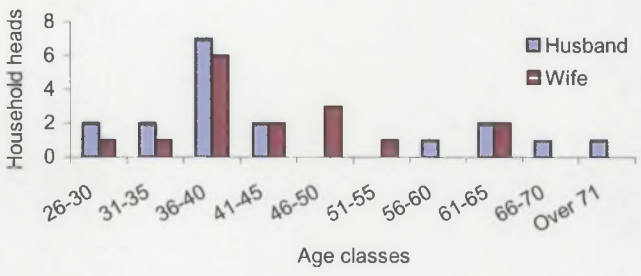


Fig III –1: Age classes of household heads in Bubaka village, Iganga District.

Education level of Household Heads

Primary level education is the most common educational attainment for both male and female-headed households. Less than five households had household heads with secondary and post secondary levels education. Less than five households had heads with no education at all and there more wives than husbands in this category (*Figure III -2*).

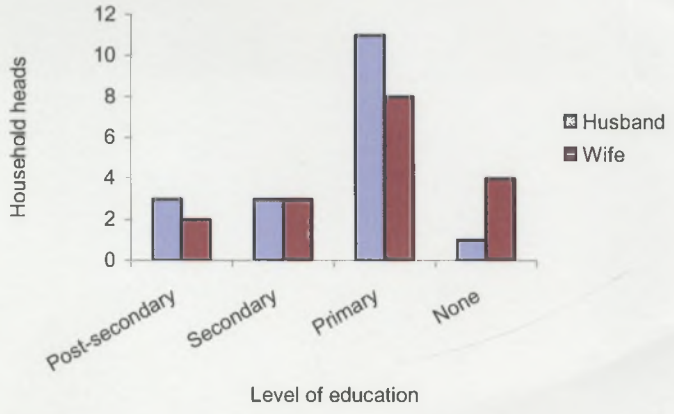


Fig III –2: Education level of household heads in Bubaka village, Iganga District

Duration of stay by households in the area

Most of the households have been present in the area for over twenty years, while less than two households have lived in the area for 10-20 years and the same number have stayed in the area for less than 10 years as shown in *Figure III -3* below.

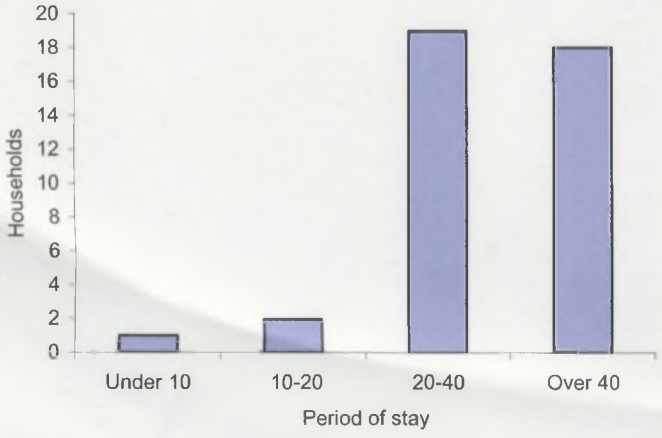


Fig III –3: Duration of stay by households in Bubaka village, Iganga District

Land Use Activities

Main occupation

The main occupation of the household heads for the last ten years was farming. However, farming as an activity has increased in the last ten years while employment and trading have declined. School attendance and hunting were only activities engaged in the past and are not currently very predominant. These findings are shown in *Figure III -4.*

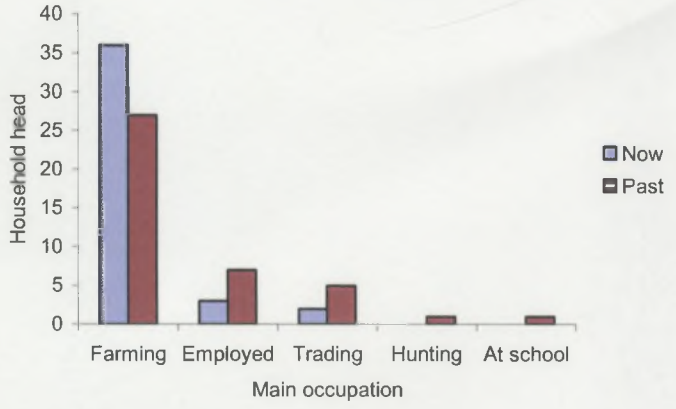


Fig. III – 4: Main occupation of the household heads in Bubaka village, Iganga District

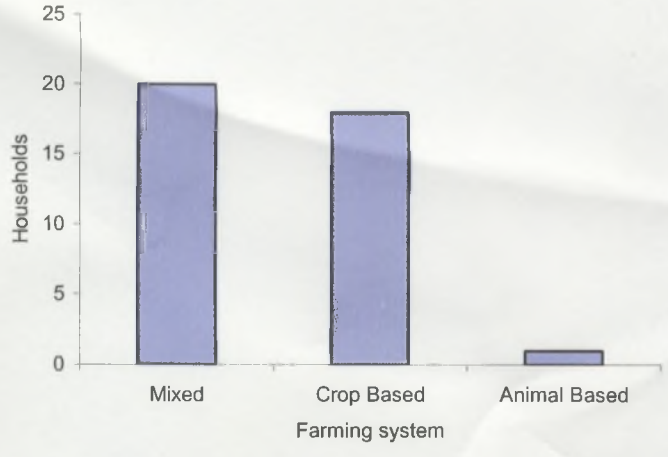


Fig. III –5: Farming systems practiced by households in Bubaka village, Iganga District

Land ownership

Land availability is a critical issue in most parts of the country as population continues to grow at over 3% per annum. In Bubaka village, the majority of households have less than five acres of land. There are more households with less than five acres of land now than ten years ago as shown in *Figure III -6* below.

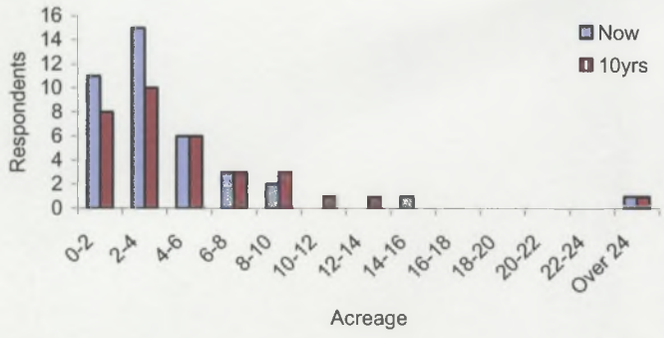


Fig. III – 6: Land ownership now and in the past in Bubaka village, Iganga District

Renting and hiring of land is a common phenomenon in the area. The majority of farmers hire one acre of land, while very few hired more than two acres. An interesting observation was that there were more farmers hiring land as compared to those renting land. This is a clear indicator of scarcity and unequal access to land in the area (*Figure III -7*).

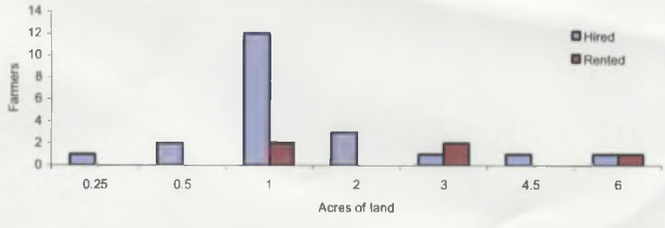


Fig III – 7: Amount of land in acres, hired or rented by farmers in Bubaka village, Iganga District

Unlike Soroti district where grazing is the predominant land use activity, the two main land use activities in Bubaka village are wood/forest tree lots and cropping. This variation in land use is due to differences in agro-ecological potential. Soroti district lies in the semi-arid north-eastern part of the country while Iganga lies in the high rainfall Lake Victoria basin. The other land use activities include fallow, grazing and fodder growing. This is shown in *Figure III -8.*

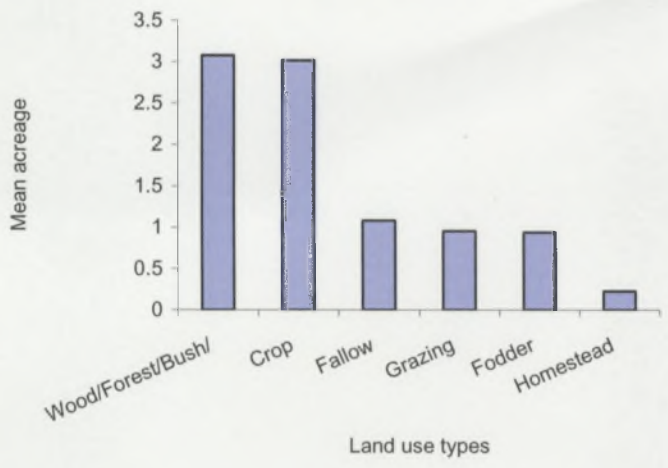


Fig III –8: Land allocation into different uses in Bubaka village, Iganga District

Crop Production

The main crops grown for both seasons of the year are maize, beans potatoes, cassava, soya beans, and groundnuts. Maize, beans and potatoes are the three main staple foods in the areas and are also important sources of income. Coffee is also being increasingly produced as a cash crop in the area. The other crops grown on small scale include banana, millet, sweet potatoes and sorghum (*Figure III -9*).

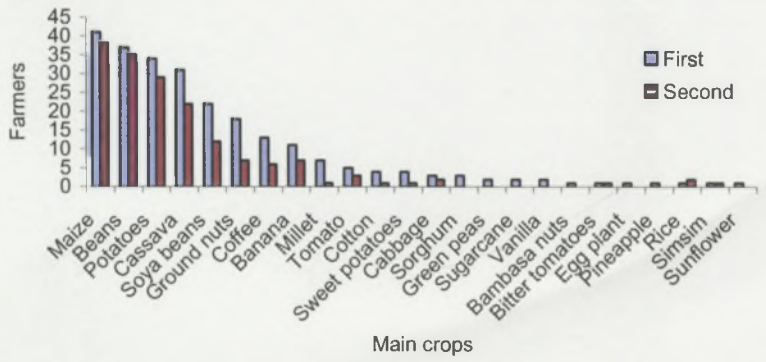


Fig III – 9: Main crops grown by farmers in the first and second seasons in Bubaka village, Iganga District

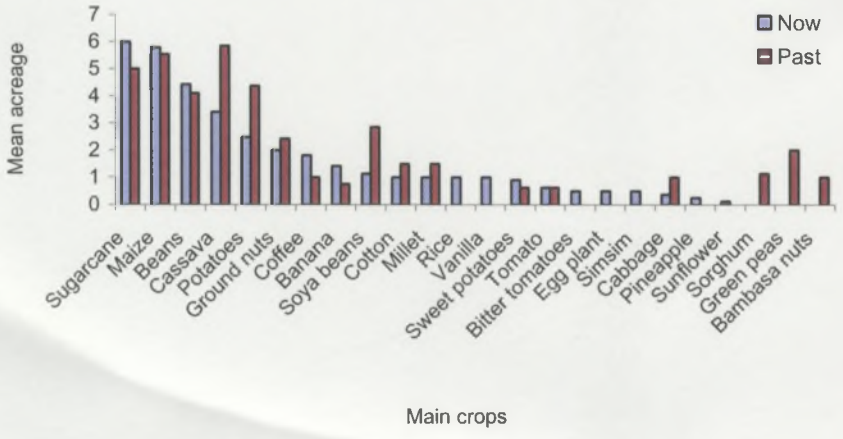


Fig.III –10: Amount of land grown with main crops now and ten years ago during the first in Bubaka village, Iganga District season

In terms of acreage, however, sugar cane is allocated more land than any other crop, followed by maize. This could be attributed to the fact that this village has many sugar cane out growers with ready market from the sugar plant at Kakira in Jinja District. Land allocation to maize is not surprising given that the crop has emerged as a major non-traditional cash crop in Uganda in the recent years. On the other hand, land allocation to cassava and potatoes has

declined in the last ten years and this could be as a result of disease (especially cassava mosaic) and land shortage. Sorghum and green peas grown ten years ago are not grown today in Bubaka village. As shown in Table 1, production is mainly for home consumption with smaller quantities being sold for income. Some crops have been abandoned mainly of lack of market, inadequate labour and poor yields. The other reasons cited include, pests and diseases and land shortage.

Crop husbandry practices

The most common cropping patterns are mono-cropping and intercropping and the system seems not to have changed much over the last ten years (*Table III -1*). The main sources of seed today include selection from previous harvest, market, borrowing, and to a limited extent from Cooperatives. Purchase from the market and borrowing as sources of seed have increased in the last ten years while Cooperatives have slightly increased over the years. Pest control as a husbandry practice is very limited in use, although it has slightly increased in the last ten years. This could be attributed to the high prices of chemicals and lack of awareness of benefits.

Table III –1: Common seed sources, cropping and harvest uses now and ten years ago during the first season in Bubaka village, Iganga District

		Now	Past	Difference (past-now) (N=256)
Seed source	Selection	143	130	-13
	Market	25	11	-14
	Borrow	14	1	-13
	Cooperative	5	4	-1
Cropping pattern	Inter	89	74	-15
	Mono	99	72	-27
Pest control	Chemical	18	8	-10
	None	155	122	-33
Harvest use	Home	125	75	-50
	Sale	31	25	-6
	Sale/Home	31	46	15

Unlike in Soroti district where animal traction is the predominant land preparation method, the hand hoe is the main implement used in Iganga District (*Table III -2*). Only seven households are using ox-plough for land preparation in Bubaka village today, while nine used it ten years ago. There is no clear understanding of this distinction but it is likely to be as a result of cultural influence and soil types.

Table III –2: Crop and land management now and ten years ago in Bubaka village, Iganga District

Crop / Land management		Now	Past	Difference (past-now) N = 187
Land preparation	Hoe	159	160	1
	Panga		8	8
	Ox-plough	7	9	2
	Tractor	187	5	-182
Planting	Hoe	175	182	7
Weeding	Hoe	175	181	6
	Chemical	1	1	0
Soil fertility management	Manure	16	18	2
	Fertilizer		1	1
	None	163	163	0
Harvest	Manual	176	182	6
Labour source	Family	101	112	11
	Hired	11	3	-8
	Both	65	67	2

Other husbandry activities like planting, and weeding are entirely done using the hand hoes and the practice has not changed much in the last ten years. Only one household uses chemicals for weed control.

Soil management practices

Application of fertilizers is non-existent in the village, while only sixteen farmers use manure. This could be attributed to perception farmers about the fertility of soil. The majority of farmers believe that soil infertility is not a problem (*Table III -3*). However, soil erosion is

recognized as a problem and farmers are well aware of the causes. The main erosion control practices are terracing and strip cropping, and to a limited mulching.

Table III –3: Soil erosion and soil infertility, causes, indicators and control methods in Bubaka village, Iganga District

		Respondents N = 42
Erosion	Present	39
	Absent	3
Erosion causes	Heavy rains	3
	Topography	37
Erosion control	Mulching	1
	Strip cropping	11
	Terracing	18
Soil infertility	Present	29
	Absent	13
Indicators of soil infertility	Over used soil	1
	Poor crop yields	28
	Nutrient leaching	1

Livestock Ownership and Management

Livestock ownership

The main livestock kept in Bubaka village, Iganga district are chicken, goats and to a limited extent cattle and pigs (*Figure III -11*). The low numbers of household keeping cattle is not surprising knowing that Iganga district is not in the 'cattle corridor' (a stretch of area where cattle keeping is a predominant activity) of Uganda. An interesting observation, however, is that the number of households keeping livestock has been declining for the last ten years.

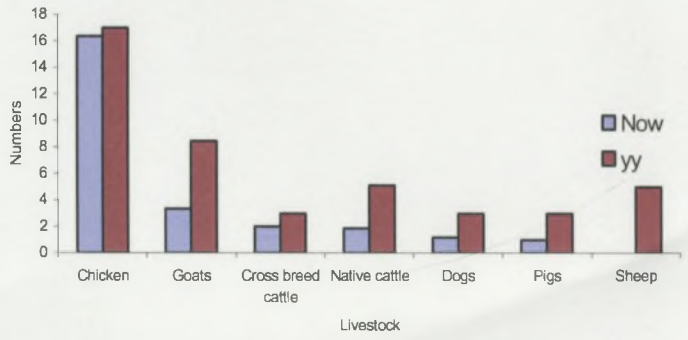


Fig III –11: Number of animals kept in the past and today in Bubaka village, Iganga District.

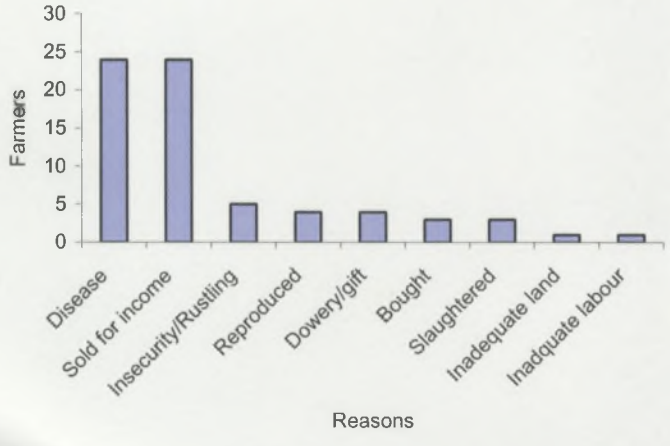


Fig. III –12: Reasons for differences in the number of livestock today and in the past in Bubaka village, Iganga District

The main reasons for this trend are livestock disease and sales of animals (*Figure III -12*). Iganga is one of the districts in Uganda with high prevalence of animal trypanosomosis and this indeed could explain the low cattle density. The other reason that could be responsible for low cattle density is land shortage. With the majority of households having less than five acres of land, cattle keeping become difficult and most farmers resort to cropping given the agro-ecological potential of the area.

Livestock products

The main livestock product from which farmers obtain income is milk (*Table III -4*). However, only ten households earned income from milk, while four households earned income from sales of animals. This is a clear indicator that cattle keeping is a not a major source of livelihood in the area.

Table III –4: Cattle products and sources of income to farmers in Bubaka village, Iganga District

Income sources	Farmers (N=42)
Milk	10
Adult	4
Calf	0
Ox rent	0
Manure	0
Skin	0

Grazing systems

The main cattle keeping system is free-ranging/tethering and the predominance of the system seems not to have changed much in the last ten years. One farmer is implementing zero grazing practices now and none used to ten years ago. However, as land availability continues to dwindle, zero grazing is likely to become the only viable system. There are on-going efforts by government through the Ministry of Agriculture, Animal Industry and Fisheries to distribute free crossbred heifers for zero grazing to farmers in the southeastern Uganda, including Iganga District.

Table III –5: Cattle keeping system now and ten years ago in Bubaka village, Iganga District

Cattle keeping system (N=39)		**Free-ranging/ Tethered**	**Zero Grazing**	**Combined Free-/ Zero grazing**
Zebu	Now	18	0	0
	Ten yrs ago	19	0	1
Dairy	Now	0	1	0
	Ten yrs ago	0	0	0

There is no marked variation in availability of grazing resources in the different seasons of the year. Farmers mainly use own pasture and uncropped land during the dry and wet seasons. There is very limited use of neighbours' pasture and uncropped land in both seasons of the year now and in the past. Unlike in Akoroi village, Soroti District, there is no public land for grazing in Bubaka village.

Table III –6: Main grazing areas during wet and dry seasons now and ten yrs ago in Bubaka village, Iganga District

N = 42			
Grazing areas -today		Wet	Dry
Own	Pasture/uncropped land	14	15
	Post harvest cropped	5	5
Neighbours	Pasture/uncropped land	4	4
	Post harvest cropped	4	4
Public land		0	0
Grazing areas -past			
Own	Pasture/uncropped land	13	13
	Post harvest cropped	3	3
Neighbours	Pasture/uncropped land	6	6
	Post harvest cropped	4	4
Public land		0	0

Water sources

The main sources of water for cattle are rivers/streams, boreholes, and to a limited extent wells and lakes/ponds (*Figure III -13*). The use of bore hoes as a source of water is increasing as more of them are sunk in almost all villages in south-eastern Uganda, by RUWASA, a project within the Water Department.

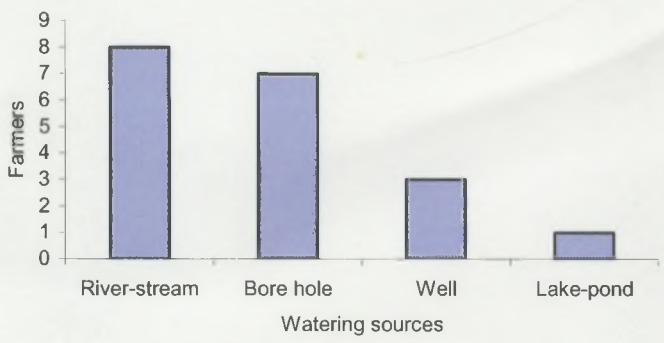


Fig. III –13: Main watering sources for the cattle in Bubaka village, Iganga District

Perceived trypanosomosis prevalence and control

Only ten respondents perceived trypanosomosis to be a problem, while thirty two did not perceive it to be a problem. On trypanosomosis control, fourteen respondents mentioned a combination of drugs and traps, while only two mentioned traps only, two mentioned drugs and one mentioned communal crush spraying. An important observation was that respondents did not know of any environmental implications of tsetse control. Only one respondent thought tsetse control could contaminate water sources. These results are shown in *Table III - 7.*

Table III –7: Perceived trypanosomosis prevalence and its control methods in Bubaka village, Iganga District

N = 42		
		Farmers
Is it a problem?	Yes	10
	No	32
Control methods if present	Crush pen	1
	Drugs	2
	Traps	2
	Combined drugs and traps	14
Reasons for non control where present	Lack of know how	1
	Drugs expensive	2
Implications of control to the environment	Water source contamination	1

Vegetation types

Knowledge of plant species

Less than ten of the respondents were able to name plant species found in the area today. More than thirty of the respondents were able to name plant species that have disappeared from the area (*Figure III -14*).

Fig III –14: Knowledge of particular plants that have disappeared or are disappearing from the area in Bubaka village, Iganga District

Wildlife Biodiversity

Changes in wildlife types and numbers

The main types of wildlife were birds, mammals, reptiles and rodents (*Figure III -15*). Although all wildlife types show a declining trend in numbers in the last ten years, the magnitude seems to be more pronounced for mammals and rodents. Hunting and deforestation are mostly to blame for the dwindling numbers of wildlife (*Figure III -16*).

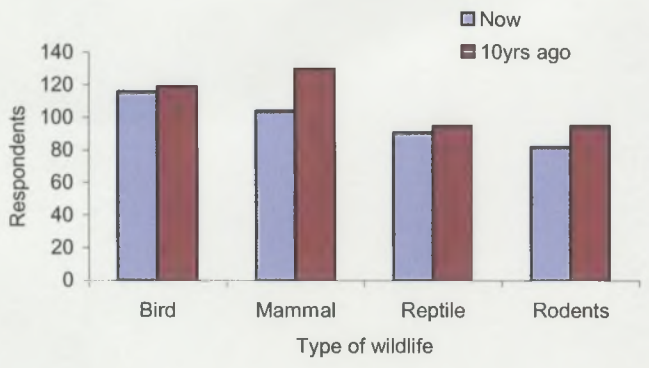


Fig. III –15: Type of wildlife found in the area today and ten years ago in Bubaka village, Iganga District

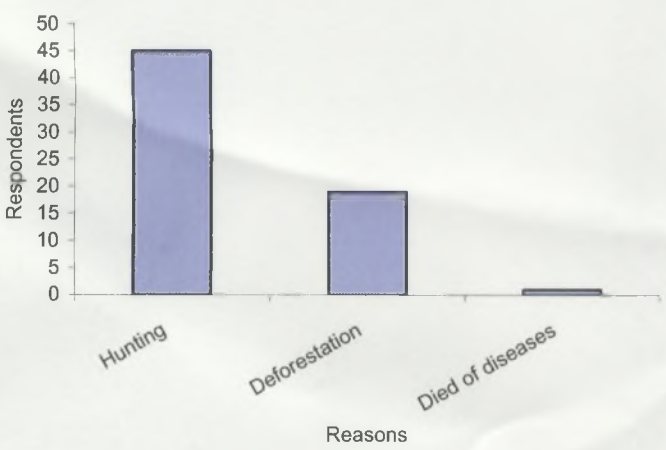


Fig. III –16: Perceived reasons for wildlife disappearance in Bubaka village, Iganga District

The habitat most affected by wildlife disappearance is bush, followed by forests, and swamp-grassland. The habitat least affected by wild life disappearance is the river line areas. Results are shown in *Figure III -17* below.

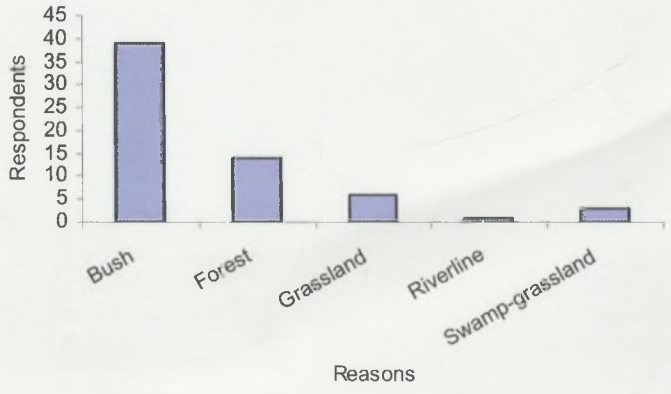


Fig. III –17: Habitats most affected by wildlife disappearance in Bubaka village, Iganga District

Wildlife conflicts

Human/wild life conflicts are a problem in Bubaka village. Ten of the respondents rated wildlife conflicts as of high magnitude, twenty rated them as of moderate magnitude, while less than five rated the conflicts as of low magnitude. The main source of conflict mentioned was crop destruction and preying of chicken. To a very limited extent poisoning of livestock was also cited. The other minor source of conflict mentioned was harboring of tsetse flies. These findings are shown in *Figures III -18 and 19.*

Fig. III – 18: Human wildlife conflicts in the area in Bubaka village, Iganga District

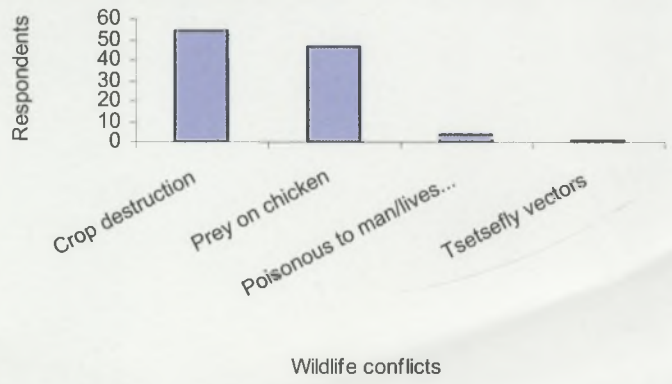


Fig. III –19: Nature of wildlife conflicts in Bubaka village, Iganga District

Water resources

Domestic water sources

The main source of water for domestic use now is boreholes (*Table III -8*). The use of bore holes as a source of water for domestic use has dramatically increased in the last ten years. This is a result of efforts of district local governments and Non Governmental Organisations (NGOs) to provide clean water to rural communities. This has led to a corresponding decline in the use of rivers and streams as sources of water for domestic use.

Table III –8: Main domestic water sources now and ten years ago in Bubaka village, Iganga District

Source	Season	Past	Now
River/Stream	Dry	27	5
	Wet	23	5
Well	Dry	8	2
	Wet	15	2
Bore hole	Dry	0	34
	Wet	1	35
Lake/Pond	Dry	6	1
	Wet	2	0
Spring	Dry	0	0

	Wet	0	0
Roof catchments	Dry	0	0
	Wet	0	0
Piped water	Dry	0	0
	Wet	0	0

The perceptions of the respondents indicate that water for domestic is not polluted. Only four respondents thought water was polluted. Furthermore, the majority of respondents believe their water is clean, safe and that it has a very good taste (*Table III -9).*

Table III –9: Perceived water quality in Bubaka village, Iganga District

N = 42		
		Respondents
Pollution level	Not Polluted	37
	Fairy polluted	4
Cleanliness	Dirty	4
	Fairly clean	9
	Very clean	28
Taste	Bad	6
	Fairly good	7
	Very good	28
Safety	Safe	33
	Unsafe	9

Seasonality of access to water

The majority of households in Bubaka village move less than a quarter of a kilometer to fetch water in both the dry and wet season (*Figure III -20*). The number of households within this range increases in the rainy meaning that water becomes more easily accessible at shorter distances. In the wet season, for example, households with iron-roofed houses are able to harvest rainwater and use it for domestic purposes.

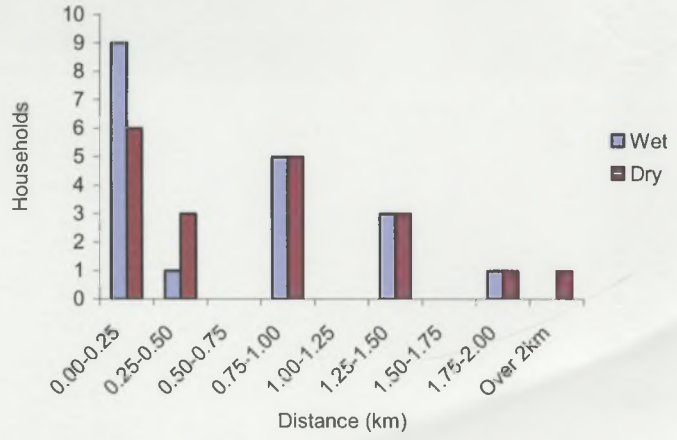


Fig. III –20: Distance from households to domestic water sources during wet and dry seasons in Bubaka village, Iganga District

Fuel Resources

Fuel sources

There are three main sources of fuel, namely trees, bush/forest, paraffin and to a very limited extent charcoal. There has been a marked decline in the use of bush/forests as a source of fuel in the last ten years. This could be as a result of government restrictions aimed at conserving forests. As a result, there is an increase in the use of own trees and charcoal as source fuels not used ten years ago as shown in *Figure III -21*. At the national level, the use of charcoal increased from 14% in 1999 to 18 % in 2002, while the use of firewood has gone down from 84% to in 1999 to 78% in 2002 (Uganda Bureau of Statistics, 2003). In Bubaka village, the most important and sued source fuel dry wood, followed by paraffin and maize stalks as shown in *Table III -10*.

The main reason given for changes in availability of fuel is clearing of forests. Due to increasing population growth, there has been serious encroachment on forests for cultivation, firewood and logging for timber. The other reason cited is scarcity, which is it itself a result of high rates of product use in relation to replenishment.

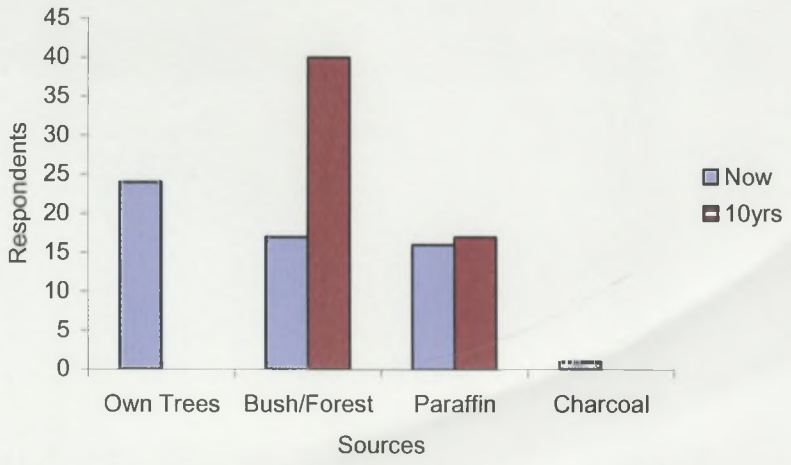


Fig. III –21: Sources of fuel now and ten years ago by importance/usage in Bubaka village, Iganga District

Table III –10: Ranking of fuel sources in order of importance by usage in Bubaka village, Iganga District

(N = 120)				
Rank	Dry wood	Paraffin	Maize stalks	Charcoal
1	40			
2		36	3	
3		3	32	1
4			1	4

Availability of fuel related environmental products

The majority of respondents believe natural forests are disappearing, which could be as a result of human encroachment for purposes of agriculture, logging for timber and charcoal making. Similarly, many respondents believe access to natural forests is very limited and this again could be as a result of government restrictions. The respondents also believe that the forest cover has decreased mainly as a result of encroachment by cultivators and increased population pressure (*Table III -11*).

Table III –11: Fuel related environmental variables now and ten years ago in Bubaka village, Iganga District

Environmental factors		Respondents N = 39
Natural forests availability	Present	1
	Absent	41
Natural forest access	Present	1
	Absent	41
Forest cover trends	Decreased	41
	No Change	0
Reasons for observed trends in forest cover	Crop cultivation	23
	Population pressure	16
	Charcoal burning	1

Forest Products

The main forest products are medicinal plants, grass, honey, fibres, medicinal plants, firewood and wild fruits. The other products obtained from the forests are poles, craft materials, and wild animal meat. There has been a decline in the use of all forest products in the last ten years. The most affected forest products are wild animals (meat), craft material and wild fruits. These findings are shown in *Figure III -22*.

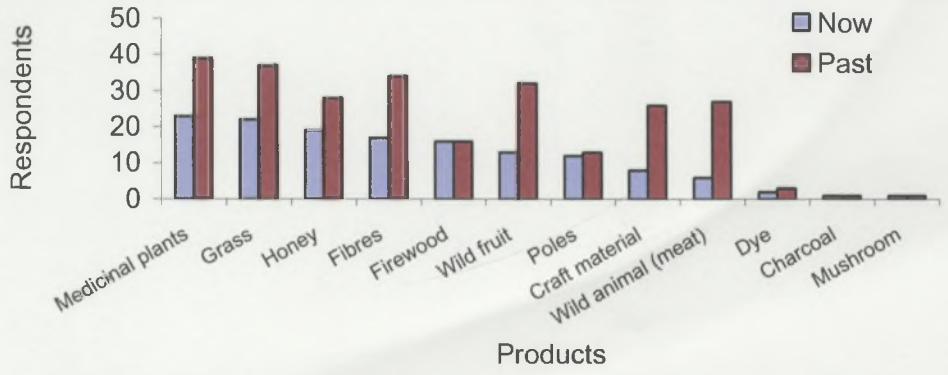


Fig. III –22: Forest/bush products obtained now and in the past in Bubaka village, Iganga District

The most regularly used forest product is firewood, while grass, honey, wild animals, medicinal plants, fibres and wild fruit are rarely used (*Figure III -23*). The main reason given for the low use of these products is scarcity. The other minor reasons cited are change in diet and lifestyle and necessity as shown in *Table III-12*.

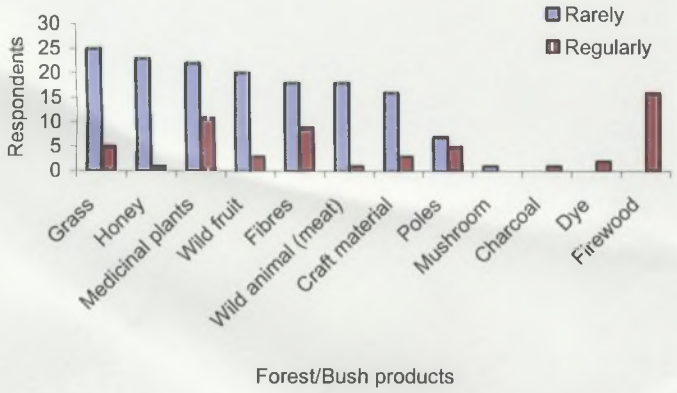


Fig. III –23: Level of forest/bush products use in Bubaka village, Iganga District

Table III –12: Rare and non-use of bush and forest products today compared to ten years ago in Bubaka village, Iganga District

Product name	Use	Reason for rare and non use N = 259			
		Lifestyle & diet change	More access to Healthcare	Scarcity	Necessity
Fibres	Construct-Build				1
	Ropes	1		18	
Grass	Construct-Build				1
	Thatching	1		19	3
Honey	Food	2		21	1
	Food-medicine				
Medicinal plants	Medicine	1	1	17	
Poles	Construct-Build				6
Bush meat	Food	1		16	
Wild fruit	Food	1		20	1

Ease of access to forest products

The perceptions of respondents indicate that it is now less easier than it was ten years ago to access forest products. This as a result of scarcity of products as human population and, hence demand for the products, continues to increase. Unless something is done to curb the situation forests cover is likely to completely disappear leading to environmental problems. These findings are shown in *Figure III -24*.

Fig. III – 24: Obtaining forest/bush products now and ten years ago in Bubaka village, Iganga District

DISCUSSIONS

Landscape in Iganga is characterized by cultivations. Within the EMMC Mapped area of Bubaka village close to 80% comprises of cultivations. Land under natural vegetation is only 15% half of which is in the swampy areas. Much of the other half is in riverine water courses and grazing areas. There are no true forests in Iganga. Within the mapped area with woody tree resources is some 2% of the land surface that was identified to have woodlots.

In Iganga like in Kamuli and Busia (Kamuli and Busia reports: Maitima, et. al. 2003 Kamuli; and Maitima, et. al. 2003 - Busia) demand for woody resources is high. The situation in Buyuba Busiri is very similar to that of Busia township in Kenya. In both places proximity to major towns provides ready markets for products like charcoal and construction bricks. Within Bulamagi Parish where the EMMC mapped Buyuba Busiri village is located there were large quantities of bricks being made for the market in Iganga town. This mass production of bricks has resulted into heavy harvesting of large plants that are suitable for making fire.

There are no tree nurseries in the area despite presence of several exotic tree species like Grevellia and Eucalyptus. Introduction of tree nurseries with fast growing plant species could be very useful. Because of the high demand there is a possibility that tree planting as a commercial enterprise can be viable.

Iganga district has many wetlands some of which have water all the year round. These wetlands are protected by the central government but since the central government is very thin on the ground, enactment of these laws is left mainly to the local councils. In Uganda decisions are made mainly made by the local communities. Local communities are likely to value activities that have individual and more immediate gains than those that are of public goods and long term benefits like wetland conservation. This is why most of the wetlands that are not waterlogged are now grazing areas and those that are waterlogged are cultivated. Protection of wetlands must be made in a way that the local communities especially those adjacent to the wetland can benefit in a way or the other either by mapping out areas that can

be utilized without draining the swamp or planting selected animal feed crops that can be sold to animal keepers who are away from the swamps.

The surrounding residents also use water resources within the swamps for domestic purposes. At the same time agricultural chemical wastes including those used to spray livestock to control trypanosomosis wash into the swamps. There is a need to monitor the concentrations of these chemical wastes in the swamp waters in order to maintain safety standards for human and livestock consumption. This problem may have a higher risk in the future due to increased livestock and introduction of animal spray programmes by FITCA. The flowing rivers have lots of dissolved and suspended sediment particles in the water originating from exposed soils in cultivations along the rivers and livestock and human track routes. Some of these problems could be overcome by introducing land use planning to prevent growing of certain crops in riverine areas and planting of vegetation in appropriate places to check sediment flow.

Growing of pastures for FITCA animals appear to target bush areas and wetland margins. This may be a good idea in as far preventing soil erosion is concerned but if the animals to be grazed are too many the problem of overgrazing will defeat this purpose and erosion will be even higher and chemical contamination will be high.

Human/wild life conflicts are a problem in Bubaka village. Ten of the respondents rated wildlife conflicts as of high magnitude, twenty rated them as of moderate magnitude, while less than five rated the conflicts as of low magnitude. The main source of conflict mentioned was crop destruction and preying of chicken. To a very limited extent poisoning of livestock was also cited. The other minor source of conflict mentioned was harboring of tsetse flies. Farming close to the swamps could be one reason there is such a high rate of conflicts with wildlife.

There are low cattle densities in Iganga. The main reasons for this trend are livestock disease and sales of animals. Iganga is one of the districts in Uganda with high prevalence of animal trypanosomosis and this indeed could explain the low cattle density. The other reason that

could be responsible for low cattle density is land shortage. With the majority of households having less than five acres of land, cattle keeping become difficult and most farmers resort to cropping given the agro-ecological potential of the area. There is need for more efforts to integrate livestock with crop production especially after FITCA controls trypanosomosis. With these small sizes of land a more intensive land use system would benefit farmers more.

Application of fertilizers is not popular in the village, while only sixteen farmers use manure most of the farmers sampled did not use manure. This could be attributed to perception farmers about the fertility of soil. The majority of farmers believe that soil infertility is not a problem. However, soil erosion is recognized as a problem and farmers are well aware of the causes. The main erosion control practices are terracing and strip cropping, and to a limited mulching. There is need for farmers to be educated on the benefits of using manure to increase fertility of their land

Unlike in Soroti district where animal traction is the predominant land preparation method, the hand hoe is the main implement used in Iganga District (Table 2). Only seven households are using ox-plough for land preparation in Bubaka village today, while nine used it ten years ago. There is no clear understanding of this distinction but it is likely to be as a result of cultural influence and soil types. This situation will change following FITCA efforts in promoting traction and pasture development.

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Appendix 1

List of species in iganga

Abutilon mauritianum
Acacia campylacantha
Acacia seyal
Achyranthus aspera
Acmella calirhiza
Adenostemma caffrum
Aeschynomene abyssinica
Ageratum conyzoides
Albizia coriaria
Albizia grandibracteata
Albizia zygia
Allophylus abyssinicus
Amaranthus dubius
Amaranthus hybrida
Amaranthus hybridus
Arachis hypogea
Aristolochia elegans
Artocarpus heterophyllus
Artocarpus integrifolia
Aspili kotschyi
Aspilia africana
Asystasia gangetica
Bidens pilosa
Biophytum petersiana
Blumea caffra
Boerhavia coccinea
Brachiaria brizantha
Cana indica
Capsicum frutescens
Cardiospermum ha
Carica papaya
Cassia bicapsularis
Cassia didymobtrya
Cassia hirsuta
Cassia kiki
Celosia trigyna
Centella asiatica
Chamaecrista kirkii
Chloris pychnothrix
Cissampelos mucronata
Citrus sinensis
Coffea canephora
Colocasia esculanta
Commelina africana
Commelina benghulensis
Conyza floribunda
Crolalaria deserticola
Crotalaria incana
Crotalia spinosa
Cynodon datylon
Cyperus alba
Cyperus bulbosa
Cyperus dives
Cyperus iria
Cyphostema cyphopetalum
Cyphostemma adenocaule
Desmodium repandum
Desmodium triflorum
Dicrocephala integrifolia
Digitaria abyssinica
Digitaria longiflora
Dioscorea cayanensis
Draceana fragrans
Dyschoriste radican
Dyschoriste radicans
Elensine indica
Erlangea pulchera
Erythrococca bongensii
Erythrococca bongensis
Euphorbia heterophylla
Euphorbia hirta
Ficus brachypoda
Ficus exasperata
Ficus natalensis
Ficus ovata
Ficus thonningii
Ficus vallis-choudae
Flueggea virosa
Galinsonga parriflora
Geophila repens
Glycine soy
Gossypium hirsuta
Grewia mollis

Grewia similis
Guizotia scabra
Gyanura scandens
Hewettia sublobata
Hibiscus cannabinus
Hoslundia opposita
Hydrocotyle mannii
Impreta cylindrica
Indigofera arrecta
Indigofera atriceps
Ipomea cairica
Ipomea wightii
Ipomoea batatas
Ipomoea hederifolia
Jatropha curcas
Justicia anselliana
Justicia exigua
Kigelia africana
Lactuca capensis
Lagascea mollis
Lantana camara
Lantana trifolia
Leersia hexandra
Leonotis nepetifolia
Leucas martinicensis
Lycopersicon esculenta
Mangifera indica
Manihot esculenta
Markhamia lutea
Melananthera scandens
Milicia excelsa
Mimosa pigra
Musa paradisiaca
Musa saplentum
Oldenlandia corymbosa
Oryza sativa
Ottelia ulvifolia
Oxalis corniculata
Oxygonum sinuatum
Panicum maximum
Phoenix reclinata
Phoseolus vulgaris
Phyllanthus amarus
Phyllanthus guineense
Phytolacca dodecandra
Plectranthus bartatus
Pseudospondias microcarpa
Pycreus nitidus
Pysalis micrantha
Rhyctenium repens
Rhynchelytrum repens
Rhyncosia-brown hairs
Ricinus communis
Roetboellia grass
Saccharum officinale
Sapium ellipticum
Senecio discifolius
Sesbania sesban
Setaria homonyma
Setaria macrophylla
Sida acuta
Sida ovata
Sida rhombifolia
Sida rhomboidea
Sida veronicifolia
Sigesbeckia abyssinica
Solanum aethiopum
Solanum incanum
Solanum nigrum
Sorghum vexilata
Sorghum vexillata
Sorghum vulgaris
Spathodoea campanulata
Spermacoca princei
Spilanthus mauritiana
Sporobolus pyramidalis
Steganatonia araliaceae
Stereospermum kunthianum
Synedrella nodiflora
Syzygium cuminii
Tagetes minuta
Tephrosia nana
Tridax pubescans
Triumfetta rhomboidea
Urena lobata
Vernonia amygdalina
Vernonia cinerea
Vernonia lasiopus
Vigna unijugata
Xanthosema esculenta
Zea mays
Zornia setosa

Field names for plants being identified

? Fuerina (leaflets)
Abutilon sp.
Acacia sp.
Acalypha
Adenostemma
Albizia(like tar.)
Aloe sp.
Amaranthus sp.
Aristolochia
Brachiaria
Cassia -6 leaflets
Chloris sp.
Cissus sp.
Cochorus ol.
Commelina sp.
Corchorus (lancestle)
Cucurbit
Cyperus
Cyperus - tiny
Cyperus 4
Cyperus sp.
Desmodium
Desmodium sp.
Dicrocephala sp.
Digitaria sp.
Echinochlfa
Erlangea
Euphorbiacea
Ficus - big round lves
Ficus - long big lves
Ficus- long thin lves
Ficus sp.
Fimbristylis sp.
Furena sp.
Galinsoga sp.
Jussea
Kalyabakala
Kalyabakya
Labiatae
Lactuca
Lagascea
Ludwigia
Musa saplentum (type 2)
Panicum (small)
Panicum sp.
Paspalm sp.
Phyllanthus
Phyllanthus (green smal)
Phyllanthus pseudo-niruri
Phyllanthus sp.
Pistia
polygonum
Polygonum sp.
Portulacca
Psidium sp.
Rhyncosia
Roetboelia
Sansevaria
Satureia sp.
Scmella
Sesamum
Setaria (green)
Setaria (purple florets)
Short grass
Sida sp.
Sonchus sp.
Spermacoce
Synedrella
Syzyium cuminii
Tephrosia
Triumfetta
Tyloglossum
Unidentified
Urena sp.

Appendix 2

Questionnaire Used in socio-economic surveys

ENVIRONMENTAL MONITORING AND MANAGEMENT
COMPONENT (EMMC / FITCA)

Household Survey Questionnaire

Date of interview: _____

Start time_____ End time_____

Household Code No: _____

District: _____

County: _____

Sub-county: _____

Parish: _____

Village: _____

Location of interview: _____

Name of Farmer: _____

Category of Farmer: _____

Household GPS reading: Latitude (N/S) _____ Longitude (E/W) _____

Alt _____

Filled questionnaire reviewed by:

Reviewer's Name	**Date**

Household Information

1. Name of Household head _____
2. Age_____ years
3. Sex 01. Male 02. Female
4. Educational Level 01. None 02. Primary
   03. Secondary 04. Post-secondary
5. How long have you lived in this area? 01. <10 years 02. 10-20 years
   03. 21-40 years 04. >40 years
6. Name of respondent (if different from household head)
   _____
7. What is the ethnicity of the household head? _____
8. How is the respondent related to the household? 01. Husband 02. Wife
   03. Son 04. Daughter. 05. Other specify_____
9. **Household characteristics**

Name	Age	Sex (M / F)	Education	Relation with HH	Residency	Work on HH land

Relation with HH
01. Husband
02. Wife
03. Son
04. Daughter
05. Employee
06. Other Specify

Work on HH land
01. No
02. Part time
03. Full time

Residency
01. Non-resident
02. Part time resident
03. Full time resident

Education
01. No education
02. Primary level
03. Secondary level
04. Post secondary

Land use

10. What is the main occupation of the household head now?

    01. Farming 02. Trading 03 Fishing 04. Employed

    05. Others Specify_____

11. What was the main occupation of the household head 10-15 years ago?

    01. Farming 02. Trading 03 Fishing 04. Employed

    05. Others Specify_____

12. If a farmer what kind? 01. Mixed 02. Crop based 03. Animal based

13. Who manages the following day-to-day activities?

    (a) Livestock 01.Husband 02. Wife 03. Children

    04. Employee 05. Other family member

    (b) Crops 01.Husband 02. Wife 03. Children

    04. Employee 05. Other family member

14. How much land do you own? _____Acres

15. How much land have you hired for crop production? _____ Acres

16. How much land have you rented out? _____Acres

17. Were you hiring any land 10 years ago? 01. Yes 02. No

18. Were you renting out any land 10 years ago? 01. Yes 02. No

19. How much land did you own 10-15 years ago? _____Acres

20. If you have more now how did you acquire the additional land?

    01. Bought 02. Inherited

    03. Allocation 04. Other specify_____

21. If you have less what happened to your land? 01. Sold ____ 02. Subdivided

    03. Others specify _____

22. What proportion of your land in acreage is allocated to each of the following?

	Cropped		Un-cropped		
Homestead	Food /Cash crop	Fodder crop	Fallow	Grazing	Bush/forest/wood
_____	_____	_____	_____	_____	_____

Cropping Systems

23. Please provide information on the **principal crops** grown in your farm during the **First season** **(today** and in the **past).**

Today								Past (10 Years Ago)							
Crop	Unit Acres	Seed or Seedling	Source of seeds	Pattern	Crop pest control	Yields Units	Use of harvest	Crop	Unit Acres	Seed or seedling	Source of seeds	Pattern	Crop pest control	Yields Level	Use of harvest

Seed or seedling	Source of seed	Pattern	Pest control	Yields level	Use of harvest
Amount of seed in Kilograms	Market	Mono-cropping	Chemical	More	Sale
No. of seedlings	Selection (from harvest)	Inter-cropping	Traditional	Less	Home use
	Borrow	Strip-cropping	No control	Equal	Sale/home
	Cooperative				

Circle where choices are given

Household code_____
Enumerator Name_____
Date of interview_____

24. Please provide information on the **principal crops** grown in your farm during the **Second season** **(today** and in the **past).**

Today								Past (10 Years Ago)							
Crop	Unit Acres	Seed or Seedling	Source of seeds	Pattern	Crop pest control	Yields Units	Use of harvest	Crop	Unit Acres	Seed/seedling	Source of seeds	Pattern	Crop pest control	Yields Level	Use of harvest

Key

Seed or seedling	Source of seed	Pattern	Pest control	Yields level	Use of harvest
Amount of seed in Kilograms	Market	Mono-cropping	Chemical	More	Sale
No. of seedlings	Selection (from harvest)	Inter-cropping	Traditional	Less	Home use
	Borrow	Strip-cropping	No control	Equal	Sale/home
	Cooperative				

Circle where choices are given

Household code_____
Enumerator Name_____
Date of interview_____

25. State different crop / land management methods **today** in comparison to **10-15 years ago** in the following categories. Provide the information using at least five most important crops. ***(Important crops are those with higher acreage in comparison to others)***

Crop Name	Land preparation		Planting		Method of weeding		Soil fertility management		Harvesting		Source of labour	
	Past	Today	Past	Today	Past	Today	Past	Today	Past	Today	Past	Today

Key

Land preparation / planting / method of weeding
Hoe
Ox-plough
Tractor

Harvesting
Machine
Manual

Soil fertility management
Fertilizer
Manure
Both
None

Source of labour
Family
Hired
Both

26. How do you clear land (bush) today? 01. Pangas /axes 02. Burning 03. Machine

27. How were you clearing land (bush) in the past? 01. Pangas /axes 02. Burning 03. Machine

Circle where choices are given

Household code_____
Enumerator Name_____
Date of interview_____

28. Which crops have since disappeared? State the crops name and explain the reason why you no longer grow them.

Crop Name	Reasons for not growing the stated crops

29. Is there any erosion on your farm? 01. Yes 02. No

30. If yes how are you controlling soil erosion? 01. Terracing 02. Trash lines
03. Strip cropping 04. Other (specify)_____

31. What in your opinion is the cause of soil erosion in your farm? _____

_____

32. Do you think there is soil infertility in your farm? 01. Yes
02. No

33. If **yes** what are the indicators of soil infertility? _____

Livestock

34. State the **number** of animals you kept in the **past** and **today** and give reasons for any differences.

Type	Number of animals		Reasons for differences in past and present livestock numbers
	Past	Today	
Native Cattle			
Graded			
Cross- Breed			
Goats			
Sheep			
Donkey			
Pigs			
Dogs			
Chicken			

35. In the past did you own? 01. Oxen 02. Ox-plough

Circle where choices are given

Household code_____
Enumerator Name_____
Date of interview_____

36. Do you own any now? 01. Oxen 02. Ox-plough

37. Explain the reasons for any differences in **35** & **36** above

_____

_____

38. Which of one of these do you hire most to cultivate your farm?

01. Oxen 02. Ox- plough 03. Tractor 04.None

39. From which of the following livestock products do you make income?

01. Milk 02. Calves 03. Adults

04. Renting of ox-plough 05. Manure 06. Hides and skin

07. Any other specify _____

40. What is your main system of keeping cattle now and what was it 10 years ago, if established then? (Put the answer in the table)

	Presently	10 years ago
Dairy cattle		
Zebu cattle		

Key
01. Only grazing (free-range or tethered)
02. Grazing with some stall feeding
03. Only stall feeding (zero grazing)

41. What are your main grazing areas during different seasons **today**? (✔)

Grazing areas	Dry season	Wet season
Own pasture/un-cropped land		
Own post harvest cropped		
Neighbours post harvest cropped		
Neighbours pasture/un-cropped		
Public land		
__		
__		

42. What were your main grazing areas during different seasons in the **past?** (✔)

Circle where choices are given

Household code_____

Enumerator Name_____

Date of interview_____

Grazing areas	Dry season	Wet season
Own pasture/un-cropped land		
Own post harvest cropped		
Neighbours post harvest cropped		
Neighbours pasture/un-cropped		
Public land		
__		
__		

43. Where do you water your livestock?

01. Lake / pond 02. River / Stream 03. Spring 04. Bore hole

05. Piped 06. Roof catchments 07 Well

44. Is trypanosomosis disease problem to your livestock?

01. Yes 02. No 3. Unknown

45. Which control measure do you apply for **trypanosomosis**?

01. No control 02. Traps/ Target 03. Bush clearing

04. Use of drugs/chemo-therapeutics 05. Use of pour-on, etc (vector control)

06. Crush pen 07. Net Zero grazing Unit

08. Other (specify) _____

46. If Trypanosomosis is present but **no control measure is employed**, why?

01. Do not know where to get drugs 02. Do not know how to control

03. Drugs are expensive 04. Drugs do not work

05. Other (specify) _____

47. What in your opinion is the implication of the trypanosomosis control method to the environment? _____

Circle where choices are given

Household code_____

Enumerator Name_____

Date of interview_____

Vegetation

48. Name **three** main plant species found in the area in the past and today in the following habitats.

Species Habitats	**Species Names**	
	Past	**Today**
Bush/forest		
Farms (weeds)		
Swamp / River line		

49. Do you know of any particular plant species that has disappeared or is disappearing from the area? 01. Yes 02. No

50. State any species that has disappeared or is disappearing; it's habitat and explain reason why they are disappearing?

Species Name	**Species habitat**	**Reasons**

Key: Habitats (Bush, Forest, Farm, Swamp, Grassland, River line, ……)

Circle where choices are given

Household code_____
Enumerator Name_____
Date of interview_____

51. State any new plant species that have emerged in the area and explain the cause of their emergency.

Species Name	Species habitat	Cause of emerging

Key: Habitats (Bush, Forest, Farm, Swamp, Grassland, River line, ……)

Wildlife Biodiversity

52. State the wildlife types found in your area in the past and today.

Types Animal Species	Species Names	
	Past	Today
Reptiles		
Mammals		
Rodents		
Birds		

Circle where choices are given

Household code_____

Enumerator Name_____

Date of interview_____

53. State the wild life species that disappeared in the area

Wild life Name	Species habitat	Reasons for disappearing

Key: Habitats (Bush, Forest, Farm, Swamp, Grassland, River line, ……)

54. Name any wildlife species that moved in the area recently

Wild life name	Species habitat	Possible reasons for emergency

55. Rate the level of human / wildlife conflict in the area.

01. Very high 02. Moderate 03. Low 04. None

56. What is the nature of human / wildlife conflict

Wild life Name	Nature of conflicts

Circle where choices are given

Household code_____

Enumerator Name_____

Date of interview_____

Water Resources

57. Where was your main source of water **10 years ago**?

During dry season:	01. Lake / pond	02. River / Stream	03. Spring
	04. Bore hole	05. Piped water	
	06. Roof catchment	07. Well	
During wet season:	01. Lake / pond	02. River / Stream	03. Spring
	04. Bore hole	05. Piped water	
	06. Roof catchment	07. Well	

58. Where is the main source of water **Today**?

During dry season:	01. Lake / pond	02. River / Stream	03. Spring
	04. Bore hole	05. Piped water	
	06. Roof catchment	07. Well	
During wet season:	01. Lake / pond	02. River / Stream	03. Spring
	04. Bore hole	05. Piped water	
	06. Roof catchment	07. Well	

59. How would you rate the quality of water in terms of the following pollution, cleanliness, and taste?

a) **Pollution**	01. Very polluted	02. Fairly polluted	03. Not polluted
b) **Cleanliness**	01. Very clean	02. Fairly clean	03. Dirty
c) **Taste**	01. Very good	02. Fairly good	03. Bad

60. Do you consider the water safe for drinking? 01. Yes 02. No

61. How far is the main watering point from the household?

During the wet season _____ meters/ kilometers

During the dry season _____ meters/ kilometers

Circle where choices are given

Household code_____

Enumerator Name_____

Date of interview_____

Fuel sources

62. State your main sources of fuel **10 years ago** and **today**. Rank your **current** sources of fuel in order of importance based on frequency of usage.

Sources of fuel	10 years ago (✔)	Today (✔)	Rank
Dry wood			
Charcoal			
Paraffin			
Gas			
Electricity			
Maize Stalks			
Swamp dry vegetation			
Others Specify			

63. Where did you get fuel 10-15 years ago? _____

64. Where do you obtain fuel today? _____

65. Explain the difference between (63 and 64) _____

_____

66. How much time do you take to gather fuel wood (time for walking to and fro and gathering)? 01. 10 min 02. 30 min 03. 60 min 04. 120 min +

67. Are there any natural forests in this area? 01. Yes 02. No

68. If yes, do you have access to these forests? 01. Yes 02. No

69. What has been the trend of forest cover in the area?

01. Increased 02. Decreased 03. No change

70. What do you think is the reason for the observed trend in forest cover?

_____

Circle where choices are given

Household code_____
Enumerator Name_____
Date of interview_____

71. Apart from timber/fuel what other important **products** do you obtain from the **bush/Forest/uncultivated**?

Product	**Obtained 10 years ago (✔)**	**Obtained Today (✔)**	**General Use /Purpose**	**Level of use Today**	**Give reasons for rare use and not us**
Honey					
Wild fruit					
Wild animal (Bush meat)					
Grass					
Medicinal Plants					
Fibres					
Dye					
Craft Material					
—					
—					

Level of use

Regularly
Rarely
Not used

72. Are these products easier or difficult to obtain today than 10 years ago? Tick appropriate (√)

Product	**Today** Easier	Difficult	**10 Years Ago** Easier	Difficult
Honey				
Wild Fruit				
Wild Animal				
Grass				
Medicinal Plants				
Fibres				
Dye				
Craft Material				

Thank you very much for participating in the survey

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1. Do you think the answers from respondent were sincere and truthful?

   01. Very true 0 2. Fairly true 03. Not true

2. Summarize your view of respondent answers in the space provided below.
3. Counter check the questionnaire to ensure that all the questions have been answered
4. Record end time.

Comments from the enumerator

_____

_____

_____

_____

_____

_____

_____

Appendix 3

Photograph showing vegetation clearance to create grazing fields for FITCA animals

This vegetation that is on the edge of a swamp and is bordering a stream is being cleared to prepare a grazing ground for the animals that FITCA was to introduce for the promotion of animal traction. This will be used as open grazing area for animals in addition to the pasture crops that the farmers were planting in their fields.