LUCID's Land Use Change Analysis as an Approach

for Investigating Biodiversity Loss and Land Degradation Project

Results of Feedback Workshops In Sango Bay, Lake Mburo National Park and Ntungamo/Kabale, Uganda

LUCID Working Paper Series Number: 28

By

Godfrey Taulya
and
Lilian Busingye

Makerere University
Institute of Environment and Natural Resources
P. O Box 7298
Kampala, Uganda

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Address Correspondence to:
LUCID Project
International Livestock Research Institute
P.O. Box 30709
Nairobi, Kenya
E-mail: lucid@cgiar.org
Tel. +254-20-630743
Fax. +254-20-631481/ 631499

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TABLE OF CONTENTS

1. INTRODUCTION

Chronic social crises reveal that development efforts neither result in more equitable distribution of wealth nor in an overall decrease in the number of poor people. According to Adedeji (1985), where improvements in national economic indicators have been obtained, it has often been at a price of harsh environmental degradation, with population growth being singled out as a major cause of environmental stress. Barton *et al*. (1997) pointed out the top-down decision-making process common in developing countries and the underlying linkages between population growth and development on one hand, and environmental stress on the other. Plans, programs and projects are designed and implemented with little or no involvement of the local institutions and members of the community. The end result has often been exacerbation of the problems, plans, programs or projects were intended to solve e.g. defective policies that distort access to natural resources via widening the gap between the rich and the poor. It follows therefore that the solutions to population growth lie mostly in empowering local communities to take care of their environment through greater local participation (Banuri and Amalric, 1992). This would lead to environmentally sound and socially responsive practices, particularly through participatory assessment of problems and resources (Borrini-Feyerabend, 1995) as exemplified by Participatory Action Research (PAR) (Barton *et al*., 1997).

PAR includes Rapid Rural Appraisal (RRA), Participatory Rural Appraisal (PRA), Rapid Assessment Procedures (RAP), Activist Research and Farmer Participatory Research. Among the common features characterizing all these forms of PAR are that they deal with issues directly experienced and explicitly acknowledged as problems by local people/institutions and they have an in-built communication strategy, which emphasises holding meetings and workshops as a way of providing feedback of research findings to the local community and institutions (Barton *et al*., 1997). These features greatly increase participation of the local communities and institutions in environmental programs and thus improve the relevance of proposed solutions to address identified constraints for sustainable environmental management. It was against this backdrop that the feedback workshops reported herein were held, with the aim of presenting the major findings of the LUCID project to the local communities in the study areas and verifying the conclusions deduced from them. The LUCID project was aimed at using Land Use Change as a tool for understanding Biodiversity Loss and Land Degradation.

2. METHODOLOGY

The PRA tools of focus group discussions, brainstorming and pair-wise ranking were used at all three sites. Sets of guiding statements were followed that reflected the major findings for each area, which were generally similar for all sites. The guiding statements were broadly grouped into 3 categories *viz.* land use/cover change, soil degradation and biodiversity change. Details of the statements and responses of the communities are presented in the results section of this report.

The workshops were held in Sango Bay (Rakai District), areas adjacent to Lake Mburo National Park (Mbarara District) and on the Ntungamo/Kabale border. Each site constituted several Local Council (LC) villages from which 6 participants (one of whom was an LC leader) were purposively selected (Patton, 1987) on the basis of adequate historical knowledge of the area. Facilitators that possessed adequate experience in the use of PRA tools were selected such that they were neither part of the LUCID research team nor members of the local community in order to avoid bias (Barton *et al*., 1997).

Each guiding statement was translated in the local language and clearly explained to the participants who were then asked individually to state their position on whether they agreed with the statement or not, giving their reasons for the position taken. Their responses were carefully probed, without leading the respondents, for more information or clarification where necessary. The reasons put forward were then subjected to brainstorming in order to generate a

list of the most important reasons for and against the statement. The lists of major reasons for and against the statement were subjected to pair-wise ranking (Barton *et* al., 1997) to determine whether the community was in agreement with the statement. A summary and brief discussion of the findings are presented in the next section.

3. RESULTS

The guiding statements are presented below in italicised type. If it was not applicable to every site, the site at which it was used is provided in brackets following the statement.

3.A. Land Use and Cover Change

3.A.i. Knowledge of the implications of land use practices influences land utilisation.

'Land use practice' was in this case taken to mean the management practices employed in a major type of land use (e.g. rain-fed agriculture, forestry etc.).

Participants at the three sites expressed agreement with this conclusion. In Sango Bay, the most important reason forwarded in support was the fact that farmers know that bananas are more sensitive to poor soil conditions compared to other crops. Farmers therefore institute better soil and water conservation practices in banana plantations compared to other annual and perennial crops because deterioration of the soil conditions (e.g. through soil erosion) would lead to rapid decline in banana yields.

In areas adjacent to Lake Mburo National Park, participants supported the statement and gave the reason that they avoid burning grasslands at the summits and interfluves of hill slopes because they know that at the onset of the rains, the resultant poor ground cover would lead to high erosion rates. The eroded sediments would deeply bury early-planted, small seeded crops like millet and sorghum down slope thereby preventing their uniform germination and emergence, thus necessitating re-sowing the fields.

On the Ntungamo/Kabale border, participants also supported the above statement reasoning that cultivation of the same crop on the same piece of land, season after season, led to the eventual emergence of common pests and diseases. Farmers noticed a serious decline in soil fertility as a result of this farming practice. The lowered soil fertility, combined with pests and diseases, were blamed by the farmers for their low yield.

3.A.ii. Possession of several parcels of land in various locations discourages the owners from investing in land improvements in distant parcels.

Participants at all the three sites were in agreement with this conclusion. In Sango Bay area, the most highly ranked reason in support of this statement was the uncertainty about the security of investments in distant parcels. It was argued that one way of circumventing this insecurity was to put the investments under the care of a trusted friend or relative who would take up residence on the property. However, this was at risk of conflicting with the trustee in case the latter claims ownership of the property at an opportune time (for instance, upon the death of the true owner).

For areas around Lake Mburo National Park area, the most highly ranked reason was low returns to the investment due to the high overhead costs (e.g. transport costs and extra labour that needs to be hired in the vicinity of the distant parcels).

On the Ntungamo/Kabale border, farmers said that cultivation took place only in the valley. With the increase in population density, land fragmentation had become a common practice reducing optimal land use. In this area, it was uncommon for an individual farmer to own several parcels of land due to the overhead costs associated with the practice.

3.A.iii. Ownership of several parcels of land ensures food security for a household.
There was disagreement with this statement and the same reason was ranked highly at all the sites: management by households tended to be too thinly distributed among the parcels of land and it resulted in sub-optimal yields. The household labour force gets so strained in working multiple parcels that operations such as tillage, weeding and harvesting are performed too late to synchronize crop growth with the rainfall season and to aid the crops in escaping peak pest loads and disease inocula. Yields are therefore reduced due to moisture stress, competition from weeds and pest/disease damage. Owning several parcels was also expensive in terms of agricultural inputs such as pesticides, fertilisers, and labour to mention but a few. Farmers concluded that owning several parcels of land to ensure food security was not viable.

3.A.iv. The area under cultivation increased by less than 5% between 1955 and 2000 (Sango Bay and Ntungamo/Kabale border)
There was agreement with this finding. In support of the statement, it was pointed out that almost all the available arable land was already under crop cultivation by 1955. The remaining land was either too rocky with soils too shallow to be cultivated, or gazetted public forest reserve. There was therefore more land use intensification than extensification (which was measured in the LUCID project) in the area in the past 50 or so years owing to the lack of land for expansion of cultivation. Furthermore, people increasingly took to trading, especially at the nearby landing site of Kasensero, and this reduced the impetus for increasing the acreage under crops in the face of the natural population increase.

The same situation applies in Ntungamo/Kabale border. Cultivation takes place only in the valley and the valley was already under crop cultivation by 1955. Land fragmentation occurred with population increases and with time there was no land for agricultural expansion. The remaining land is either too hilly or rocky, or the soils are sandy (*orushenyi*) and do not accommodate agriculture. They said that they could not afford costs associated with agriculture like pesticides, pumps, modern methods of farming, and storage facilities. The prolonged droughts experienced in his area have not encouraged farmers to practice agriculture. Another reason given for the lack of agricultural expansion is the fact that the indigenous people in this area are pastoralists and practice nomadism with little cultivation. Participants highlighted poverty as one of the reasons for turning to petty trading.

3.A.v. The area under cultivation increased by 50% in the past half a century (Lake Mburo National Park area)
There was agreement with this finding because by 1955, this area was a gazetted game reserve in which cultivation was strictly prohibited. However, in 1963, the government permitted settlement of immigrants, mainly from Ntungamo and Bushenyi to settle in the area. This marked the opening up of the virgin savannah grassland to crop cultivation and there followed a spurt of land use extensification, in spite of a brief lull between 1983 and 1986 when the settlers were briefly expelled from the area by the authorities.

3.A.vi. Frequent droughts have contributed to land use change
There was disagreement with the statement in Sango Bay, the reason being that the area does not experience such prolonged droughts that would lead to land use change.

In the Lake Mburo National Park area, there was agreement with this statement. The main reason was that the area is semi-arid and experiences prolonged droughts, the most severe of which lead to conversion of cropped land (mainly in the valleys and lower slopes) to grazing lands. Under normal conditions, grazing is restricted to the summits and slope interfluves. The area is characterized by shallow soils on the slopes and summits with very low moisture storage capacity. This renders the slopes and summits unsuitable for crop cultivation but they support grass (Land Tenure Center, 1989). The lower slopes with deeper soils have higher moisture storage capacity and thus can support most crops. Drought conditions lead to a rapid drying of the grass on the summits and slope interfluves whereas the lower slopes and valleys

retain the capacity to support grasses but can hardly support crops. Grazing is therefore shifted to the lower slopes, and community members resort to trading to earn cash and poaching in the park to meet their food requirements.

On the Ntungamo/Kabale border, farmers were in agreement with the above statement. Being in a rain shadow, with soils of low moisture storage capacity, pastoral land use has taken precedence over arable farming. This area experiences a dry season in the months of January to March, and a prolonged dry season during the months of June to August. During this period, the savannah on the hill slopes dries up and the bare land is exposed to wind erosion. The crops dry up since the soil has a low capacity to retain moisture. Farmers then resort to petty trading for survival.

3.A.vii. Frequent floods have contributed to land use change
This was true for two sites. In Sango Bay, there are vast expanses of low-lying plains covered with grasslands where grazing is normally carried out. These areas frequently flood and in such condition they are only used as fishing grounds. They cannot be used for grazing because of high rates of foot and mouth disease among livestock. The livestock are moved to hill summits, which are normally used for private wood lots, thereby increasing land use intensification in this physiographic unit.

During periods of heavy rains in the area adjacent to Lake Mburo National Park, valleys, the most suitable physiographic unit for crop cultivation, become flooded. They thus become unsuitable for maize, millet, sorghum and beans that cannot withstand conditions of poor soil aeration. Farmers are thus forced to cultivate these crops on the more marginal upper slopes, not only intensifying land use in this unit but also exposing it to degradation through accelerated soil erosion and increased biodiversity loss. They are also forced to encroach on the Park to cultivate.

The situation on the Ntungamo/Kabale border is different. This area does not experience flooding. This area does experience soil erosion during the rainy seasons from March to May and from August to December. Soil is washed from the hill slopes and deposited in the valleys. Flooding is not experienced due to low soil water holding capacity.

3.A.viii. Presence of diseases has contributed to land use change
There was agreement with this statement in all the sites. In Sango Bay, wet conditions increase the incidence of foot and mouth disease in cattle and malaria in human beings, which makes them shift to the slope summits thus intensifying land use there.

For areas adjacent to Lake Mburo National Park, the reason for supporting this stand was that malaria is most widespread during at the onset of the rainy season when gardens are opened. The poor health of household members reduces the availability of labour for tillage thereby leading to reduced acreage under cultivation.

On the Ntungamo/Kabale border, diseases are common to humans, plants and livestock. Malaria is common during the wet season weakening the labour input to agriculture. Plants are commonly affected by pests and diseases, which are brought about by poor farming methods, reducing output per acre. During the dry and wet seasons, livestock are prone to diseases. Common diseases that attack livestock include the East Coast Fever, and mastitis.

3.A.ix. Immigration/emigration have contributed to land use change
In the Sango Bay area, there was disagreement with the statement that migration has affected land use change. The main reason for the disagreement is that there has been neither a net increase nor a net reduction in population due to migration. Immigration and emigration rates are roughly equal; any significant migration has been conducted by the trading community who exert no direct influence on how land is used.

For areas adjacent to Lake Mburo National Park, there was agreement with this statement mainly because immigrants have significantly contributed to a rise in the local population numbers and an increase in both land use intensification and extensification. Immigrants intensify the area's land use when they buy land thus reducing the land available for fallowing. They also lead to land use extensification by providing cheap labour for small, rich households with more land than they can till on their own to expand their area under cultivation.

The Ntungamo/Kabale border area has not experienced immigrants mainly because of the nature of the area. The area is mainly suitable for pastoralism and there is no more land available for cultivation. The long dry spells combined with the nature of the soil do not attract immigrants.

3.A.x. Overpopulation has contributed to land use change

There was agreement with this statement at all sites. In Sango Bay, overpopulation has led to increase in land use intensification as farmers attempt to obtain all their requirements from the severely restricted land available to them. The rapid population growth was attributed to early marriages and high fertility rates. There has therefore been a tendency towards greater intercropping and less fallowing.

For the area adjacent to Lake Mburo National Park, the main cause of land use change has been an increase in labour availability that has led to an expansion of land under cultivation. The high population growth rate was attributed to early marriages and high fertility rates, and to an influx of immigrants as local land has until recently been sold cheaply.

In the Ntungamo/Kabale area, rapid population growth has been the result of early marriages and high fertility rates. High population densities have had serious environmental effects on land resources including a land shortage for farming especially where serious land fragmentation has occurred. With land fragmentation, livestock is reared and grazed on marginal hillsides, roads and valley bottoms. Farmers reported that their crop yields have declined due to worsening weather conditions, diseases, soil erosion and decreased fallow periods (IFPRI, 2003).

3.A.xi. Landlessness has contributed to land use change

There was disagreement with the statement that landlessness has been associated with land use change in Sango Bay with the main reason being that all the permanently settled people either owned family land or bought land, however small the piece. The few immigrants are mainly nomadic herders and they settled on public land. They do not exert a major influence on land use, apart from more intense use of the summits for grazing during the rainy seasons.

In areas adjacent to Lake Mburo National Park, participants agreed with this statement because there are many landless immigrants who work as casual labourers. They have significantly contributed to an extensification of cultivation due to their cheap labour.

The situation was different on the Ntungamo/Kabale border. Landlessness is not evident. The majority of people are pastoralists who practice nomadism. The remaining cultivators have small plots. Those who feel that their land can no longer support them normally sell their small plots and shift to other areas.

3.A.xii. Availability of markets/demand for farm products has contributed to land use change

There was agreement with the statement that the availability of markets affects land use at all sites, and for a similar reason in that all sites have a ready market for their produce. In the Sango Bay area, the high demand for foodstuffs is mainly from the nearby Kasensero landing site, where there is much trading activity. Many people conduct trading at the landing site and they depend on marketed produce for their food requirements. As a result, farmers in Sango

Bay have intensified agricultural production in a bid to produce a reasonable surplus over their family requirements.

For areas adjacent to Lake Mburo National Park, the demand for marketable produce is mainly because the area has good access to roads that connect it to the main road to Kampala. This has elicited both extensification and intensification of agricultural production.

The same reason applies to the Ntungamo/Kabale border area. It is located on the main Kabale-Mbarara highway. The high demand for onions in various districts of Kabale, Kisoro, Mbarara and Kampala has led to intensified agricultural production of onions. Tracks, buses, and private cars all stop at the stage to buy onions. Onions are very profitable due to high demand and high returns.

3.A.xii. Government policies have contributed to land use change
There was agreement with the statement that policy affects land use in Sango Bay and in the Lake Mburo National Park site. In Sango Bay, the main example given is the 1964 Forest Act, which prohibited any form of agriculture in the forest. It was strictly enforced until 2001. Around 2001, the collaborative forest management approach was adopted and this relaxed the enforcement of the 1964 Act. Under the new approach, community members were apportioned plots in the forest in which they were allowed to cultivate (with exception of sugar cane) and harvest trees with permission from the authorities. Permission is granted on condition that farmers plant and nurture trees both in the forest and on their private land. This policy has thus contributed to land use intensification in the area.

For areas adjacent to Lake Mburo National Park, government policy restricting access to the Park has contributed to land use extensification towards marginal land and intensification with accelerated land degradation in the less marginal areas

Unlike in the above two sites, on the Ntungamo/Kabale border there is a general lack of implementation of the existing laws and policies. As pointed out by NEMA 2000, this may be due to lack of inter-departmental collaboration, ignorance of the importance of the policies to enhance environmental quality, and a lack of proper interpretation of laws.

3.B. Soil Degradation
3.B.i. High population pressure led to soil degradation in the 1955 to present period.
There was disagreement with this statement in Sango Bay. The main reason was that poverty also plays a large role in causing land degradation in addition to high population densities. Poor households face a downward spiral of natural resource degradation (Cleaver and Schreuber, 1994). Poverty places most soil conservation practices (such as terracing, inorganic fertilizers, contour bunds and retention ditches) beyond the reach of most farmers leading to inevitable soil degradation.

For areas adjacent to Lake Mburo National Park, there was agreement with this statement because high population densities were seen to be associated with shorter fallow periods, which leads to reduced yields and increased poverty. Poverty then led to further soil degradation as explained for Sango Bay. The difference between the two sites is that in Sango Bay, population densities were high and poverty had already set in from the 1950s, whereas in the Lake Mburo National Park area, the community experienced the transition from low to high population pressure and observed the onset of declining yields leading to poverty.

High population density was cited as a major contributor to soil degradation in the Ntungamo/Kabale border region.

This is in line with ReVelle and ReVelle, 1988 who pointed out that soil degradation is often experienced when large numbers of people cultivate a limited amount of land.

3.B.ii. Soils in the natural vegetation areas (forest and grassland in Sango Bay; savannah in Lake Mburo National Park) are more fertile than in cultivated areas.
There was agreement with this statement at both sites. In Sango Bay, the reason advanced was the observation that yields from crops grown in the forest were far higher than those obtained from gardens in the cultivated areas.

For areas adjacent to Lake Mburo National Park, it was observed that yields from newly opened land and those from fallowed land are usually greater than those from continuously cultivated land.

Hasset and Banwart, 1992 also noted that areas of natural vegetation usually accumulate organic matter, which stabilizes the soil structure and increases cation exchange capacity of the soil thereby reducing leaching losses of nutrients from the root zone. Furthermore, this was in line with World Resources, 1991 that debris from deeply rooted vegetation recycles nutrients that had initially been leached out of the rhizosphere through decay. The vegetation also protects the soil against erosive action of wind and water unlike in the continuously cultivated areas. Savannah soils were found to have three characteristics that restricted farming: High acidity, Low nutrient content, and a variable soil potential, depending mostly on topography. Annual cropping systems are profitable in the short term, but they eventually degraded the soil. As a result of this degradation, productivity in the cultivated areas declined.

3.B.iii. Possession of a land title or more secure tenure encourages investment in long-term conservation of soil.
There was agreement with this statement in Sango Bay area reasoning that farmers invest in soil conservation only when they expect to benefit from it. If one were not certain of using the land in future, he/she would not invest in soil conservation for another to benefit. This statement was not applicable for Lake Mburo National Park since all community members inhabited the area without land titles or any form of legal ownership, although they maintain it as their own.

3.B.iv. Tangible economic returns increase investment in soil conservation by farmers.
There was agreement with this statement at all sites. The reason given in all sites was that tangible benefits led to higher investments in better or more expensive conservation practices. The farmers could then afford pesticides, pumps, fertilisers, mulch, etc. Farm and household factors affecting levels of soil management include agricultural potential, size of livestock herd, education, and non-farm income earning activities. Better-off farmers are therefore more likely to have better natural resource management than poorer farmers (IFPRI, 2003)

3.B.v. Government policies affect soil conservation practice (Sango Bay and Lake Mburo).
There was agreement with this statement at both sites. In the Sango Bay area, farmers singled out the collaborative forest management policy as an example of the role of government policies influencing soil conservation. This policy revealed to farmers that they stood to benefit if they took better care of their soil as seen in the forest. Their efforts are being facilitated by the training in soil conservation offered under the ILD project operating in the area. For areas adjacent to Lake Mburo National Park, restriction of access to the Park for agricultural activities has prevented an increase in cropped area and this has prompted farmers to conserve the soil in their settlements.

3.B.vi. Local leaders play a significant role affecting soil conservation by farmers.
This was true for both Sango Bay and Areas adjacent to Lake Mburo National Park. In Sango Bay area, local council chairpersons are extension agents in the ILD project and offer free training to farmers in soil conservation in their areas of jurisdiction.

For areas adjacent to Lake Mburo National Park, it was pointed out that local council executives have nursery beds in which they raise tree seedlings that are distributed freely to members of the community. Litter from the trees aid in soil conservation. The litter prevents erosion and contributes soil organic matter.

The participation of local leaders in soil conservation sensitisation to farmers in the Ntungamo/Kabale border region is not evident. Farmers rely on the information they receive when an extension worker from the district visits, which is not common. Farmers continue to practice indigenous farming methods.

3.C. Biodiversity Change

3.C.i. There are more species of plants and birds in the areas under cultivation compared to areas under natural vegetation.

This was considered true in Sango Bay area because of the many herbaceous plants growing, as weeds in the cultivated areas that are not frequently encountered in the forest, i.e. there are more plant species in the cultivated areas than in those with natural vegetation. However, there was disagreement with the statement with respect to bird species because more bird species are found in the natural vegetation areas than cultivated areas since the forest is a natural habitat to most bird species.

In areas adjacent to Lake Mburo National Park, farmers disagreed with the above statement because they leave only crops and plants of medicinal value in their gardens thus reducing the species diversity in the cultivated areas. Clean weeding is a common practice in the cultivated areas. They also forwarded the same reason in support of their stand as regards the bird species as the participants of Sango Bay area, saying that there are more bird species in the natural vegetation areas than in cultivated areas.

The difference in perception over this statement between the two sites may have been due to difference in the nature of the dominant vegetation. In Sango Bay, the dominant vegetation is tropical rainforest whose dense canopy and probable allelopathy may contribute to the reduction in the species diversity of undergrowth, unlike in the open canopy savannah grasslands of Lake Mburo National Park area.

Participants in the Ntungamo/Kabale border area disagreed with the above statement. The reason given was that in the cultivated areas all plants other than the desired crops were removed during weeding. In areas with the natural vegetation, many plant species are found. Also in the natural vegetation areas (savannah grassland) more bird species are found since it is a natural habitat to most bird species.

3.C.ii. There is more biodiversity loss in the cultivated areas both in time and space than in the areas of natural vegetation.
This was considered true at all sites for the same reason. Much of the natural vegetation at Sango Bay and areas adjacent to Lake Mburo National Park is on gazetted land and thus protected against human activities, unlike outside protected areas where agricultural production is at the maximum.

In Ntungamo/Kabale border area, the savannah grasslands were seen as possessing more biodiversity than areas under human activity.

The farmer's position on biodiversity was in line with ReVelle and ReVelle, 1988 observation that factors such as a diversity of environmental conditions, harshness of environmental conditions, and the length of time a system has to evolve are not the only

factors affecting biodiversity, but they appear to be major controlling influence. Human interference may also move conditions far, takes the form of reducing the diversity of natural conditions.

4. CONCLUSION

Most of the findings and conclusions of the LUCID project were verified as being true at all sites for one reason or the other. A few project statements were judged as being false at various sites except for the statements regarding biodiversity loss being most rapid outside protected areas, which was true everywhere.

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6. APPENDIX

Site 1. Sango Bay

RESEARCH FINDING (BY LUCID TEAM)	FEEDBACK WORKSHOP RESPONSE	
1.Land use/cover change:	**Response**	**Comment**
a) Knowledge of different implications of land use practices influence land utilisation in this area.	TRUE	Farmers know that bananas are more sensitive to poor soil conditions compared to other crops. They therefore institute better soil and water conservation practices in banana plantations compared to other annual and perennial crops in the area. HOWEVER, this is subject to economic considerations, besides possible implications in terms of adverse effects on the land.
b) Possession of several parcels of land in various locations by a household discourages the owners to invest in land improvement especially distant parcels.	80 %NOT TRUE 20% TRUE	Due to lack of finance, labour and time, farmers are not able to manage the different parcels effectively and so get lower harvests than expected. However, they concurred with the conclusion that it reduces investment in distant parcels.
c) Owning several land parcels ensures food security.	FALSE	They therefore concluded that possession of several parcels of land does not necessarily translate into food security for the household Some community members argued that it was not a guarantee that food security would be attained in this way.
d) The area under cultivation has increased by less than 5% in the past 50 years. (1950 to 2000)	TRUE	They attributed this to the fact that that almost all the available land was already under settled cultivation by 1955 and that the remaining land was either too rocky (hence shallow soils) or gazetted land. In spite of the population increase over this period, many of the indigenous people are taking up trade for their livelihood, leaving a few to till the little available arable land. There has also been Land use intensification.
e) The following contributed to land use change in this area between 1950 to 2002:	80% TRUE, 20%FALSE	To a great extent most of the mentioned factor have contributed to land use change.
ei) Frequent Droughts	FALSE	Community members told us that they had not experienced frequent droughts in the area.
eii) Frequent Floods	TRUE	On the issue of floods, during the heavy rains the grasslands get flooded and as a result they turn into fishing grounds rather than grazing grounds.
eiii) Reported presence of disease	TRUE	They said that one of the reasons that the pastoralists move away from the land is the prevalence of the foot and mouth disease in these areas during the rainy season. This leads to a change from the land being used as a grazing area to a fishing ground

eiv) Immigration/emigration	FALSE	This does not affect them because their own community members migrated to Tanzania as well as Tanzanians coming into the area on a seasonal basis. Immigrants in the area are mainly produce traders who do not directly influence land use change in the area because they only come during peak harvest seasons to buy produce and later leave. The other group of immigrants are the Rwandan pastoralists, who settle in Ttome, gazetted grassland to graze their cattle in the dry season.
ev) Reported Overpopulation	TRUE	They attributed it to early marriages and high birth rates. Overpopulation contributed to land use/cover change as a result of movement of people away from arable farming into trade. This has contributed to the observed finding that there is change in land use from 1950 to 2000.
evi) Reported Landlessness	FALSE	Landlessness had not been experienced in this area.
evii) Availability of markets/ demand for farm products.	TRUE	There is a very high demand / market for farm products at Kasensero fish landing site. Buyers come from Tanzania, Kenya and Rwanda to buy food crops.
eviii) Government policies	TRUE	They had the Forest Act of 1964 that was strictly enforced up to 2001. The Forest Act protects forest cover from being converted into agricultural land. In this way government policies have a potential influence on land use change in the area.
2. Soil degradation: a) High population pressure led to degradation of soil in the period 1955 to present.	FALSE	High population pressure has not been the only factor that has led to degradation of soil in the area. Other factors include poverty, lack of fertilizers, soil erosion, overgrazing and lack of extension services.
b) Soils in the forest are more fertile than those in the cultivated areas.	TRUE	This was proved when the farmers were given land in the designated areas of gazetted land. Farmers obtained higher yields from these areas than from their gardens.
c) Possession of a land title or more secure tenure encourages land users to invest in long-term conservation of their soils.	TRUE	Possession of a land title or more secure terms of tenure encouraged land users to invest in long-term conservation of their soils unlike those farmers who rent land, this being related to the security of tenure.
d) Tangible economic returns influence the level of investment in soil conservation by farmers.	TRUE	The higher the tangible economic returns (for example increased crop yields) the higher the level of investment in soil conservation. This is because the farmer can now afford the costs associated with of a conservation practice, for example retention ditches and farm yard manure in banana plantations.
e) Government policies and Local leaders play a significant role in promoting conservation of soils in the area.	TRUE	Local leaders were reported to be instrumental in promoting soil conservation. They are involved as trainers/extensions agents in the ILD project, which seeks to promote to promote better land management and soil conservation in the area.

		Likewise, government policies for example the Collaborative Forest Management policy also play a significant role in promoting soil conservation. The Collaborative Forest Management policy enables farmers to farmers to fallow their land for fertility rejuvenation, which also ensures better vegetative grounds cover to protect the soil against erosion.
3 Biodiversity change a) There are many species of plants and birds in the cultivated areas than in the cultivated areas than in the pastures and other areas with natural vegetation.	FALSE	Farmers expressed disagreement with the conclusion that there were more plant and bird species in the cultivated areas than those with natural vegetation. They were of the view that natural environments had greater species diversity than cultivated areas. However, a forest guard informed us that the conclusion could be right in that within the forest, trees of a given species tend to grow together in localised areas of the forest (probably due to allelopathy and/ or creation of microclimates that do not favour the germination and growth of seedlings for other species) and this would give a lower species diversity compared to the cultivated areas. He illustrated his stand to the farmers present by physically counting the number of different plants growing in a nearby garden. The result of this count convinced them that the conclusion might be right.
b) There is more biodiversity loss in the cultivated areas than in areas with natural vegetation and Biodiversity loss occurs both in time and space.	TRUE	They agreed that there is more biodiversity loss in the cultivated areas than in the natural environments arguing that in the former, only the crop plant species and those of medicinal value are spared in the weeding operations. With time, this leads to the loss of some plant species in the cultivated areas unlike the natural environments. They also expressed agreement with the conclusion that the biodiversity loss occurs both in time and space.

Site 2. Lake Mburo National Park

FINDING	FEEDBACK WORKSHOP RESPONSE	
1.Land use/cover change.	**Response**	**Comment**
a) Knowledge of different implications of land use practices influence land utilisation in this area.	TRUE	Examples of implications include the knowledge that bananas are more sensitive to poor soils make the farmers conserve banana plantations soils better than for other perennial crops like coffee. They were also aware of the consequences of bush burning. This knowledge has greatly reduced on this particular practice.
b) Possession of several parcels of land in various locations by a household discourages the owners to invest in land improvement especially distant parcels.	TRUE	Community members said that due to lack of finance, labour and time, they found it easier and cheaper to manage parcels that were near their homesteads. However, they concurred with the conclusion that it reduces investment in distant parcels.
c) Owning several land parcels ensures food security.	FALSE	Community members concluded that possession of several parcels of land does not necessarily translate into food security for the household. This was due to lack proper management of the land parcels.
d) The area under cultivation has increased by 50% in the past 50 years. (1950 to 2000)	TRUE	The inhabitants were allowed to settle in this area around 1963, which was a game reserve by then. Each household at that time settled on more land than they needed to meet their requirements. However as the population increased due to high fertility rates, the land holdings per family became insufficient to meet household requirements and so what was initially left as fallow land was now continuously cultivated, resulting in an increase in the area under small scale subsistence farming.
e) The following contributed to land use change in this area between 1950 to 2002	TRUE	To a great extent most of the mentioned factor have contributed to land use change.
ei) Frequent Droughts	FALSE	Community members told us that they faced a major drought in 1992. However, each year they face drought from September to December. This is due to the sunshine of July to August, which destroys the crops.
eii) Frequent Floods	TRUE	On the issue of floods, during the heavy rains during the month of April the grasslands get flooded and as a result cattle are moved to the hilltops and gardens get flooded.
eiii) Reported presence of disease	TRUE	On disease, they said that one of the reasons that the pastoralists move away from the land is the prevalence of the foot and mouth disease in these areas during the rainy season. The

		community members said that during this time they are attacked by Malaria and as a result there is reduced cultivation.
eiv) Immigration/emigration	TRUE	Community members said that they have experienced an influx of migrants mainly from nomadic pastoralists looking for grazing land and people from overpopulated areas like Kabale, Ntungamo and Bushenyi. These people come into this area looking for land for settlement. Casual labourers are another category of people who come looking for employment.
ev) Reported Overpopulation	TRUE	The community agreed that there population was high and they are more than the available land. They attributed this to very high birth rates, immigration and early marriages.
evi) Reported Landlessness	TRUE	Especially people who come in as casual labourers experience landlessness. They work on a "Leija-Leija" basis and as a result more land is cultivated. This is their main source of survival and they don't own land of their own.
evii) Availability of markets/ demand for farm products.	TRUE	When there is a very high demand / market for farm products, farmers tend to cultivate more in order to get a surplus for selling. But when there is a slump on farm products on the market, farmers cultivate less for household consumption only. During the slump, they turn to petty trading.
eviii) Government policies	TRUE	Government policies protecting the park stop community members from carrying out any activity like digging, grazing, and hunting, cutting trees or even fetching water from the park. In this way government policy have a potential influence on land use change in the area.
2.On Soil Degradation a) High population pressure on the land alone led to degradation of soil in this area in the period 1955 to present.	TRUE	High population pressure has been the major factor that has led to degradation of soil in the area. Community members said that due to the high population pressure, they have not been able to follow their land and as a result they get a low harvest due to over cultivating the same piece of land. This has led to increased poverty levels in the area.
b) Soils in the forest are more fertile than those in the cultivated areas.	TRUE	Community members were in agreement with the conclusion. They said that fallowed land or virgin land would produce higher yields.
c) Possession of a land title or more secure terms of tenure encourage land users to invest in long-term conservation of their soils.	N/A	The community members settled in this area without acquiring it through purchase and so could not get documentary proof of ownership.
d) Tangible economic returns	TRUE	The higher the tangible economic returns (for

influence the level of investment in soil conservation by farmers.		example increased crop yields) the higher the level of investment in soil conservation by farmers. This is because the farmer can now afford the costs associated with of a conservation practice, for example retention ditches and farm yard manure in banana plantations.
e) Government policies and Local leaders play a significant role in promoting conservation of soils in the area.	TRUE	Local leaders were reported to be instrumental in promoting soil conservation. They have a tree bed from where they normally distribute trees to community members. These trees are planted to check soil erosion in the area.
3 Biodiversity change a) There are many species of plants and birds in the cultivated area than in the pastures and other areas with natural vegetation.	FALSE	The community members commonly practice clean weeding in this area, sparing only plant species of medicinal value in their gardens apart from the crops. Furthermore there are more bird species in the pastures and other areas with natural vegetation compared to the cultivated areas.
b) There is more biodiversity loss in the cultivated areas than in areas with natural vegetation and Biodiversity loss occurs both in time and space.	TRUE	A large proportion of land in this area is under the National Park and hence there is restricted agricultural activity, which the community members agreed was a major avenue through which biodiversity is lost. Being under the National Park, biodiversity in the non-agricultural areas is protected against loss through human activities.

Site 3. Ntungamo/Kabale Border

FINDING	FEEDBACK WORKSHOP RESPONSE	
1.Land use/cover change.	**Response**	**Comment**
a) Knowledge of different implications of land use practices influence land utilisation in this area.	TRUE	Knowledge on the implications of bush burning. They are aware of the adverse consequences this practice has on their land. They are also aware that poor farming practices like over cultivation of the same plots of land with same species of crops leads to eventual emergence of common pests and diseases.
b) The area under cultivation has increased by less than 5% in the past 50 years. (1950 to 2000)	TRUE	They attributed this to the conclusion that almost all the available land was already under settled cultivation by 1955 and this was land in the valley, the remaining land was the rocky hills. In spite of the population increase over this period, many of the indigenous people are taking up trade for their livelihood.
c) The following contributed to land use change in this area between 1950 to 2002	80% TRUE, 20% FALSE	To a great extent most of the mentioned factor have contributed to land use change.
ci) Frequent Droughts	TRUE	Community members agreed to this conclusion. They attributed the frequent droughts to the Rain Shadow location of their area. They experience drought in January to march, and from June to August.
cii) Frequent Floods	FALSE	They do not experience flooding during the rainy seasons despite the soil erosion from the hill. They attributed this to the Sandy Soils (Orushenyi) in the area. These Soils do not retain Water.
ciii) Reported presence of disease	TRUE	On disease, they said that one of the reasons that the pastoralists move away from the land is the prevalence of the foot East Coast fever and Mastitis. Presence of Plant pest and diseases has reduced on the output production per unit.
civ) Immigration/emigration	FALSE	They said that the mentioned factor does not affect them because this area is only suitable for pastoralists and the land for cultivation cant accommodate any more people. The pastoralists keep moving to other areas as far as Sango bay in search for grazing land since the area tends
evi) Reported Landlessness	FALSE	Landlessness had not been experienced in this area. This area is sparsely populated.
evii) Availability of markets/ demand for farm products.	TRUE	Increased returns from onions has led to and increased growth of onions. Former tomato gardens have been turned into onion gardens due to the low demand for tomatoes. This was due to the establishment of the Biharwe market in Mbarara, which took over the supply of tomatoes to Mbarara and Kampala.

eviii) Government policies	TRUE	No government policies seem to be implemented in this area. There are no extension Agricultural officers and as a result farmers do what they like / carry out any methods that are cheap and convenient for them.
2.On Soil Degradation a) High population pressure on the land alone led to degradation of soil in this area in the period 1955 to present.	FALSE	High population density has led to land fragmentation reducing on optima land use. However, high population has not been the only factor that has led to land degradation. Other factors include poverty, lack of fertilizers, soil erosion, overgrazing and lack of extension services.
b) Exogenous factors e.g. refugee influx seriously influence Land Utilisation	FALSE	The nature of this area does not attract settlers/refugees. It's basically a pastoral area with rocky hills and it experiences prolonged droughts. Refugees mainly settle in Kikagati and Nakivale.
c) Possession of a land title or more secure terms of tenure encourage land users to invest in long-term conservation of their soils.	TRUE	Possession of a land title or more secure terms of tenure encouraged land users to secure loans in order to invest in long-term conservation of their soils, unlike those farmers who rent land, this being related to the security of tenure.
d) Tangible economic returns influence the level of investment in soil conservation by farmers.	TRUE	The higher the tangible economic returns (for example increased crop yields and prices of Onions) the higher the level of investment in soil conservation by farmers. This is because the farmer can now afford the costs associated with of a conservation practice, for example mulching, pumps and pesticides.
3 Biodiversity change a) There are many species of plants and birds in the cultivated areas than in the cultivated areas than in the pastures and other areas with natural vegetation.	FALSE	Farmers expressed disagreement with the conclusion that there were more plant and bird species in the cultivated areas than those with natural vegetation. They were of the view that natural environments had greater species diversity than cultivated areas. The uncultivated Savannah grasslands had more bird and plant species compared to the valley where agriculture takes place.
b) There is more biodiversity loss in the cultivated areas than in areas with natural vegetation and Biodiversity loss occurs both in time and space.	TRUE	They agreed that there is more biodiversity loss in the cultivated areas than in the natural environments arguing that in the former, only the crop plant species and those of medicinal value are spared in the weeding operations. With time, this leads to the loss of some plant species in the cultivated areas unlike the natural environments. They also expressed agreement with the conclusion that the biodiversity loss occurs both in time and space.