BT

ILRI
INTERNATIONAL LIVESTOCK RESEARCH INSTITUTE

Farming in Tsetse Controlled Areas
FITCA

Environmental Monitoring and Management Component
E M M C

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

Assessment of Land Use, Vegetation and human perceptions on environmental changes Akoroi Village, Soroti District, Eastern Uganda.

Joseph Maitima, Evanson Njuguna, Christopher Laker, Annah Rutebuka,
Simon Mugatha and Dorcas Mbuvi

December 2003

Natural Resources Institute

no M4

CIRAD

TABLE OF CONTENTS

PART III

LIST OF FIGURES

LIST OF MAPS

LIST OF TABLES

OVERVIEW: Fitca Project

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 are 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

ACKNOWLEDGEMENT

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

GPS Mapping Team Soroti:

Akello Hellen,

Okiki M. Ocen,

Egau S. Alanyu,

Edeku James,

Opolos J. Ronny,

Etoru Joseph.

Field Guides:

Sam Okupot,

Amunya Richard,

Eribu John

Achon J.

Botanist:

Wanyama Olivia.

Sociologist:

Annah Rutebuka.

Drivers:

Peter Kamau

Mugume

GENERAL INTRODUCTION

The Study Area

Soroti district is located in the middle of eastern Uganda in the transition between the wetter southern part of the country and the drier northern part. In the north the major occupation of people is livestock keeping and in the south people are mainly cultivators but majority are mixed farmers who keep livestock in addition to farming. Soroti is located in a convergence zone for two major land use practices of the mainly grazing north and the mainly cultivating south. Due to the influences from both the north and south both land use practices are important in Soroti but livestock raiding by the northern Kalamanjong livestock keeping has reduced significantly. However, people have embarked on a restocking programme to fill the gaps left by the stolen animals.

Within Soroti the project was implemented in Serere sub-county where incidences of both human and animal trypanosomosis were very high based on clinical reports from Serere dispensary. Selection for all EMMC implementation sites was done carefully involving consultants from CIRAD (Kleitz et al 2002, Maitima, et al. 2002.), ILRI scientists and experts from the country FITCA projects. Considerations were made on vector distribution, disease prevalence, cattle movements, land cover /vegetation characteristics and community willingness to participate in the project. Since FITCA is implemented by participating countries themselves EMMC had to liaise with country FITCA teams to know areas where the project planned to implement activities that have more immediate and direct impacts to the environment in addition to other more general indirect impacts that are expected in all the areas of FITCA.

It was under these considerations that Akoroi village was selected as EMMC site. Akoroi is located in a remote area some 40 kilometers south east of Soroti town. The area is endowed with relatively richer vegetation compared to other areas in the district. The vegetation in the area provides a typical habitat for tsetse habitation. Tsetse and trypanosomosis problem in the area especially the human disease has been high.

FITCA Uganda had already mobilized communities in the village to do communal spraying of livestock. Although livestock disease (nagana) was not particularly a big problem, livestock is considered to be a host for tsetse and therefore a reservoir for the human sleeping sickness that was a major problem in the area. Controlling tsetse in the livestock areas is therefore an indirect way to control sleeping sickness.

Soroti district is located in a relatively dry climate compared to the wetter southern part of eastern Uganda. The area receives little rainfall due to its distant location from lake Victoria that is the major source of precipitation for the southern part of Uganda. Major cash crops are Cassava and cotton. Cotton growing had however, declined due to poor market but recently production of cash crop is increasing due to new emerging markets. Akoroi village is however, relatively more productive than most of the district due to its more fertile soils.

People, Occupation, Technologies

People in Soroti belong to the Teso tribe one of the major ethnic groups of Uganda. Teso people in Soroti as well as in Akoroi practice mixed farming, cultivating crops and raring livestock. Majority of livestock kept are cattle. Goats and sheep are also kept by many farmers but not in large numbers. Chicken and Turkey are also kept for both home consumption and selling for cash when need be. Despite practicing these farming activities, poverty rate in the village is high, due to poor markets for farm products and low livestock productivity. Livestock keeping in the area has declined tremendously due to recent raids by the Kalamajong from the north. Many farmers are now re-stocking their livestock following a period of peace between the two communities.

Fig .1: Map showing FITCA Uganda districts and EMMC sites

Objectives

The overall objective of FITCA project is to promote farming activities in tsetse controlled areas so that land use activities could maintain the flies at low densities and the prevalence of both animal and human trypanosomosis is kept low. Tsetse infested areas are marginal areas where production systems operate at very narrow ecological ranges and are very susceptible to disturbance. Tsetse control areas have generally been neglected as low potential areas by governments and therefore the areas are lagging behind in development.

The initial objective of EMMC was to understand the environmental settings of FITCA 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 of

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. FITCA promotes livestock development to improve food security, 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:

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.

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

2. 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).

3. 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

Akoroi Village

Serere Sub-County

Soroti District

EMMC/FITCA Study Area

Uganda

(May 2003)

INTRODUCTION

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.

Serere/Soroti is one of the four EMMC study areas in Uganda located in Soroti district of central Uganda bordering several swamps that form part of lake Kyoga hydrology system (*Map I -1*). The area is sparsely settled with farming activities encroaching into the natural woodlands and forested areas. FITCA efforts in Uganda are mainly targeting reduction of Human trypanosomosis rather than livestock's (EMMC Report 2002). The area has high incidence of human sleeping sickness. The site was selected as a representative of areas within diseases routes due to migration of livestock between the pastoral communities in the north and agricultural communities in central and southern Uganda. The expected indicators of change include reduction in natural vegetation cover and increase of both human and livestock populations.

STUDY AREA

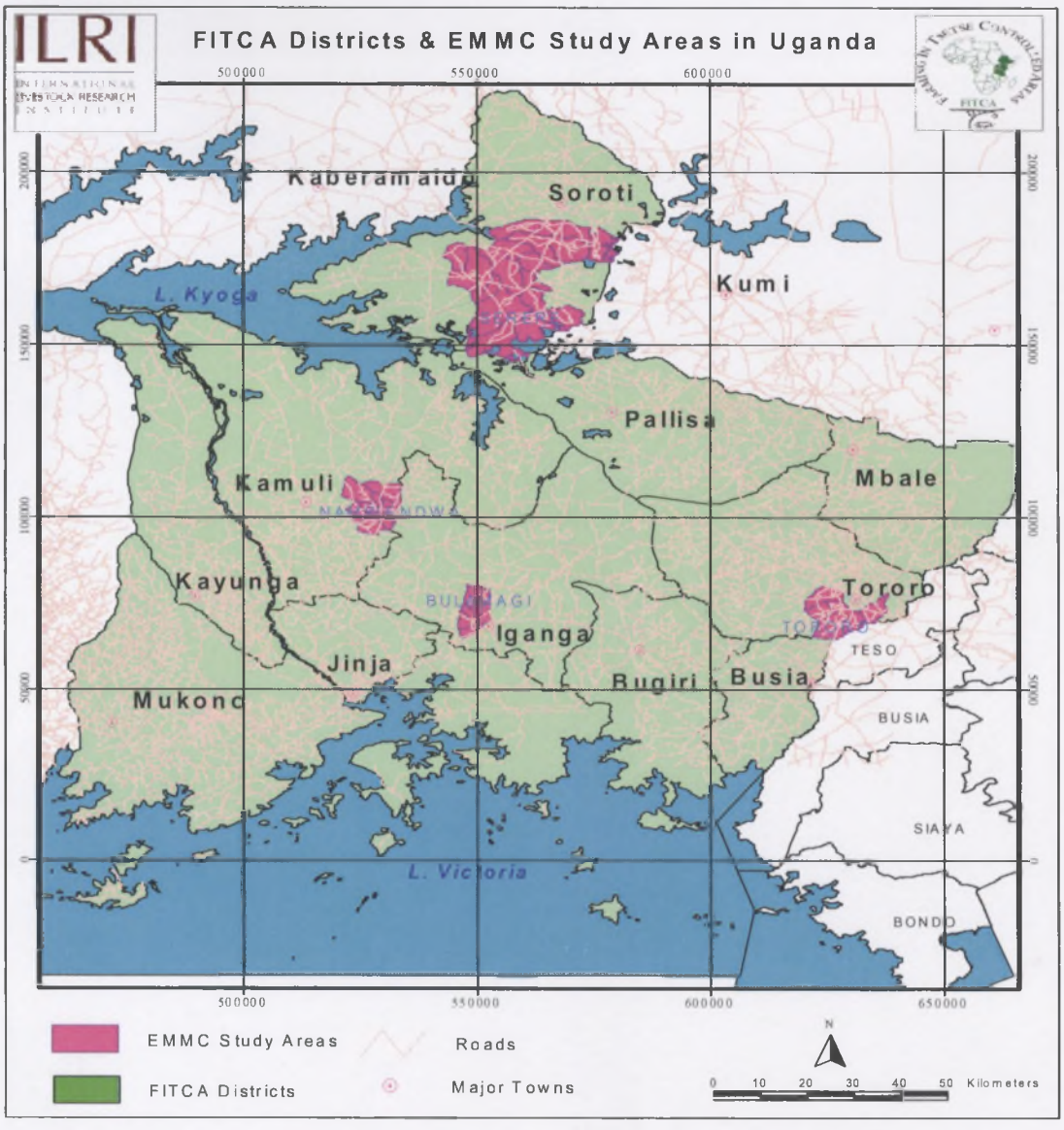
The mapping site study area is located within Akoroi village of Kanyangan Parish of Serere County in soroti district of Uganda (*Map I -2*). The site is about 40 Km south of Soroti town and about 15 Km from Serere county headquarters. It is next to kanyangan, which is the main shopping centre of Kanyangan Parish. The parish is sparsely populated with a density of 57 people per Km^2 (*Table I -1*). Farming activities are taking place within the cleared woodlands and forests.

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

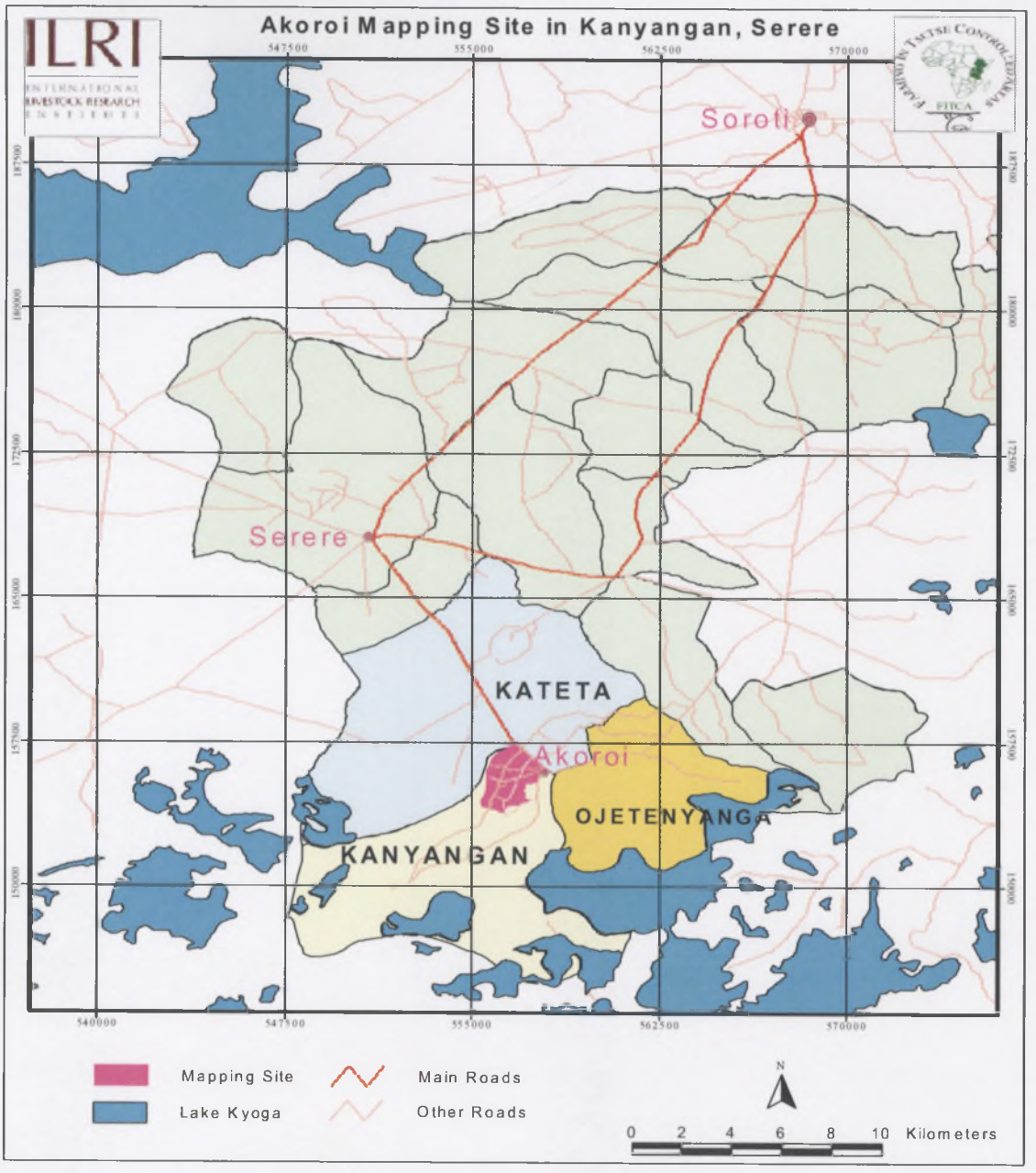
Parish Name	**Area Km^2**	**Male**	**Female**	**Totals 1991**	**Density / Km2**
Kanyangan	72.16	2,001	2,137	4,138	57.34
Kateta	102.94	3,804	4,080	7,884	76.59
Ojetenyanga	46.02	2,080	2,278	4,358	94.70

Source: Population census Uganda, 1991

Map I -1 FITCA Districts & EMMC Study Areas in Uganda



Map 1–2 Mapping Site Akoroi Soroti



Fieldwork

The mapping was accomplished by using hand held Global Positioning Systems (GPS) as explained in the method report. Seven people including six locally recruited trainees for ten days between 2nd May and 15th May 2003 did the work. The first two days were used for training the recruits 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 in soroti town every morning. This caused delays in starting the work in the morning and this prompted us to have a portable printer in our other sites of operation afterward.

There was no mobile phone network in and it was quite difficult to contact each other during the mapping work. We operated on two vehicles for transporting personnel within the site and at least this assisted in faster communication even without mobile connection. The mapping work took place on the month of May when the farmers were doing their first weeding. The crops were short less than a meter and easily identifiable. Under these conditions different cultivation boundaries were easy to identify and map. The visibility was good and one was able to see far and wide within the cultivated areas hence reducing the possibility of missing some of the smaller crop types within the bigger ones. Akoroi village and vicinity can in general be described as woodland, which is being cleared for cultivation and settlement. The woodlands are quite extensive and the possibility of missing other intermediate classes (such as bush, shrubs, old fallows and fallow cassava) within the woodlands was high. We tried to over come this problem by also walking inside the woodlands after the outer boundary mapping to ascertain the continuity of this cover type.

RESULTS

An area of 5.3 Km^2 was mapped within Akoroi village of Kanyangan parish of Serere. A total of 334,217 meters (334 Km) were walked to map 1016 polygons of various land use and cover types. The main classes identified included cultivated areas, built up areas and the natural areas.

A unique category that was classified in this study site was what we defined as fallow cassava with over 12 % cover of the total area surveyed. This is cassava crop that is left in the farm after maturing for one year or more. We were informed that this was one way of preserving cassava for use when there are shortages or during very dry years. The crop is used throughout the year when need arises. When left out for many years fallow cassava actually become bushes and even shrubs and trees start to grow within. This class was quite confusing since it can either fall under fallows or cultivated areas in the higher levels of classification. In this analysis it has been classified as a fallow and hence as part of the 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 4*) and the corresponding maps.

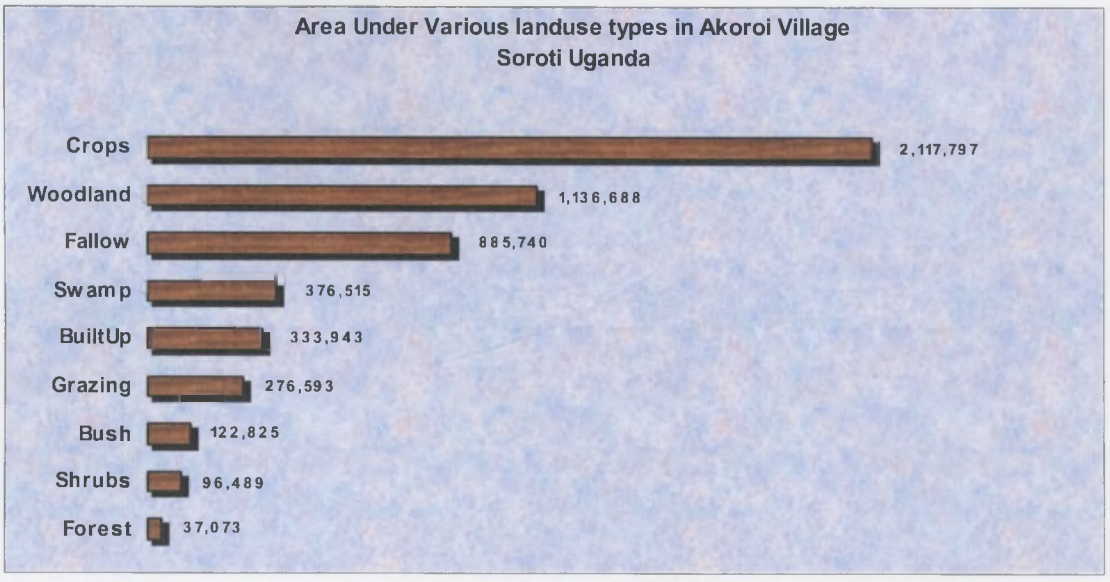
Cultivated areas or croplands (40 %)

The cultivated areas covered about 40 % of the totals areas. Within this class the main crops were identified as millet (15 %) and cassava (12 %). Millet was mainly intercropped with maize. A few farms also had intercrops of millet with sorghum or groundnuts. The rest of cultivated land consisted of ploughed lands (6 %) and small pockets of sweet potato, maize, sorghum, beans and rice near the swamps. Cotton was also being introduced and farmers were buying cotton seeds at a subsidised price from one of the companies promoting the resumption of cotton growing in Uganda.

Table I -2: Major Land use area cover (Akoroi Soroti)

Class	Count	Area (Meters)	Ratio of total	Percent of total
Forest	1	37,073	0.0069	0.69
Shrubs	13	96,489	0.0179	1.79
Bush	19	122,825	0.0228	2.28
Grazing	50	276,593	0.0514	5.14
BuiltUp	181	333,943	0.0620	6.20
Swamp	3	376,515	0.0699	6.99
Fallow	155	885,740	0.1645	16.45
Woodland	96	1,136,688	0.2111	21.11
Crops	498	2,117,797	0.3934	39.34
Totals	**1,016**	**5,383,663**	**1.00**	**100.00**

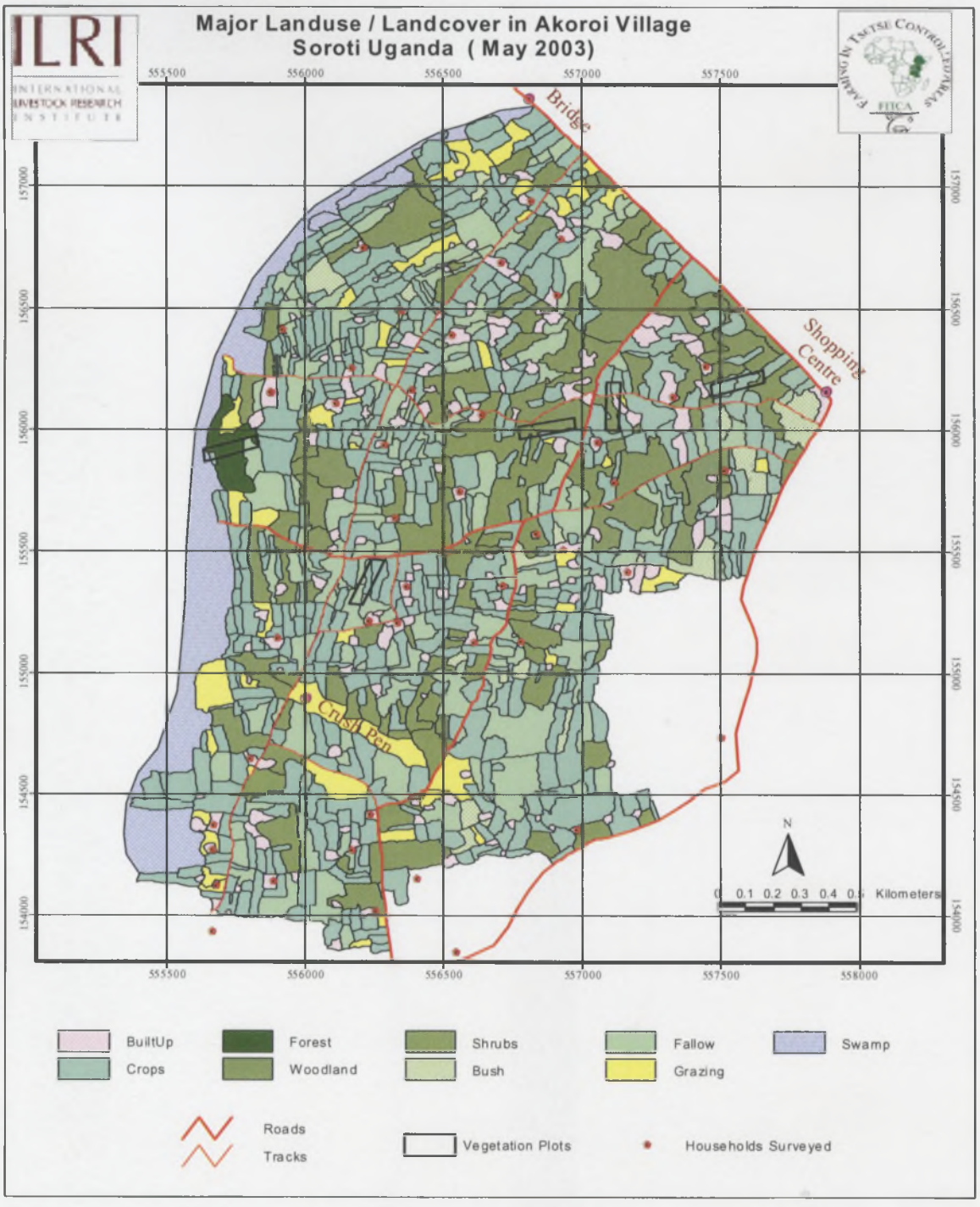
Fig. I - 1: Bar graph of area cover of major land use types



Built up Areas (6 %)

The Akoroi site is in a rural set up and the human population density is quite low. The nearest urban center is serere which is 15km away. The built up areas consisted mainly of homesteads. The homesteads consisted of houses and woodlots with a few having shed for livestock and goats scattered all over the study site. The homesteads also had a mixture of small pockets of cultivations including millet, maize, beans and cassava. There are no fences or hedges around the homesteads or the farms making the mapping work easier. Other classes included in the built-up class were the shopping center, churches, cowsheds and a flourmill.

Map I - 3: Major Land use Classes Akoroi

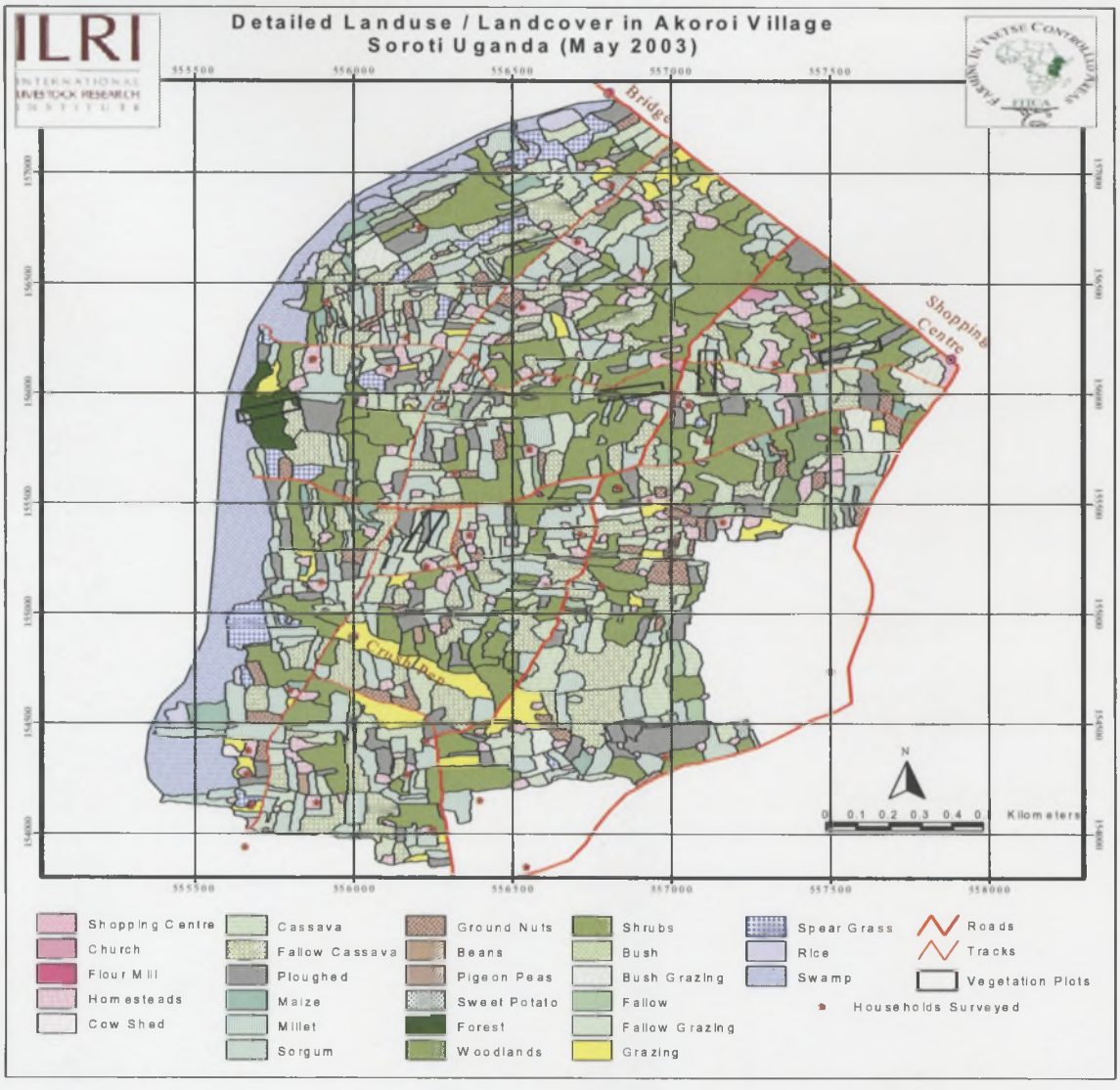


Natural areas (54 %)

This class is dominated by woodland cover type that occupies 21 % of the total land area surveyed. The area classified as forest was an extension of the woodlands but with over 80 % tree cover. Other categories included shrubs and bushes that are also found within the bigger class of woodlands. The study site forms part of the lake kyoga system with many swamps within the site. Swamps, which are classified as natural areas, occupies about 7 % of the total area within which there are farms of rice which could not be accessed for mapping. Other classes included here are the grazing areas consisting of grasses such as spear grass, fallows and a mixture of fallows, Grazing and bushes. The last included in this class is the fallow cassava as defined above occupying over 12 % of the total area.

Table I -3: Detailed Land use area cover Akoroi

Landuse Class	Count	Area (Meters)	Percent of total	Average Area	Minimum Area	Maximum Area
Flour Mill	1	384	0.01	384	384	384
Pigeon Peas	1	651	0.01	651	651	651
Shopping Centre	1	5,779	0.11	5,779	5,779	5,779
Cow Shed	2	7,137	0.13	3,568	2,691	4,446
Church	2	7,163	0.13	3,582	1,734	5,429
Beans	4	9,838	0.18	2,460	1,373	3,136
Sweet Potato	9	23,840	0.44	2,649	967	4,428
Rice	7	29,308	0.54	4,187	598	9,143
Sorgum	5	29,756	0.55	5,951	1,119	14,818
Forest	1	37,073	0.69	37,073	37,073	37,073
Bush	9	39,528	0.73	4,392	962	15,056
Fallow	15	52,094	0.97	3,473	820	7,589
Maize	14	63,351	1.18	4,525	917	14,269
Bush Grazing	10	83,297	1.55	8,330	918	16,371
Shrubs	13	96,489	1.79	7,422	2,792	28,124
Spear Grass	18	108,979	2.02	6,054	863	22,776
Fallow Grazing	28	141,691	2.63	5,060	1,335	12,456
Ground Nuts	51	155,915	2.90	3,057	428	7,235
Grazing	32	167,614	3.11	5,238	720	22,149
Homesteads	175	313,480	5.82	1,791	158	7,006
Ploughed	88	364,978	6.78	4,147	430	27,780
Swamp	3	376,515	6.99	125,505	5,312	356,463
Cassava	143	631,507	11.73	4,416	686	20,081
Fallow Cassava	112	691,955	12.85	6,178	402	38,997
Millet	176	808,653	15.02	4,595	514	21,345
Woodlands	96	1,136,688	21.11	11,840	833	79,411
	1,016	5,383,663	100	10,473	158	356,463



Map I - 4 – Detailed Land use/Land cover in Soroti Uganda

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 many others. 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 5,383,663 m^2 (5.3 Km^2). The cultivated areas, which include annual and perennial crops, occupy about 40 % with annual crops annuals occupying double the area of perennial crops (*Table I -4*). The natural (semi) areas occupy over 54 % with the remaining 6 % 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
Flour Mill	384	0.01	Built up
Shopping Centre	5,779	0.11	Built up
Cow Shed	7,137	0.13	Built up
Church	7,163	0.13	Built up
Homesteads	313,480	5.82	Built up
Built up	**333,943**	**6.20**	
Forest	37,073	0.69	Natural
Bush	39,528	0.73	Natural
Fallow	52,094	0.97	Natural
Bush Grazing	83,297	1.55	Natural
Shrubs	96,489	1.79	Natural
Spear Grass	108,979	2.02	Natural
Fallow Grazing	141,691	2.63	Natural
Grazing	167,614	3.11	Natural
Swamp	376,515	6.99	Natural
Fallow Cassava	691,955	12.85	Natural
Woodland	1,136,688	21.11	Natural
Natural	**2,931,923**	**54.46**	
Beans	9,838	0.18	Annual
Rice	29,308	0.54	Annual
Sorghum	29,756	0.55	Annual
Maize	63,351	1.18	Annual
Ground Nuts	155,915	2.90	Annual
Ploughed	364,978	6.78	Annual
Millet	808,653	15.02	Annual
Annuals	**1,461,799**	**27.15**	
Pigeon Peas	651	0.01	Perennial Semi
Sweet Potato	23,840	0.44	Perennial Semi
Cassava	631,507	11.73	Perennial Semi
Perennials	**655,998**	**12.18**	
Cultivated	**2,117,797**	**39.34**	
Grand Totals	**5,383,663**	**100.00**	

Table I –5 Calculated X and Y Shifts

	X	Y
Akoroi	557,008.28	157,142.79
	557,068.52	156,845.20
Average	-60.24	297.59

PART II

Analysis of vegetation composition, diversity and structure in Akoroi Village, Soroti Uganda

Akoroi Village

Serere Sub-County

Soroti District

EMMC/FITCA Study Area

Uganda

INTRODUCTION TO VEGETATION SURVEYS

Like in other FITCA sites vegetation was studied in Akoroi village to determine species composition, distribution, ecosystem structure and function within the tsetse control area. The purpose of vegetation analysis in the tsetse control area was to develop baseline information upon which (1) effects of tsetse and trypanosomosis control in the area can be analyzed and (2) provide information on ecological changes taking place in the area that can guide development of an environmental monitoring system. This study on vegetation is part of a wider campaign that includes mapping of land use and land cover in the area and a survey of socio-economics of land use. These three study components are all aimed at presenting the situation and trends of changes in FITCA areas from the household to community and from farm to landscape level.

Unlike other FITCA EMMC sites in Uganda, Akoroi is quite well vegetated with scattered patches of thick vegetation some of which have never been cultivated or are at least very old fallows to the extent that canopy stratification has already established itself. In many areas fallows indicating recent cultivation are abundant.

One unique land use observed in Akoroi was the presence of numerous abandoned cassava gardens that had grown into thick bushes of fallow dominated by invader species. Cassava cultivation is a major land use in Soroti as it is subsistence as well as a cash crop. Land use mapping in Akoroi has revealed that cassava cultivation was the second largest crop cultivation. Fields with Fallow cassava constituted by far the largest land cover of all the land with crops in Akoroi.

Human disturbance on vegetation by grazing, harvesting of plant resources is high. Most of the vegetation is secondary and highly fragmented by open grazing areas, cultivations and fallows.

Fig. II -1 Photo of a tree debarked for fiber

Habitat Diversity and Fragmentation

Akoroi has diverse ecosystems ranging from riverine swamps to thick dryland forests, woodlands and open bushes. Some of the riverine areas are used for cultivation of rice and arrowroots. Some of the woodlands appear to be remnants of previous thick lowland sub-humid forests. Plants are harvested for various reasons, provision of firewood for domestic uses, building materials, and firewood to burn bricks. Charcoal burning is widespread and is major cause for felling of trees. Charcoal produced isused locally and also sold to businessmen who transport them to markets away from the village.

Fig II -2 Photo showing a remnant forest and a recently cleared field

This photo shows a recently cleared field with numerous tree stumps as remnants of some of the trees before clearance. On the background a forest stand is shown but although disturbed by grazing and wood harvesting features of a true dryland forest still remains.

METHODS

Study Plot

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.

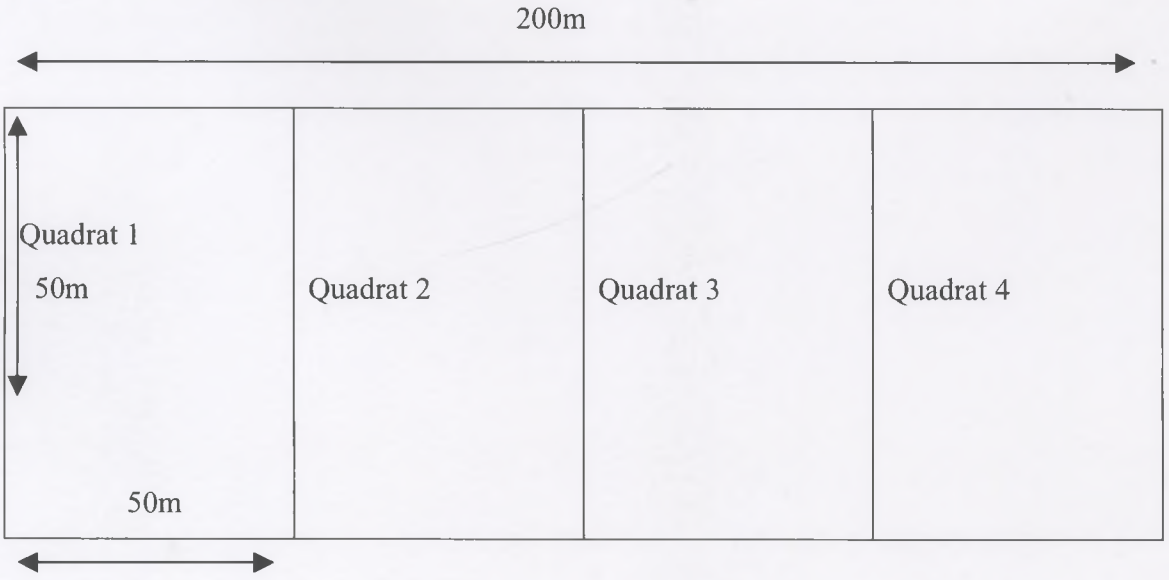
Study on plant species diversity was done using standard quadrat sampling methods. The study was done in the three life forms and canopy stratifications i.e., tree, shrubs, and herbs. Sampling of trees was done using 50x50m quadrats, shrubs by use of 25x25m quadrats and herbs by use of 1x1m quadrats.

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.

Fig. II –3: Photo of Olivia doing a quadrat in Akoroi

Sampling Plan

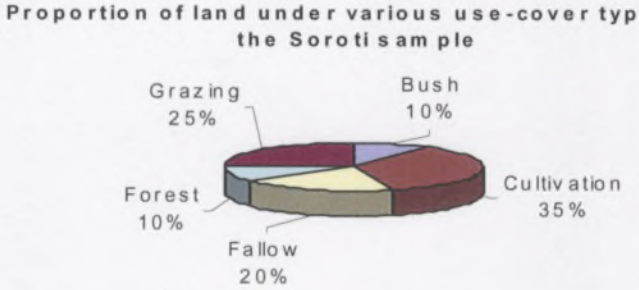
Plot 1



RESULTS

Vegetation data from quadrat samples was entered into a computer data base and analysis was made using SPSS to determine species composition and density in different life forms and in different land use patterns in the study site. The following are results of these analyses.

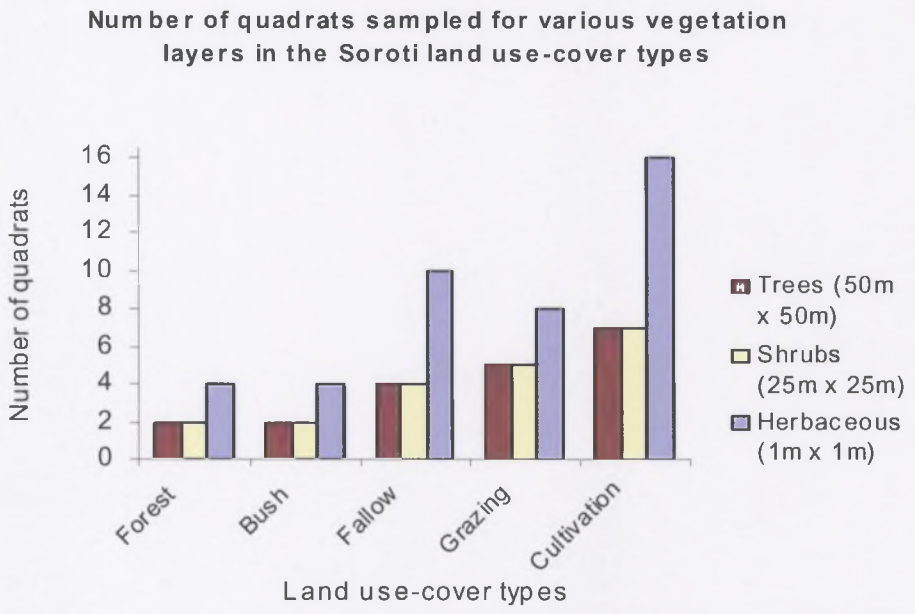
Fig. II 4a – Proportion of land under various cover type use



These are the proportions of land cover within the plots studied in Akoroi vegetation survey. Land use or land cover types were determined in the field for every quadrat.

The statistics of land cover shown above reflect the proportion of areas under which samples for vegetation studies were made. Most prominent land use type is cultivation from which 35 % of the sampled were made, 25 % of quadrats sampled were in razing areas. In Sororti some of the areas characterized as fallow were abandoned cassava plantations that had grown up to look like bush. A bush was distinguished from fallow and grazing area by the absence of any indicator for previous cultivation and grazing.

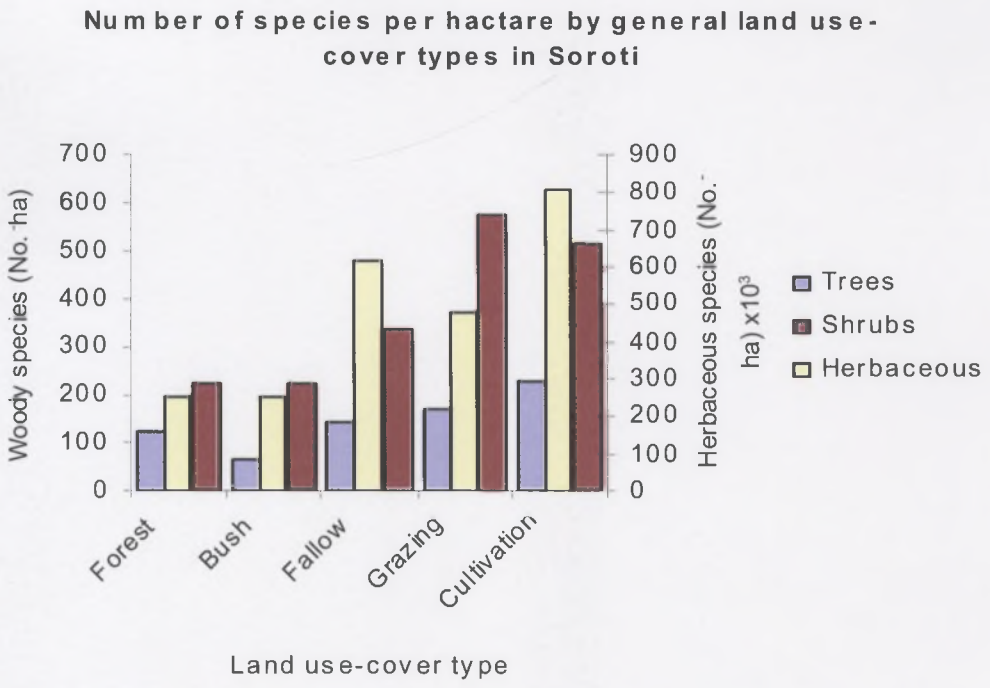
Fig. II 4b – Number of quadrats sampled for various vegetation layers



This diagram shows the number of quadrats sampled for in each lan use / land cover category vegetation The tree quadrats were 50x50m, shrubs 25x25m and herbs were 1x1m because natural forests and bush were fewer the number of quadrats for these land cover types were

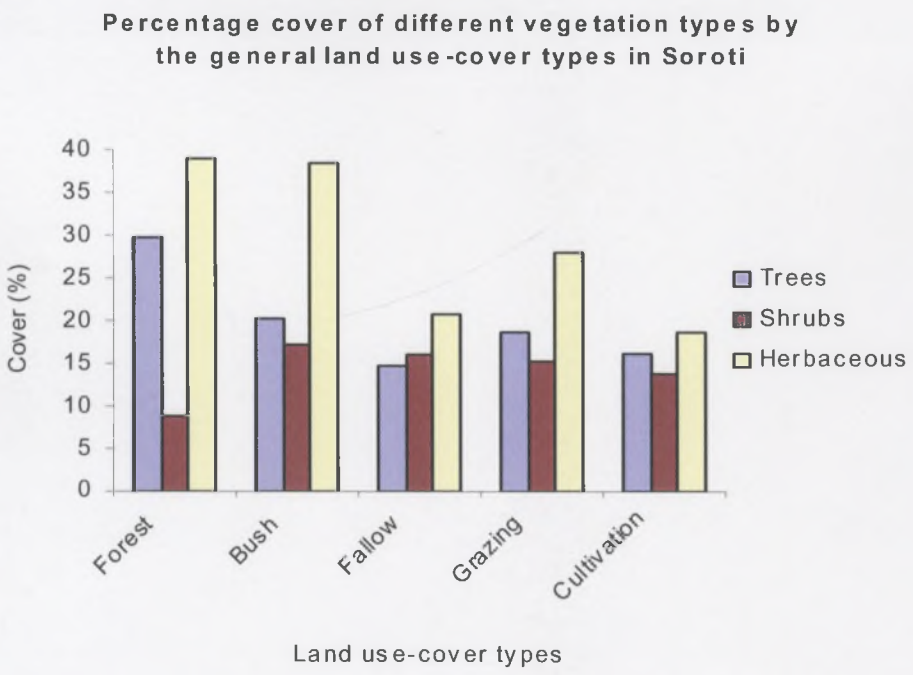
also fewer while land under fallow, grazing and cultivation was higher and therefore sampling efforts for these land use types was also higher

Fig. II 4c – Number of species per hactare by general land use cover types



This diagram shows that the number of tree species per hectare in all the land cover/use types were lower than those of the shrubs and herbaceous plants. Surprisingly there are more species of trees, shrubs and herbaceous plants within the fallow, grazing and cultivation than in the forests and bush which are less disturbed. This is a demonstration that moderate increase in land use from natural or near natural plant cover to non-intensive land use increases plant diversity.

Fig. II 4d – Percentage cover of different vegetation types



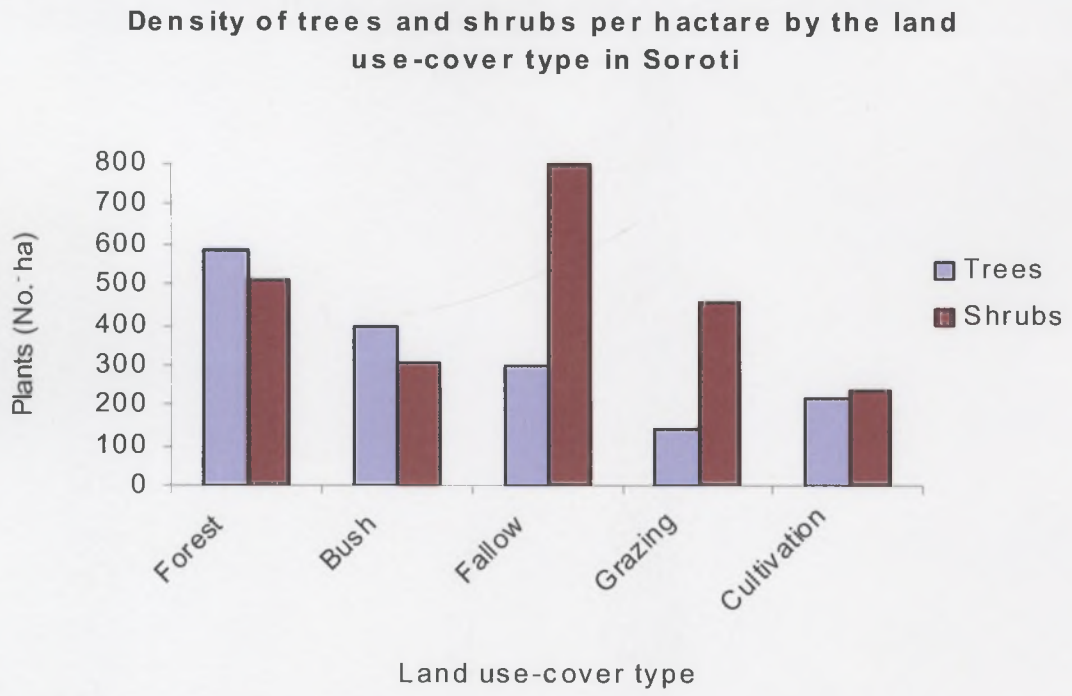
This diagram shows relative average percentage cover of vegetation types per land use category. The most important vegetation cover in Akoroi is that of the herbaceous plants. In each land use type herbaceous cover has the highest percentage followed by trees. Shrub cover is the lowest.

Within the areas categorized, as forests tree canopy cover is only 30%, which means 70% the canopy layer comprises of open spaces. The other possibility is that the trees are young and have not reached their maximum canopy span. However the tree cover is highest in the forest and has no much variance among the bush, fallow, grazing and cultivation.

In all land use types herbaceous cover is the highest followed by trees except in the fallow lands under fallow where shrubs cover show a slight increase over trees.

This shows that shrubs are the most scanty vegetation types in Akoroi. Shrubs are the most harvested by people.

Fig. II 4e – Density of trees and shrubs per hectare

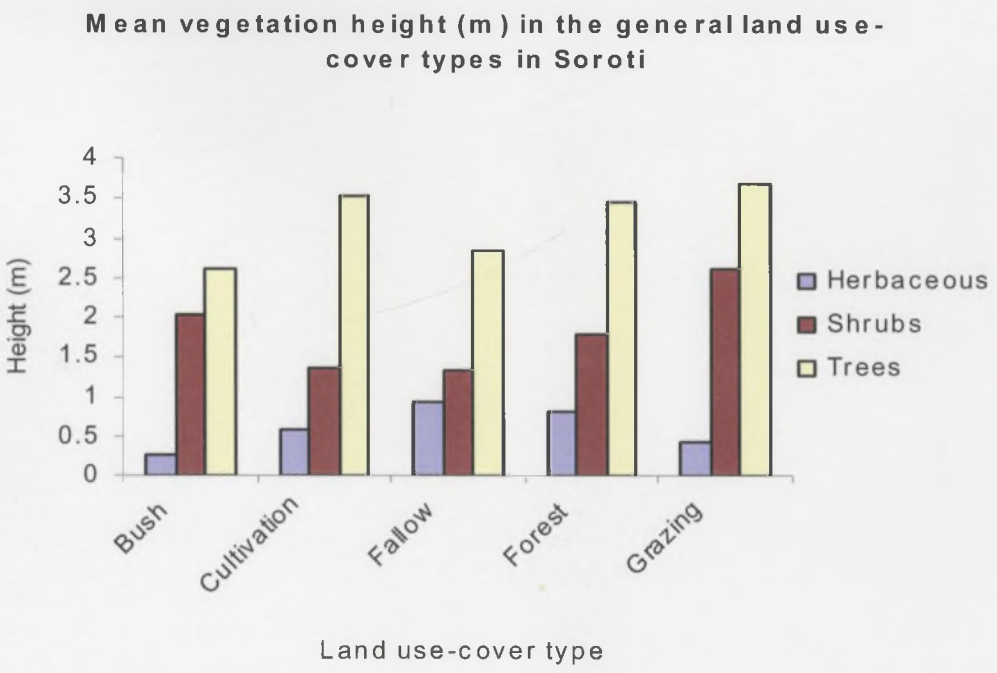


This diagram shows a very interesting observation that trees have a higher density than shrubs on only within the forests and bush. Within the fallow and the grazing lands the density of shrub species is remarkably higher than that of trees while in cultivation the density of the two vegetation types is nearly the same.

As indicated earlier much of what is described, as fallow comprises of abandoned cassava plantation and cava being a shrub their presence makes the density of shrub species much higher. Most of the grazing areas are open with little tree cover and this is also reflected by having a higher shrub density than that of trees.

Taking forests and bush as being less disturbed than the rest of the land use types and considering grazing and cultivation as a change in land use, the effects of the change on tree species is that there is a remarkable reduction in the density of tree species

Fig. II 4f – Mean vegetation height (m) in general land use types



This diagram shows that the stratification of trees, shrubs and herbaceous vegetation categories is quite distinct. The mean height for tree plants ranges from 2.5 to 4.0 meters. This is relatively low for tees compared to the height of trees in a similar agro ecological zone. An average height of a mature tree is 5.0 meters. This mean height range therefore shows that most of the trees in Akoroi are young and have not reached their maximum heights.

A similar situation is observed for shrubs. The mean height of the shrub species ranges from about 1.25 m in cultivation and fallow to 1.5m to 2.5 m in the other land use types. This again shows that the level of disturbance of shrub species is high, as the shrub species are not let to attain their maximum heights.

A striking observation is that trees are taller in the cultivation and grazing areas than in the bush. Bush being communal lands harvesting of tree species is heavier than in the individually owned lands where farmers will find it their own responsibility to protect trees in their land.

DISCUSSIONS

Among all other FITCA-EMMC sites, Akoroi appeared to have a substantial amount of vegetation cover dominated by shrubs, trees and fallow. There were remnants of a former extended forest in some parts especially in localized areas along the riverbanks and in a few scattered places. Although the average tree cover in the forests was about 30%, there was distinct touching tree canopy cover above the shrub layer in many places.

Within the forests, the shrubs canopy layer was very minor. Shrubs were important only in the areas of the forest that were disturbed. The mean height of trees was lowest in the bush and grazing areas. The number of species in all the three vegetation categories appeared to be more in the cultivation, grazing and fallow than in the forest and bushes that less disturbed but the density of trees and shrubs per hectare were lowest in the cultivation and grazing. This showed a change of land use from forest or bush to cultivation and grazing increased the number of plant species but lowered their percentage cover and the density per hectare unless in the shrubs, where shrubs had increased.

It is well known that a change in land use intensity from low to high increases the diversity of plant species (Rucina, 2002) but reduces as land use intensity becomes very high. This is the point where the total number of species is thought to be a time when most of the indigenous species are lost from the ecosystem and are replaced by weeds and exotic species. Based on this understanding land use intensity in Akoroi was still relatively low. This argument was also supported by the fact that there were still many areas with land under fallow at various stages of maturity. In areas where land was under intensive use there were no fallows or if they existed they were only very few and very young.

Cultivation and grazing on wetlands was increasing hence a need to set aside some of the wetlands for conservation. The wetlands were all communal lands and were mainly utilized as communal grazing grounds. Although there were many areas for grazing on individual farms many people took their animals to graze in the communal lands.

Part

III

Human Perceptions on Environmental Changes

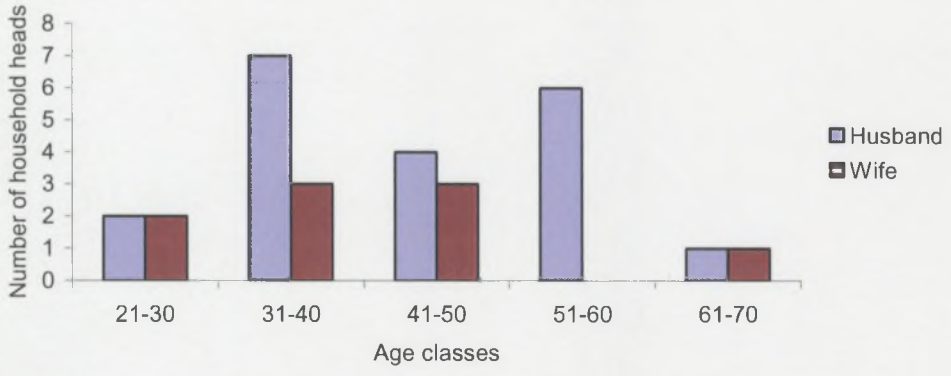
SOROTI DISTRICT (AKOROI VILLAGE)

Household Information

Age of Household Head

The most common age classes for the household heads were 31-40 and 51-60 years, followed by 41-50 years. Of the 43 households surveyed in Akoroi village, less than 5 had their heads in the age categories of 21-30 and 61-70. There were no female household heads in the ag e categories of 51-60, while there are equal male and female household heads in the age categories of 21-30 and 61-70. These findings are shown in *Figure III - 1.*

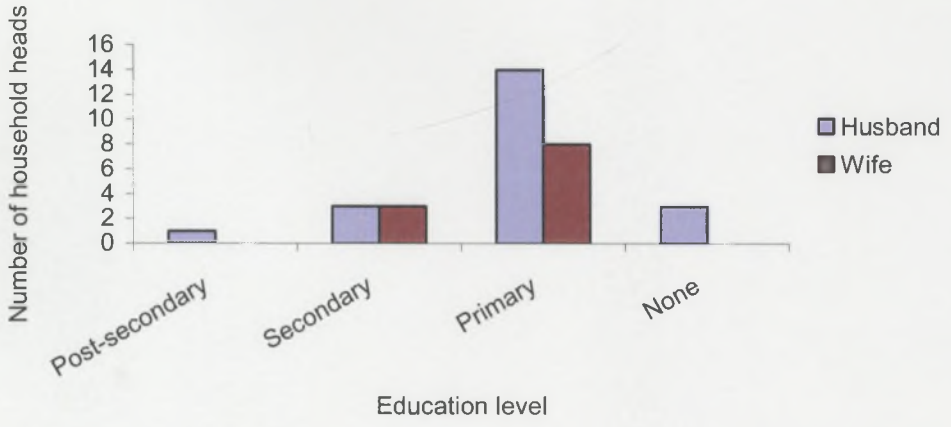
Fig. III -1. Age of household heads in Akoroi village, Soroti District



Education level of Household Heads

Primary level education was the most common educational attainment for both female and male household heads. Less than five households had household heads with secondary and post secondary levels education. Less than five households had heads had no education and these were all male headed. These findings are shown in *Figure III -2.*

Fig. III - 2. Education level of household heads in Akoroi village, Soroti District



Duration of stay by households in the area

Most of the households have stayed in the area for over twenty years, while less than ten households have lived in the area for 10-20 years and the same number has stayed in the area for less than ten years.

Land Use Activities

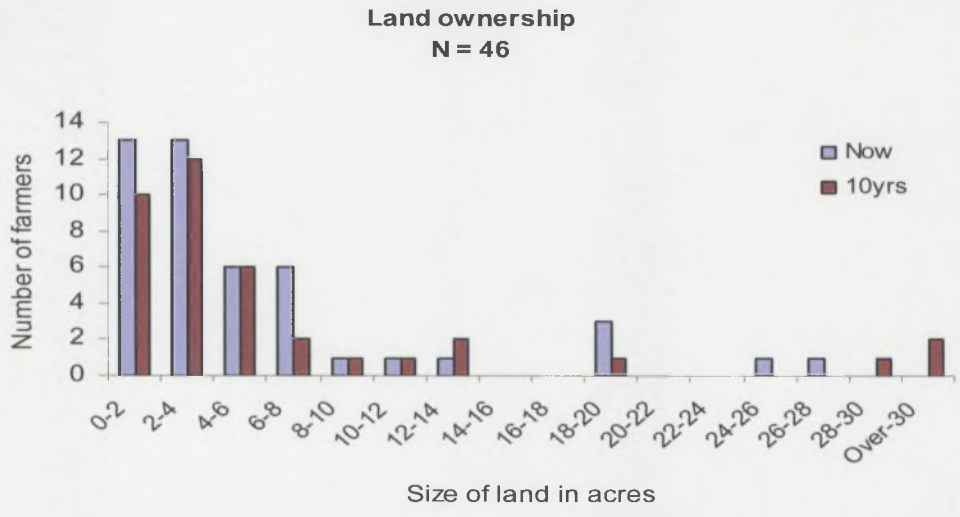
Main occupation of households

The main occupation of the majority of the respondents for the last ten years was farming. However, farming as an activity had increased in the last ten years while fishing, trading and school attendance were only activities of the past, and no longer appeared to be dominant. The majority of households practiced mixed farming, fifteen households practiced crop based farming while less than five households practiced animal based farming. As it is typical of the African traditional culture, husbands were the main managers of both crop and livestock enterprises in almost all the households surveyed. It was only in less than ten households where wives were the managers of these enterprises.

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 Akoroi village, the majority of households had less than five acres of land, and very few households own over five acres each. These findings are shown in *Figure III -3*. The situation appeared not to have changed much in the last ten years, and this could be attributed to migrations to neighbouring districts.

Fig III – 3 Land ownership in Akoroi village in Soroti District



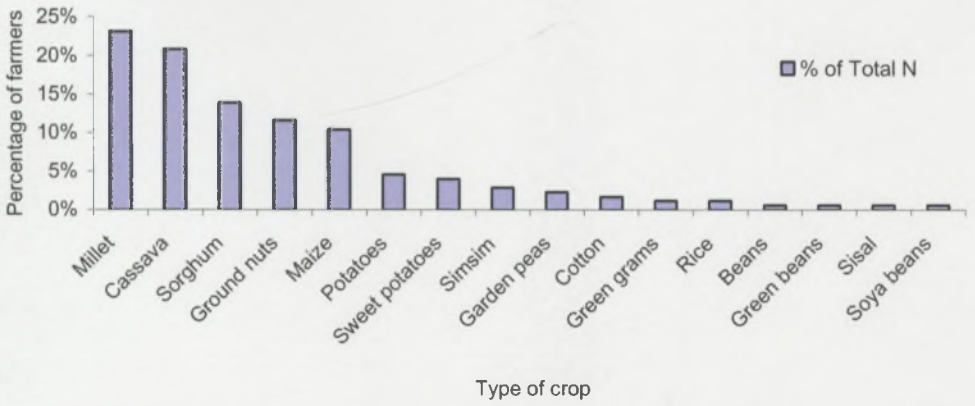
Renting and hiring of land was a common phenomenon in the area. Less than ten households did not rent or hire land. A key finding was that there were more farmers hiring land as compared to those renting land. This was a clear indicator of scarcity and unequal access to land in the area. The main use of land was grazing, and this was not surprising given that Soroti district is part of the 'cattle corridor' of Uganda. The other main land use activities included cropping, forests and fallow.

Crop Production

The main crops grown by households in this village were millet, cassava, sorghum, groundnuts, maize, potatoes and sweet potatoes. Millet and cassava were the two main staple foods in the area, and were also important sources of income. Cotton was also being increasingly produced as a cash crop in the area. The other crops grown on small scale

included simsim, garden peas, rice, beans and soybean. These findings are shown in *Figure III -4.*

Fig. III 4. Main crops grown in Akoroi village, Soroti District



Apart from maize and sweet potatoes, there were no major differences in acreage per type of crop today and ten years ago. The total acreage of maize increased from less than 50 acres ten years ago to over 100 acres today. This could be attributed to the emergence of maize as a major non-traditional cash crop in the country with a ready market both locally and in neighbouring countries. On the other hand, the production of sweet potatoes had dwindled over the years and this trend is yet to be explained. It was also revealed that the proportion of farmers growing cassava and millet had fallen by about 30% while the proportion of farmers growing sorghum had over 10%. These findings are shown in *Figures III -5 and 6.* Production was mainly for home use, and for the market (to a limited extent). This is shown in *Table III - 1.*

Crop husbandry practices

The most common cropping pattern is mono cropping and seems to have changed much over the last ten years (*Table III -1*). The other practices were inter-cropping and strip cropping, which had slightly increased in the last ten years. The main sources of seed today included, selection from previous harvest, market, borrowing and cooperative (to a limited extent). Selection, market and cooperative as sources of seed had increased in the last ten years while borrowing had progressively declined over the years. As poverty continued to increase in the

rural areas partly due to civil strife and insurgency, farmers were increasingly retaining their own seeds from harvests for future planting, and less reliant on neighbours and markets as key sources. Pest control as a husbandry practice was very limited in use, although it had slightly increased in the last ten years. This could be attributed to the high prices of chemicals and lack of awareness. There were also shifts in growing crops with some being dropped in favour

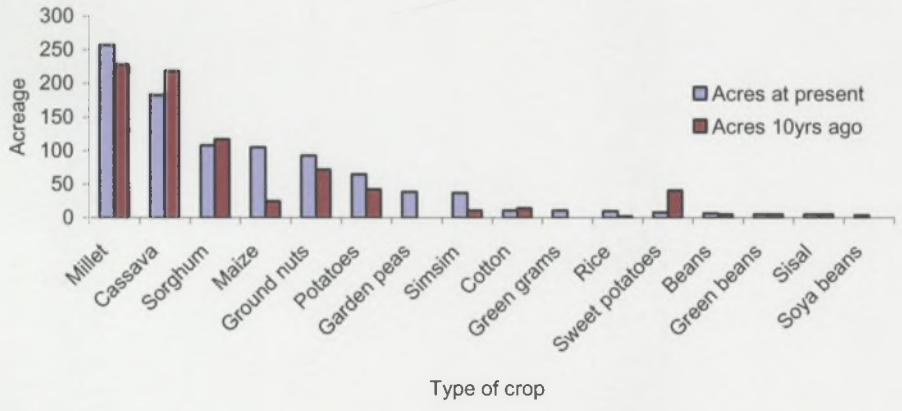


Fig. III - 5. Total acreage of crops in Akoroi village, Soroti District

of others. The major reasons provided for not growing certain crops were inadequate labour, inadequate land and lack of markets.

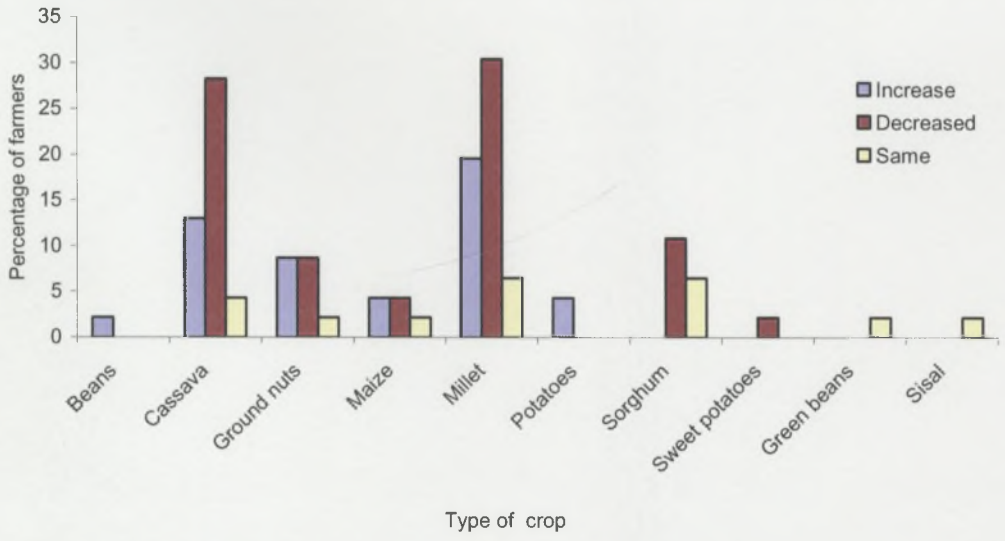


Fig. III - 6. Variation in proportion of farmers growing crops in Akoroi village, Soroti District

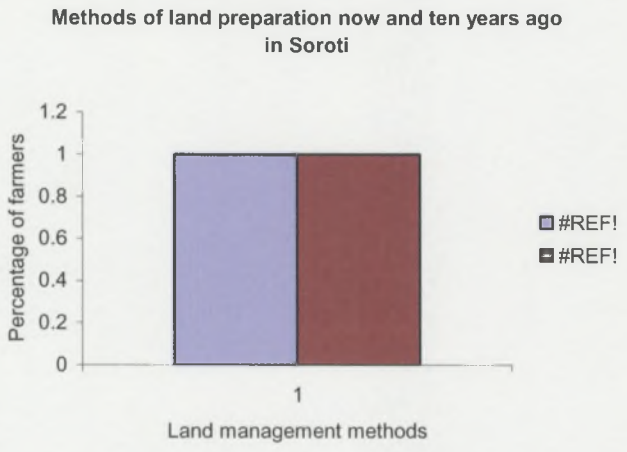
Table III - 1. Common seed sources, cropping and use of harvests in Akoroi village, Soroti District

N = 187				
		Now	Past	Difference (past-now)
Seed source	Selection	86	58	-28
	Market	53	47	-6
	Borrow	10	16	6
	Cooperative	2	1	-1
Cropping pattern	Inter	57	39	-18
	Mono	89	82	-7
	Strip	4	2	-2
Pest control	Chemical	21	6	-15
	None	128	105	-23
	Traditional		1	1
Harvest use	Home	75	68	-7
	Sale	23	8	-15
	Sale/Home	56	44	-12

Land Preparation Methods

Before the land was prepared for planting, it was normally cleared first. The most common method of clearing land was by the use of panga and axes, and by bush clearing which also seemed prominent. There was no mechanization at all in the land. An interesting observation was made on the land preparation methods. The percentage of farmers using ox-plough had increased from less than 40% ten years ago to over 70% today. The proportion of farmers using the hoe had plummeted from close to 60% ten years to less than 20% today. This was a positive trend as farmers moved from the use of manual labour for tillage to semi-mechanized production. This trend, however, is being threatened by tsetse infestation in the entire eastern region of the country *(Figure III -7)*.

Fig.III - 7. Methods of land preparation in Akoroi village, Soroti District



Crop planting methods

On the other hand, planting methods were predominantly by the use of hoe, manual planting and broadcasting. These three planting methods showed major variation in use over the last ten years. Less than 5% of the farmers used ox-ploughs for planting and this could be attributed to lack of appropriate ox-driven planting implements. Most farmers weeded their crops using the hand hoe. Seventeen households were found to be using manure. The low use of manure could be attributed to the perceptions about the fertility of their soils (*Table III -3*). The majority (forty respondents) believed that, soil infertility was not a problem in the area. A

related observation was that most farmers did not seem to know any soil fertility indicators. The majority of farmers used manual labour for harvesting and this practice had increased in the last ten years. Most households used both hired and family labour, while only 11 used only hired labour.

Table III - 2. Crop and land management in Akoroi village, Soroti District

Crop / Land management (N = 176)		Now	Past	Difference (past-now)
Weeding	Hoe	173	164	-9
	None	3	4	1
Soil fertility management	Manure	17	12	-5
	None	157	156	-1
Harvest	Machine	1		-1
	Manual	169	158	-11
Labour source	Both	86	61	-25
	Family	74	93	19
	Hired	11	6	-5

Table III - 3. Perceptions on soil erosion and infertility, causes, indicators and their control methods in Akoroi village, Soroti District

		Respondents N = 46
Soil erosion	Present	3
	Absent	43
Erosion causes	Continuous cultivation	1
	Heavy rains	2
	N/A	43
Erosion Control methods	Strip cropping	2
	N/A	44
Soil infertility	Present	6
	Absent	40
Soil infertility indicators	Nutrient leaching	2
	Stunted growth	2
	Water logging	2
	N/A	41

N/A = Not aware

The general perception of farmers was that, soil erosion was not a problem in the areas and hence there were no efforts to control it. This could be true given the terrain of the area, which was largely flat.

Livestock ownership and management

Livestock ownership

The main livestock types kept in the area-included cattle (mainly indigenous (native), sheep, goats and chicken. A notable observation was that livestock densities had dwindled over the last ten years (*Figure III -8*). Cattle densities fell from over 30% ten years ago to less than 10% today, sheep from 20% to less than 5% and goats from 15% to 5 %. Two main reasons were to blame for this trend, namely the rebel insurgency in the late 1980s and early 90s, and cattle rustling by the Karimojong warriors. There had been concerted efforts by government

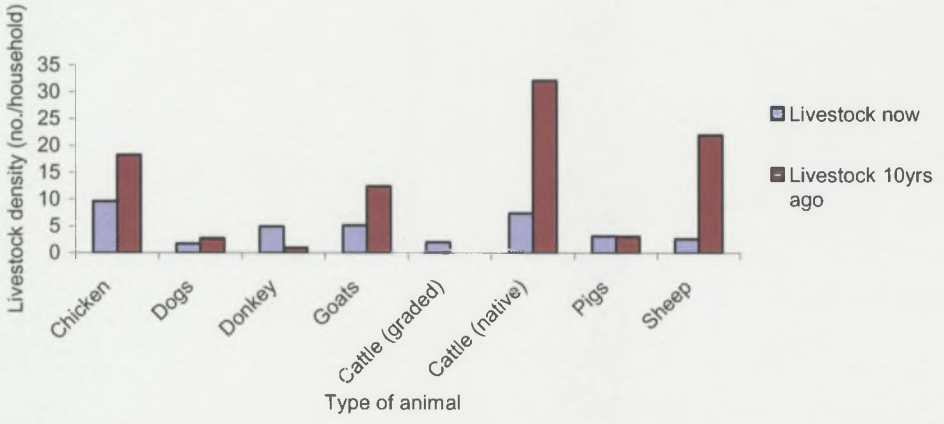


Fig. III - 8. Livestock ownership in Akoroi village, Soroti District

to restock the affected areas in eastern Uganda, but the impact was yet to be felt. An analysis of trends in stocking rates per household in different farming systems (animal based, crop based and mixed) indicated a dramatic decline.

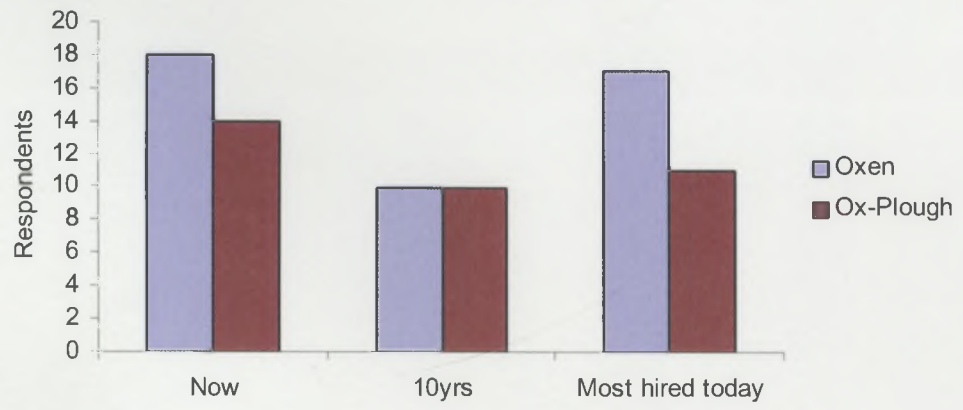


Fig. III - 9. Ownership of oxen and ox-plough in Akoroi village, Soroti District

An interesting observation, however, was that the number of households owning oxen and ox-ploughs had increased in the last ten years. This finding was in consonance with the earlier observation that the use of ox ploughs for land preparation had increased in the last ten years, and more farmers had resorted to cropping following the loss of their cattle stock through theft and rustling.

Livestock based income

The main livestock-based income was obtained from ox rent. Thirteen respondents earned income from milk, two from calf sales, one from sales of adult cows; one from sales of skins and none from sell of manure. This was an indictor that livestock was not a major source of income in the area. These are shown in *Table III -4.*

Table III - 4. Livestock based income in Akoroi village, Soroti District

Sources	Respondents N = 46
Ox rent	13
Milk	6
Calf	2
Adult	1
Skin	1
Manure	0

Grazing Systems

The main grazing system was free-ranging/tethering, with the zebu being the main breed of cattle kept. The system has increased in use with twenty-four households using it now as compared to only sixteen households that used it ten years ago. Zero grazing was not practiced ten years ago but is now emerging as a production system type under the government supported restocking program. As land availability continues to dwindle due to population increases, zero grazing is likely to become more important as compared to free ranging.

Table III - 5. Main grazing areas during wet and dry seasons in Akoroi village, Soroti District

Grazing areas – today		Wet	Dry
Own	Pasture/uncropped land	16	12
	Post harvest cropped	8	5
Neighbours	Pasture/uncropped land	12	7
	Post harvest cropped	6	2
Public land		8	12
Grazing areas – past (ten years ago)			
Own	Pasture/uncropped land	13	7
	Post harvest cropped	7	1
Neighbours	Pasture/uncropped land	8	3
	Post harvest cropped	6	2
Public land		4	9

The main grazing areas were; own pasture/uncropped land, neighbors' pasture/uncropped land, public land and post harvest cropped land. The grazing areas had not changed much in the last ten years, except on own pasture/uncropped land and public land, which exhibited a declining trend. The main source of water for cattle was rivers/streams, followed by borehole, lake/pond and lastly wells. Grazing in public lands also seems to have substantially increased now compared to ten years ago.

Perceived Trypanosomosis Prevalence and Control

Only eleven respondents perceived trypanosomosis to be a problem, three did not perceive it to be a problem, while seven did not know the disease. On control methods, twelve respondents mentioned drugs as a trypanosomosis control method, while nine did not know of any control method (*Table III -6*). An important observation was that, respondents did not know of any environmental implication of tsetse control. Only one respondent thought tsetse control could have some implications on soil fertility, but was also unclear on the exact mechanisms.

Table III - 6. Perceptions of trypanosomosis prevalence and its control methods in Akoroi village, Soroti District

		Respondents N = 46
Is it a problem?	Yes	11
	No	3
	Unknown	7
Control methods if present	Drugs	12
	None	9
Reasons for non-control where present	Lack of know how	7
	Unknown drug source	1
Implications of control to the environment	Soil fertility impact	1
	None	6
	Does not know	11

Vegetation Types

Knowledge of plant species

Twenty respondents were able to name plant species found in the area in the past and today. About the same number of respondents were able to name plant species that had disappeared from the areas. These are shown in *Figure III -10.*

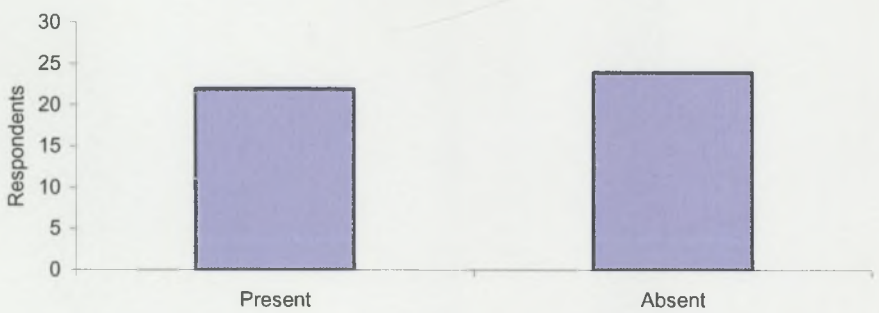


Fig. III - 10. Knowledge of particular plant species that have or are disappearing in Akoroi village, Soroti District

Wildlife Biodiversity

Changes in wildlife types and numbers

Birds were the majority wildlife types available, followed by mammals, reptiles and lastly rodents. Respondents perceptions' indicated that, there had been no major differences in wild life types and numbers in the last ten years. All types of wild life appeared to have declined in numbers but the perceived magnitude was very low. These findings are shown in *Figure III - 11.*

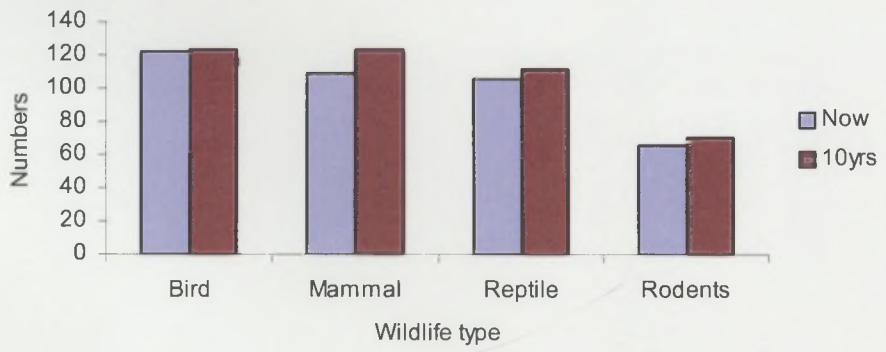


Fig. III - 11. Perceived differences in wildlife types in Akoroi village, Soroti District

The main reason attributable to the observed decline in wild life numbers as perceived by respondents was hunting, deforestation and population pressure. More than forty respondents mentioned bush hunting as the main cause of wild life disappearance, fifteen respondents mentioned deforestation, while five respondents thought population pressure was responsible.

Fig. III - 12. Perceptions of causes of wildlife disappearance in Akoroi village, Soroti District

Wildlife conflicts

Human/wild life conflicts were reported in Akoroi village. Twenty respondents rated the wild life conflicts in the village as high in importance, an almost equal number rated it as moderate, while less than five thought there were no wild life conflicts. The main wildlife conflicts mentioned were crop destruction, poisonous effect to man and livestock, and prey on

livestock. Other minor complaints were consumption of post harvest and destruction of property. These are shown in *Figure III -13.*

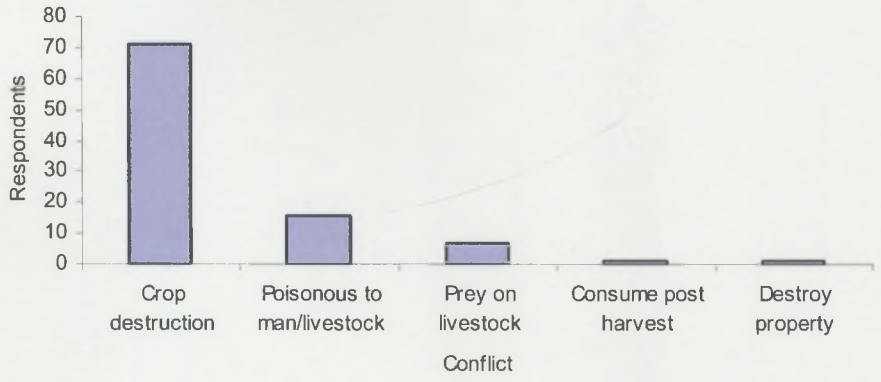


Fig. III - 13. Nature of perceived wildlife conflicts in Akoroi village, Soroti District

Water Resources

Domestic Water Sources

The main sources of water for domestic use then were boreholes, rivers/streams, and wells, and lakes and ponds. There had been a significant increase in the use of boreholes, and this had been due to the increased presence and activities of NGOs especially RUWASA, which was a unit within the Directorate of Water Development. RUWASA had been very active in most districts of eastern Uganda. It was hypothesized that the use of streams and rivers had considerable reduced in the last ten years because of this occurrence (*Table III -7*).

Table III - 7. Main domestic water sources in Akoroi village, Soroti District

	Season	Ten yrs ago	Now
Bore hole	Dry	9	28
	Wet	9	28
River/Stream	Dry	26	12
	Wet	24	10
Well	Dry	5	11
	Wet	9	15
Lake/Pond	Dry	9	1
	Wet	6	0
Spring	Dry	3	0
	Wet	4	1
Roof catchment	Dry	0	0
	Wet	1	0
Piped water	Dry	0	0
	Wet	0	0

An interesting observation was made about the perceptions of respondents of the quality of water for domestic use. Twenty-six respondents thought water was not polluted, while twenty thought it was fairly polluted. Twelve perceived their water to be very clean, Twenty-seven believe their water to be fairly clean while only seven thought their water was dirty (*Table III -8*).

Table III - 8. Perceptions about quality of water in Akoroi village, Soroti District

Quality		Respondents N = 46
Pollution level	Fairly Polluted	20
	Not Polluted	26
Cleanliness	Dirty	7
	Fairly clean	27
	Very clean	12
Taste	Bad	6
	Fairly good	30
	Very good	10
Safety	Safe	28
	Unsafe	18

Seasonality and Access to Water

The majority of households in Akoroi village were within the range of 1.75-2.00 km distance to water sources both in the dry and wet seasons, with more households having difficulty in accessing water in the dry season. This is shown in *Figure III -14*.

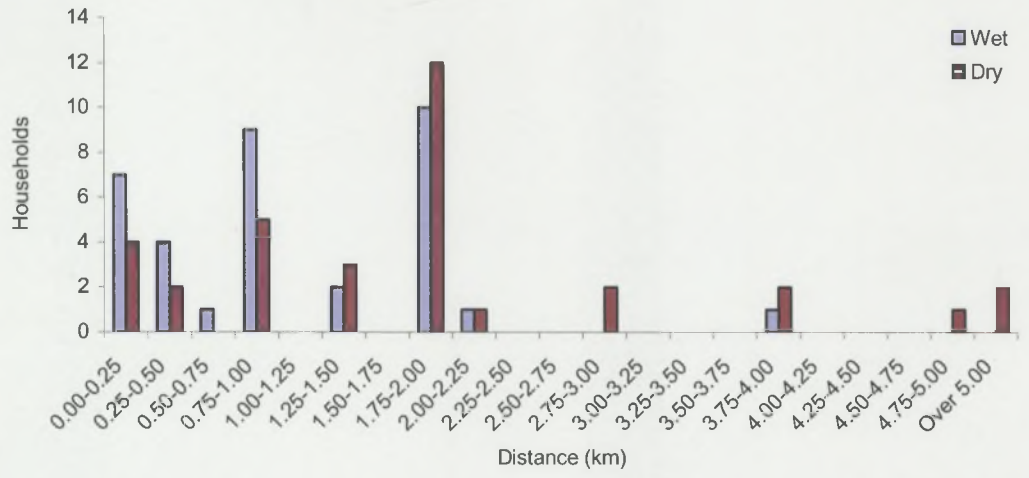


Figure 14. Comparison of distance to water sources during wet and dry seasons in Akoroi village, Soroti District

Fuel Resources

Fuel sources

The main source of fuel was dry wood, followed by paraffin. Forty-five ranked dry wood as their main source of fuel, while none ranked paraffin or charcoal as the main source. Forty two ranked paraffin as their second most important source of fuel, while only one ranked charcoal second (*Table III -9*). The sources of fuel had not changed much over the past ten years. Forty-six respondents obtained fuel from bushes ten years ago while forty-four still obtain fuel from bushes today (*Table III -10*). None of the respondents bought fuel ten years ago, while only one buys fuel today.

Table III - 9. Sources of fuel in Akoroi village, Soroti District

Rank of fuel sources in order of importance by usage				
Rank	Dry wood	Paraffin	Charcoal	Swamp vegetation
1	45			
2		42	1	1
3		1	3	

Table III - 10. Availability and sources of fuel and other environmental variables in Akoroi village, Soroti District

Availability and sources of fuel and other environmental variables now and ten years ago		
Fuel and other environmental factors		Frequency (N=46)
Fuel source ten years ago	Bushes	46
	Buy	0
Fuel source today	Bushes	44
	Buy	1
Fuel supply now compared to ten years ago	Different	43
	Same	3
Natural forests availability	Present	15
	Absent	31
Natural forest access	Present	15
	Absent	31
Forest cover trends	Decreased	35
	Increased	2
	No Change	2
Reasons for observed trends in forest cover	Charcoal burning	5
	Crop cultivation	7
	Government restrictions	3
	Population pressure	23

Availability of fuel

Fuel supply seems to have considerably changed in the last ten years. Forty-three respondents thought the supply of fuel had changed, while only three felt the supply had remained the same (*Table III –10 above*). The majority of respondents believed natural forests were absent and that the forest cover was decreasing. The main reason thought to be responsible for the dwindling forest cover was the increasing population pressure. The other minor reasons included cultivation and charcoal burning.

Forest Products

The main forest products were food (mushrooms, honey and fruits), grass, fibres, medicinal plants, wild animals (meat) craft and poles. There seemed to be no major differences in availability of forest products now and ten years ago, except for food materials, which appeared to have slightly dwindled. This is seen in *Figure III -15*.

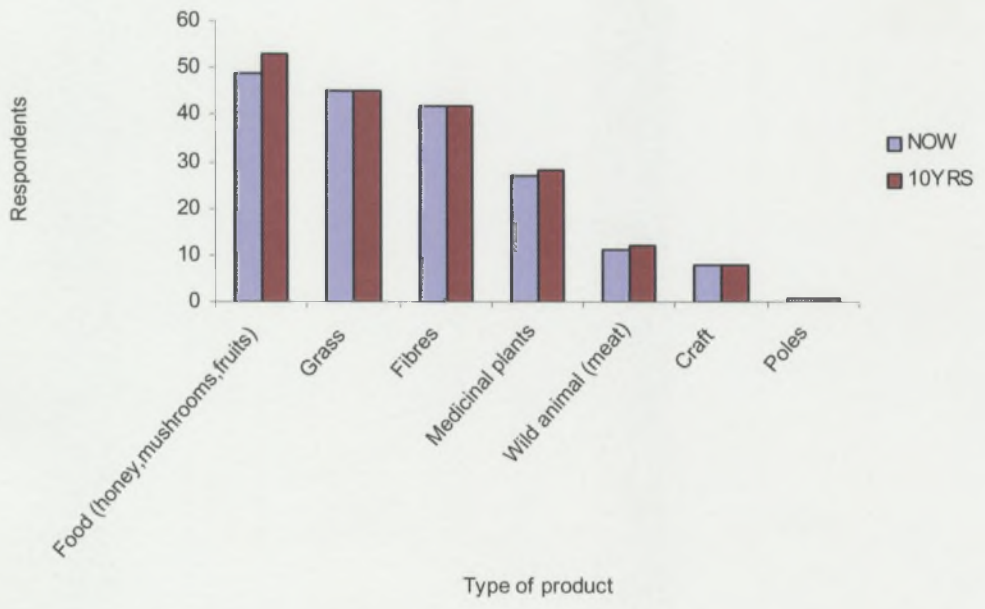


Fig. III - 15. Forest/bush products in Akoroi village, Soroti District

Level of use of forest products

The most regularly used forest products were fibres for construction, grass for thatching, medicinal plants for medicines, and wild fruits for food. Bush meat for food, honey for food, and craft/dye for crafting mats and ropes were rarely used products (*Table III -11*).

Table III -11. Level of use of forest products in Akoroi village, Soroti District

Forest and bush products level of use now compared to ten years ago n = 200				
Product name	Use	Level of use		
		Not used	Rarely	Regularly
Craft/Dye	Construction			1
	Crafting		5	
	Mats		1	2
	Ropes		1	
Fibres	Construction		19	12
	Craft		1	
	Ropes		1	
Grass	Construction		2	
	Thatching		22	13
Honey	Food		7	1
	Food-medicine		2	1
Medicinal plants	Medicine		10	12
Mushroom	Food		1	
Poles	Construction			1
Bush meat	Food	2	4	3
Wild fruit	Food		21	11

DISCUSSION

The main occupation of people in Akoroi for the last ten years has been farming. This occupation is said to have increased in the last ten years while other activities like fishing and trading were only activities of the past, and no longer appear to be important. Reasons for this were not well known but could be attributed to an increase in the demand for food by an increasing population. As observed many of the farmers were young school leavers who had taken into cultivation as an occupation. Employment in towns had become rare and opportunities in trading were beyond the reach of many people due to lack of capital.

Majority of the people practiced mixed farming, while a few people practiced animal based farming. However, ten years ago the situation was different as there were more animal based farming than now. The current decline in animal based farming was due to tribal conflicts between the Teso people and the Kalamojong that resulted into massive loss of animals due to raids. As it is typical of the African traditional culture, husbands were the main managers of both crop and livestock enterprises in almost all the households surveyed. It was only in a few homes where wives were the managers of these enterprises.

The main crops grown in this village were millet, cassava, sorghum, groundnuts, maize, potatoes and sweet potatoes. Millet and cassava were the two main staple foods in the area, and were also important sources of income. Cotton was also being increasingly produced as a cash crop in the area. The other crops grown on small scale included simsim, garden peas, rice, beans and soybean. Crop productions as a source of income had a high potential in the area but there was need to improve accessibility to markets. With the promotion of the use of oxen in ploughing, crop production would continue to increase. However, this increase might impact negatively by reducing the vegetation cover sustaining the surface water resources in the area. There was then the need to monitor cultivation to avoid bush clearing along the rivers and the swamps. Currently rice cultivation around the swamps threatens wetland conservation and public awareness is needed to avert a crisis in the near future.

It has been observed that the number of people owning oxen and ox-ploughs had increased in the last ten years. This finding was consistence with the earlier observation that the use of ox ploughs for land preparation had increased in the last ten years, and more farmers hadresorted to cropping following the loss of their cattle stock through theft and rustling. This increase in the number of oxen and ox-ploughs had enabled cultivation as farmers could till more land.

The main grazing areas were own uncropped land, neighbors' pasture/uncropped land, public land and post harvest cropped land. The grazing areas had not changed much in the last ten years, except own pasture/uncropped land and public land, which exhibited a declining trend. This was probably due to the abundance of land for grazing and the decline in livestock after the raids by the Kalamojong. The main source of water for cattle was the rivers/streams, followed by borehole, lake/pond and lastly wells. Grazing in public lands also seemed to have substantially increased then compared to ten years ago.

Birds were the majority of wildlife types available, followed by mammals, reptiles and lastly rodents. The perceptions of respondents indicated that, there had been no major differences in wild life types and numbers in the last ten years. All wild life types appeared to have declined in numbers but the perceived magnitude was very low.

Respondents perceived the main reason attributable for the observed decline in wild life numbers as hunting, followed by deforestation and population pressure. More than forty respondents mentioned bush hunting as the main cause of wild life disappearance, fifteen respondents mentioned deforestation, while five respondents thought population pressure was responsible.

The main sources of water for domestic use then were boreholes, rivers/streams, and wells, and lakes and ponds. There had been a significant increase in the use of boreholes, and this had been due to the increased presence and activities of NGOs especially RUWASA, which is a unit within the Directorate of Water Development. RUWASA had been very active in most districts of eastern Uganda. It was hypothesized that the use of streams and rivers had considerably reduced in the last ten years due to this occurrence (*Table III -7*).

The main source of fuel was dry wood, followed by paraffin. Forty-five ranked dry wood as their main source of fuel, while none ranked paraffin or charcoal as the main source. Forty two ranked paraffin as their second most important source of fuel, while only one ranked charcoal second (*Table III -9*). The sources of fuel had not changed much over the past ten years. Forty-six respondents obtained fuel from bushes ten years ago while forty-four still obtain fuel from bushes today (*Table III - 10*). None of the respondents bought fuel ten years ago, while only one buys fuel today

GENERAL CONCLUSION AND RECOMMENDATIONS

Akoroi Village is well endowed with natural resources. Quite a good percentage of land is still under natural vegetation. There are a few remnants of forests in areas where human settlement is not high. Although all the land is under private ownership, some of the land parcels are too large for the farmers to cultivate it all. However, this access to large pieces of land will soon end due land subdivision to younger generations.

Wood resources are available to meet the demands of people in construction. There are two ways in which wood resources are heavily used in a non-sustainable manner. These are in charcoal burning and brick making. The amount of wood being used in charcoal burning is high and might soon clear all the large trees especially of those species that produce charcoal of high value. The other activity that is utilizing wood in large quantities is making of bricks for construction. Charcoal bricks are made mainly for commercial purposes and there is no regulation on which tree(s) to use. There is need for some sort of regulation on which tree(s) to cut down and to encourage tree planting to replace those cut down.

Use of animal traction in land preparation is quite high although there has been a few cases of animal death due to trypanosomosis. With the implementation of animal spraying, tsetse densities are expected to reduce significantly. However, there is a shortage of animals for traction not only due to trypanosomosis but also due to animal's loss to raids by the neighbouring Kalamonjong. Restocking of livestock is now high on the agenda of many

farmers and with FITCA intervention and the prevailing peace in the area animal livestock numbers will increase and animal health will improve and thus traction power will be readily available. Cultivation will therefore increase.

The area has no cash crop at the moment except for the cassava that doubles up as a cash crop and also a source of food. Cotton growing is currently making a come back. While we were in the field for this study several deliveries of cotton seeds for planting were made to farmers. Cotton growing requires big pieces of land to be planted in order to achieve harvests that are economically viable. This will definitely increase the amount of land cultivated and reduce the current vegetation cover.

Most of the wetland areas are used for rice cultivation. Even in areas where there is no cultivation, the wetlands in the area are cultivated with rice. This is because rice is a cash crop and in the absence of any other reliable cash crop, rice growing has been on the increase.

The current scenario of land use in Akoroi village is an expanding cultivation and an expanding livestock keeping. These two are competing for land although land subdivision is taking place at the same time. Though land appears to be available for all at the moment, as a result of all these forces, there will soon be a scarcity of land in the village.

A lot of changes in land use are taking place now and for these changes to be sustainable, farmers must be trained on how to do soil conservation in their gardens to avoid or reduce erosion that is likely to reduce the output of their farming systems. The farmers need to plant trees as a measure of soil conservation. They need to be guided on the choice of the right species to plant and where or how to plant then to check movement of soils against the gradient in their gardens.

Wetlands are mainly communal or state lands and their utilization is governed by the state. However, there are conflicts between the state government and the local councils on the management of wetlands. The local councils do not effect sometimes-state laws adequately.

There is a need for the local councils especially at the LC1 level to be sensitized and guided on how to protect the wetlands.

There is only one farmer who has exotic cows while all others have indigenous breeds that are poor in yields and are not economical to ~~rare~~ rear in zero grazing units. Since less and less livestock feeds will be the trend now, keeping of dairy cows in zero grazing units is bound to increase. This will benefit the environment by reducing the grazing pressure.

REFERENCES

Bouzart B, Maitima J, Nyabenge M and Reid R FITCA/EMMC 2002. Annual report 2002

Mathai Stephen, Joseph Maitima, Fredrick Atieno, 2002 . Effects of Land use on Composition and Distribution of Plant Species in Embu-Mbeere, Kenya . Poster presented in Africam Pollen Database workshop in Rabat Morocco

Bouzart B, Maitima J, Nyabenge M and Reid R FITCA/EMMC 2002. Annual report 2002

G. Kleitz; R. Lancelot; S. de La Rocque. 2002. Assessment of disease risk and tsetse challenge Ethiopia, Kenya, Uganda. FITCA EMMC, Short Term Consultancy. ILRI/CIRAD

Maitima, J.M., Pierre Poilecot and Bernard Toutain. 2002. Agro-pastoral and agro-ecological baseline survey: Methodology. FITCA EMMC, Short Term Consultancy. ILRI/CIRAD

Njuguna C. Evanson 2003 Land Use Land Cover Mapping: GPS methodology. 2003

Maitima, J.M. E, Njuguna, J. Karuga, S. Mugatha; Assessment of land Use, vegetation and human perceptions on environmental changes in FITCA EMMC sitesa: Busia Township (Busia District, Western Kenya), 2003

Kamanyire, marilyn, 2000. Sustainability Indicators for Natural Resource Management and policy; Natural Resource Management and Policy in Uganda-Overview. Economic Policy Research Centre.

NEMA (1996) State of the environment for Uganda 1996

World Bank (1993) "Uganda Agriculture".

Reid S. Robin and Ellis E. James 1995. Final report to the Rockfeller Foundation for an environmental fellowship in International Agriculture entitled, "The environmental Implications of Controlling Tsetse-transmitted Trypanosomosis" ILRI.

Reid S. Robin. 1999???. Environmental Monitoring and management Component. Farming in tsetse control areas. ILRI

Nagel, P. 1993. The effects of tsetse control on natural resources. Meeting of the panel of experts on ecological, technical, and developmental Aspects of the Programme for the Control of African Animal Trypanosomosis and Related Development. Rome, Italy, 1-3 December, 1993.

Jahnke, H.E., Tacher, P. Keil and Rojat. 1988. Livestock production in traopical Africa, with special reference to the tsetse-affected areas. In: ILCA/ILRAD. Livestock Production in Tsetse –Affected areas of Africa, pp. 3-21. ILCA/ILRAD, Nairobi, Kenya.

Tiffen, M., M. Mortimore, and F. Gichuki. 1994. More People, Less Erosion. Environmental recovery inkenya. Overseas Development Institute. ACTS Press, Nairobi Kenya.

Tukahirwa, Joy .M.B.2003. Policies, People and Land Use Change in Uganda
A Case Study in Ntungamo, Lake Mburo and Sango Bay Sites. LUCID Working Paper Number: 17. ILRI

Appendix 1

List of plants in Soroti

Aalypha neptunica
Abutilon mauritianum
Acacia gerrardii
Acacia hockii
Acacia mellifera
Acacia senegal
Acacia seyal
Acacia sieberiana
Acalypha ornata
Acalypha villicaulis
Achyranthus aspera
Aerva lanata
Aeschynomene schimperi
Aframomum angustifolium
Ageratum conyzoides
Albizia adianthifolia
Albizia coriaria
Albizia zygia
Albizia(like tar.)
Allophylus abyssinica
Allophylus africanus
Alysicarpus glumaceus
Amaranthus dubius
Amaranthus spinosus
Amorphophallus abyssinica
Anacardium occidentale
Andropogon gayanus
Annona senegalensis
Antiaris toxicaria
Arachis hypogea
Arisaema mildbraedii
Asperangus africanus
Aspili kotschyi
Asystasia gangetica
Bare ground
Belonophora glomerata
Berkheya spekeana
Bidens pilosa
Boswellia
Brachiaria brizantha
Brachiaria decumbens
Brachiaria platynota
Bridelia micrantha
Bridelia scleroneuroides
Butryospermum parkeri
Canthium vulgare
Capparis tomentosa
Carrisa edulis
Cassia didymobtrya
Cassia hirsuta
Cassia singeana
Cassia singueana
Celosia trigyna
celtis africana
Chamaecrista kirkii
Cheatacme aristata
Chloris pycnothrix
Chrysanthellum americanum
Cissus quadrangularis
Clerodedrum rotundifolius
Clerodedrum umbrellatum
Clerodendrum myricoides
Combretum
Combretum binderanum
Combretum collinum
Combretum ekoboi
Combretum molle
Commelina africana
Commelina arrecta
Commelina benghulensis
Conyza floribunda
Crabbea velutina
Crotolaria
Curcuma longa
Cussonia arborea
Cyanotis foecunda
Cynodon datylon
Cyperus dubius
Cyperus iria
Cyperus macronthus
Cyperus oblongus
Cyphostemma adenocaule
Desmodium canam
Desmodium gangeticum
Desmodium repandum
Dicliptera laxata
Dicrostachys cinerea
Digitaria abyssinica
Digitaria longiflora
Dioscorea dumetorum
Dioscorea quantiana
Dombeya rotundifolia
Dovyalis macrocalyx
Drypetes gerrardii
Drypetes sp.
Dyschoriste radicans
Elensine indica
Eleusine corocana
Eragrostis ciliaris
Eragrostis patens
Erianai (Ochna)?
Erionit(unknown)
Erythrina abyssinica
Erythrococca bongensis
Euclea divinorum
Euclea latidens
Euphorbia candelabrum
Euphorbia heterophylla
Euphorbia hirta
Euphorbia(lk hirta)
Ficus brachypoda
Ficus glumosa
Ficus ingens
Ficus natalensis
Ficus ovata
Ficus thonningii
Flacourtia indica
Flueggea virosa
FTCA 11
Galinsonga parriflora
Gardenia jovis-tonantis

Geophila repens
Gladiolus psittacinus
Grewia bicolor
Grewia mollis
Grewia mollis-1
Grewia similis
Grewia trichocarpa
Guizotia scabra
Guttiferae
Gyanura scandens
Harrisonia abyssinica
Heeria reticulata
Hewettia sublobata
Hymenocardia acida
Hyparrhenia filipendula
Hyperrhenia rufa
Imperata cylindrica
Indigofera arrecta
Indigofera circinella
Ipomoea acuminata
Jasminum abyssinicum
Justicia exigua
Justicia flava
Kigelia aethiopica
Kigelia africana
Kyllinga alba
Lactuca capensis
Laggera alata
Lannea barteri
Lannea humilis
Lannea stuhlmannii
Lantana camara
Lantana trifolia
Leonotis nepetifolia
Lippia javanica
Lonchocarpus laxiflorus
Terminalia sp.
Terminalia velutina
Tetracera
Themedaa triandra
Thevetia peruviana
Toona ciliata
Trichilia prieuriana
Tridax pubescans
Triumfetta macrophylla
Triumfetta rhomboidea
Mangifera indica
Manihot esculenta
Mariscus sieberianus
Maytenus senegalensis
Maytenus sp.
Melhania velutina
Micrococca imperialis
Microglossa
Microglossa angolensis
Milicia excelsa
Mondia whitei
Monechma subsessile
Ochna like?
Oryza sativa
Panicum maximum
Pennisetum polystachyon
Pennisetum purpureum
Pennisetum sp.
Pentarrhinum hispidum
Pentas longiflora
Pentasia ouranogyne
Phyllanthus
Phyllanthus niruri
Phyllanthus nmulariifoliu
Phyllanthus pseudo-niruri
Physalis micrantha
Pilliostigma thonningii
PlantBotName
Polygala polygonulera
Pseudarthria hookeri
Pseudocedrella kotschyi
Psorospermum
febrifugum
Rhus natalensis
Rhus vulgaris
Rhyncharitrum repens
Rubiaceae(FTCA 9)
Sclerocarya birreai
Securidaca longiflora
Senecio discifolius
Setaria homonyma
Setaria verticillata
Sida acuta
Sida ovata
Sida rhomboidea
Sida veronicifolia
Small red with rings
Solanum incanum
Solanum nigrum
Sonchus oleraceus
Sorghum vulgare
Spathodea campannulata
Spermacoca princei
Spilanthus mauritiana
Sporobolus pyramidalis
Steganatonia araliaceae
Stereospermum
kunthianum
Strychnos innocua
Strychnos spinosa
Succulent leaves
Synedrella nodiflora
Tamarindus indica
Tapura fischeri
Teclea nobilis
Tephrosia
Tephrosia holstii
Tephrosia linearis
Tephrosia nana
Tephrosia uniflora
Terminalia (yll lves)
Terminalia brownii

Tylossema fassoglensis
Unknown 1
Urena lobata
Vangueria apiculata
Vernonia amygdalina
Vernonia lasiopus
Vigna luteola
Vitalleria paradoxa
Vitex doniana
Vitex sp.
Zea mays
Zebrina pendula
Ziziphus mucronata
Zornia pratensis

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 lands 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**

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_____

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**

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

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 2. 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 6. 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?** (✔)

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 03. 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?

_____

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, ……)

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		

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

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

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?

_____

71. part 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 using**
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 appropriately (✔)

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

Thank you very much for participating in the survey

For Enumerator Use Only

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

Photos capturing some of the environmental scenarios in Akoroi Village.

Photograph showing charcoal burning site in Akoroi Village

Charcoal burning sites are numerous in Akoroi, as seen in the photograph above such sites are barren with no vegetation.

Photograph of debarked tree

This tree dried up due to removal of its bark for fiber. Such trees are very scarce.

Photograph of a rice-growing field in Akoroi Village

Rice growing is on the increase in wetlands in Akoroi Village

Photograph of a typical maize field in Akoroi

Note the bare ground exposed to erosion. Compare vegetation cover in the bush in the far end and the cover within the cultivation.

Photograph showing a tree fallen down

This is *Euphorbia candelabrum* that had grown into a tree in a big thicket. Trees like this one fall down on their own because the soils are too thin to support heavy weight of the canopy and the being exposed to wind.

Photograph showing brick making

Brick making is widespread in Akoroi. Due to the high amount of wood required in burning of bricks there is a danger that this will cause massive tree cutting.

Photograph showing cattle grazing in the bush

This scene was once with many trees similar to the ones at the background. There are numerous stumps of trees that were cut to create this grazing field.

Photograph showing a journalist (taking notes) of local newspaper in Soroti being explained on the work being dome by FITCA EMMC. A local farmer is looking at a soil sample collected

Farmers through their local organizations were keen to know the status of their land and how EMMC could help in improving the productivity of their land.