LUCID's Land Use Change Analysis as an Approach
for Investigating Biodiversity Loss and Land Degradation Project

Human Perceptions of Biodiversity Loss: Case Studies of Sango Bay, Lake Mburo National Park and Rubaale Grasslands, S.W. Uganda

LUCID Working Paper Series Number: 29

By

Robinah K. Nanyunja

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

LIST OF FIGURES

LIST OF ACRONYMS

GEF	Global Environment Facility
LMNP	Lake Mburo National Park
LUCID	Land Use Change, Impacts and Dynamics
MUIENR	Makerere University Institute of Environment and Natural Resources
NBDB	National Biodiversity Data Bank
PRAs	Participatory Rural Appraisals
UNDP	United Nations Development Programme
UWA	Uganda Wildlife Authority

SUMMARY
The study was carried out in the communities adjacent to the forest reserves of the Sango Bay area in Southern Uganda, Lake Mburo National Park (LMNP) in Southwestern Uganda and Rubaale grasslands in Western Uganda. It focused on human perceptions to biodiversity loss with reference to the following biodiversity categories: medicinal plants, plants used as sources of income, wild food plants, and wildlife.

I used participatory rural appraisal (PRA) methods to assess biodiversity loss in the three study sites. From the PRAs, I found that the biodiversity were decreasing in all the study sites; however, there were significant variations in biodiversity loss across the sites.

The conclusions and recommendations put forward were:

- Human perceptions information indicates that there has been a decline in frequency in all biodiversity categories across the study sites, with Rubaale losing its biodiversity most quickly followed by the areas adjacent to LMNP. In this respect, tree-planting programmes may be initiated in the study areas, with immediate attention being given to Rubaale and adjacent areas to LMNP. Trees that the community has more interest in, such as sources of income and medicines, may be prioritised.

- The methods used in the study are useful tools for monitoring and assessing change in biodiversity using human perceptions. They could be improved in the future by incorporating more biodiversity indicator species and different levels of indicators such as ecosystem quality of forests, wetlands (Camacho-Sandoval and Duque, 2001), and rangelands.

- Due to the importance of indigenous knowledge in biodiversity conservation, assessment and monitoring, I recommended a thorough survey of the existing traditional conservation practices.

1.0 INTRODUCTION

Most of Uganda's biodiversity can be found in the natural forests, but a considerable amount is found in open waters, wetlands, and dry/moist savannah. The major biodiversity ecosystems in Uganda include, forests, woodlands, savannah, wetlands and aquatic biodiversity (NEMA, 2000/2001). Thee biodiversity hotspots in Uganda include Mgahinga Gorilla and Bwindi Impenetrable National Parks, Rwenzori Mountain National Park, Sango Bay wetlands and forest ecosystem, Kibaale National Park, dry mountains of Karamoja (Napak, Morungole, Kadam, Timu and Moroto), Lake Victoria and papyrus swamps of Lake Edward, George and Bunyonyi (NEMA, 2000/2001).

Uganda is well known for the richness of its biodiversity, both terrestrial and aquatic, and it has a comprehensive system of protected areas under the management of the forestry department and Uganda Wildlife Authority (Pomeroy et al, 2002). Despite this, the report on the sate of Uganda's Biodiversity 2000 showed that the rate of biodiversity loss was high estimated at 1% per year.

A value and threat analysis conducted by UNDP/GEF Cross-border biodiversity project in the Sango Bay forests showed that the people were aware of the threats they impose on the forests. The following are some of the perceived threats to the Sango Bay forests by the communities: cutting young trees for poles and firewood, poor harvesting palm leaves, debarking trees for medicines, over harvesting of timber, selective harvesting of tree species, over harvesting of palm leaves, over harvesting of Marantochloa for baskets and poor pastoral practices (Nabanyumya, Mupada and Kabesiime, 1999).

Biological diversity, the variability among living organisms from all sources is of critical value to the world. It forms the basis of our food supplies and provides raw materials for our pharmaceuticals and a growing number of industrial products (Tamanga and Bhattachan, 1999). Unfortunately, biodiversity is being lost at unprecedented rates through the destruction of habitats and ecosystems for short-term economic gain. Concern about this has led governments, multilateral organizations, scientists, environmentalists, and others to look for ways to promote the conservation of biodiversity.

As concern about the loss of biodiversity has risen, so has the appreciation for the knowledge of the indigenous peoples about the natural resources they have lived with for centuries. This knowledge has an important scientific and strategic value. The majority of the worlds' people rely on indigenous knowledge of plants, animals, insects, microbes and farming systems for either food or medicines. Eighty percent of the worlds' population depends on indigenous knowledge to meet their medicinal needs (Tamanga and Bhattachan, 1999). It is therefore likely that the people closely watch and know how the resources are consumed and change.

Since the rate of biodiversity loss in Uganda is very rapid, methods by which trends in biodiversity may be assessed rapidly and efficiently are urgently required (Burley and Gauld, 1994.). This need has led to the development of rapid biodiversity assessment approaches such as PRAs which aim to provide information on biodiversity suitable for use in conservation planning and environmental monitoring, in situations where detailed taxonomic investigations of the species concerned are not necessarily available (Oliver and Beattie, 1993)

Furthermore, Basemera quotes Gadgil *et al* (1993) as recognising the awareness of local people of the variety of uses of local biodiversity, such as medicines, which has been incorporated in the modern pharmacopoeia. Rural indigenous people are often knowledgeable about plant and animal species, including their identification and ecology (Hellier *et al,* 1998).

2.0 MATERIALS AND METHODS

2.1 STUDY AREAS

The study areas were Sango Bay in the southern part of Uganda in Rakai District, the area adjacent to LMNP in Southwestern Uganda in Mbarara District, and Rubaale grasslands in Western Uganda in Ntungamo District. In Sango Bay, the study was carried out in the three parishes of Kanabulemu, Bukora and Minziro. In LMNP work was carried out in two parishes of Lwamuhuku and Kiribwa, while in Rubaale grasslands, work was carried out in three parishes of Katooma, Kaina and Kyobwe.

2.2 SELECTION OF INDICATORS FOR ASSESSING BIODIVERSITY LOSS

A study carried out by MUIENR and funded by UNDP/GEF Cross-Border Biodiversity Project in Uganda designed criteria for selection of biodiversity indicators for monitoring and evaluation in Moroto, Napak and Sango Bay cross border biodiversity sites (Nanyunja, 2001). The current study adopted some of these criteria and made some modifications to suit its objectives. They included the following resource categories (not necessarily mutually exclusive):

- Medicinal plants which are disappearing and those, which are not;
- Plants of sources of income, which are disappearing, and those which are not;
- Wild food plants; and
- Wildlife.

2.3 SAMPLING PROCEDURE AND DATA COLLECTION

2.3.1 PARTICIPATORY RURAL APPRAISALS (PRA's)

Participatory Rural Appraisal (PRA) has become an established procedure for investigating indigenous resource management systems (Webber and Ison, 1994). It is defined as an "intensive, systematic but semi-structured learning experience carried out in a community by a multidisciplinary team which includes community members" (Theis and Grady, 1991). One of the main advantages of PRA's is that they help provide a holistic vision from the perspective of the end-user, and makes use of their experience, which is integrated with that of the researchers, in order to broaden the common knowledge-base (Chambers, 1994a,b).

A PRA technique can include rapid surveys of local knowledge as tools for investing human perceptions to biodiversity loss. In our study, group interviews were used as information gathering tools for assessing trends in biodiversity loss (changes in abundance and changes in the use of indicator species from 1950 to 2001). These tools were earlier designed and used to develop a biodiversity monitoring and evaluation framework for Moroto, Napak and Sango Bay cross-border biodiversity sites in Uganda (Nanyunja, 2001). The PRAs consisted of local histories/time lines, resources rankings and abundance scores. I collected data using these tools with prepared data sheets (Appendix).

The people in Bukora parish of Sango Bay were predominantly pastoralists while those in Kanabulemu and Minziro parishes were predominantly cultivators. The people in Lwamuhuku Parish adjacent to LMNP were predominantly pastoralists while those in Kiribwa were predominantly cultivators. In Rubaale, the people of Kaina Parish were pastoralists while those of Katooma and Kyobwe Parishes were cultivators.

One PRA was carried out in each of the three parishes of Sango Bay, one in each of the two parishes of LMNP; and one in each of the three parishes of Rubaale. Each PRA consisted of a group of 15–20 men and women participants—some cultivators and others pastoralists—ranging in age between 20-80 years. Community mobilization and the selection of participants for the PRA's were done with the help of the community forest officers in Sango Bay and political leaders in LMNP and Rubaale. The facilitating group comprised of community forest officers and myself in Sango Bay, and political leaders and myself in the community adjacent to LMNP and in Rubaale.

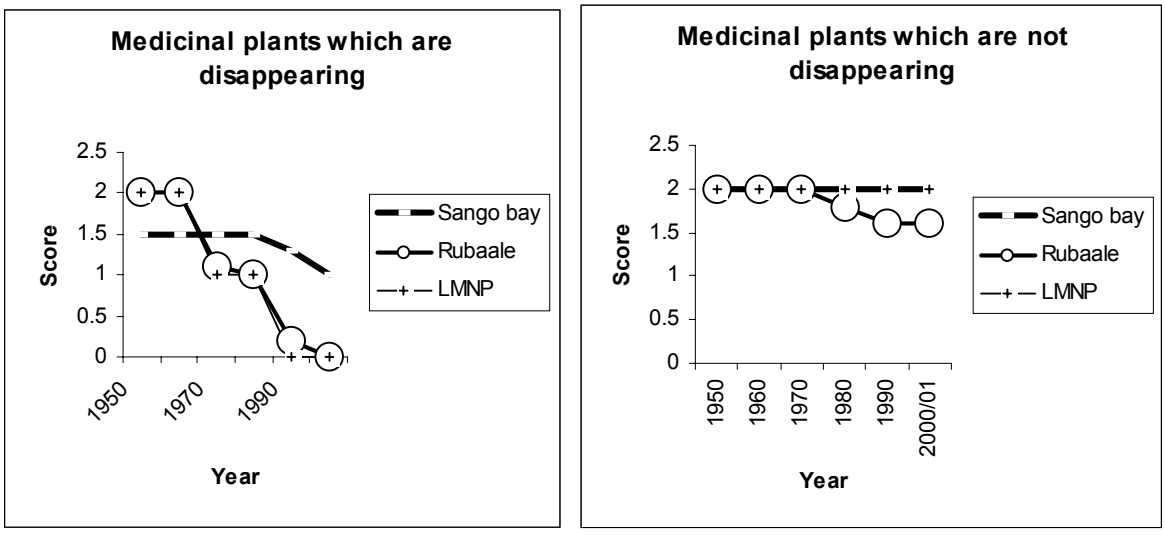
LOCAL HISTORIES/TIME LINES
This technique taps participants' memories to recall local important historical events to help date other changes, such as changes in the environment in this case (Nabasa, Rutwara, Walker and Were, 1995). I used this method to collect information on trends of indicator species use, and changes and reasons for those changes in species frequency from 1950 to 2001. Elders were very much involved and played a large role in providing this historical information. Old people possess most of the indigenous knowledge and therefore provide the best (Basemera, 2002) hence the exercise included elders and long-term residents.

RESOURCE RANKINGS
During the discussions, the participants were asked to list about 10 to 15 resources (plant or animal species) in each category. Among these, I asked them to choose the 5 key resources. One person would suggest a resource, and this would be subjected to debate. The people in support of it would then put up their hands. If the number supporting it exceeded the others, then we would accept it as a key resource. Indicator species and abundances were established in a similar manner.

ABUNDANCE SCORES
Abundance scores reflected the availability indicator species during periods between 1950 to 2001. I asked the participants to score the availability an indicator species. The scores ranged from 0 to 2 where: 0 reflected none or nearly none; 1 a few or some; and 2 many or readily available (Nanyunja, 2001). Comparing these scores between time periods would reflect a trend in change in biodiversity.

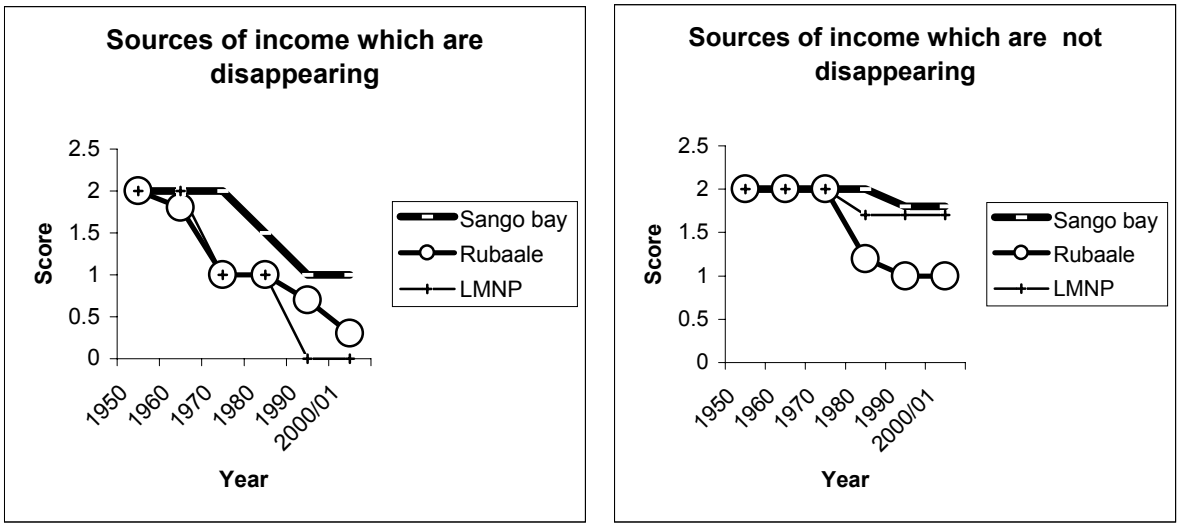
2.4 DATA ANALYSIS
The data collected in form of scores were entered and analysed, and graphed in Microsoft Excel. These illustrations show the trends of the biodiversity categories (See results in Section 3). The abundances of all the indicator species for a corresponding year (e.g. 1950) were summed and averaged across parishes for each site.

3.0 RESULTS
Figure 1: Trends of medicinal plants



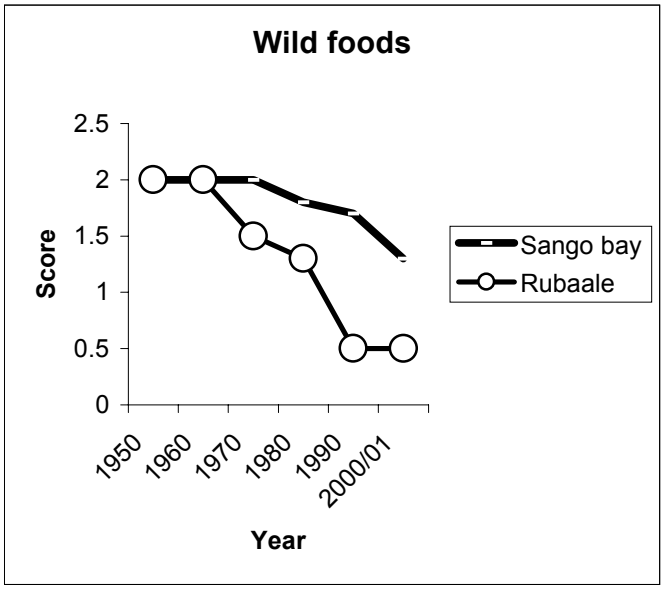
Of the medicinal plants that are disappearing, they are being lost most rapidly in LMNP and Rubaale grasslands, and least rapidly in the Sango Bay. Of the medicinal that are not disappearing, again the Rubaale site is losing them more rapidly than the other sites.

Figure 2: Trends of sources of income



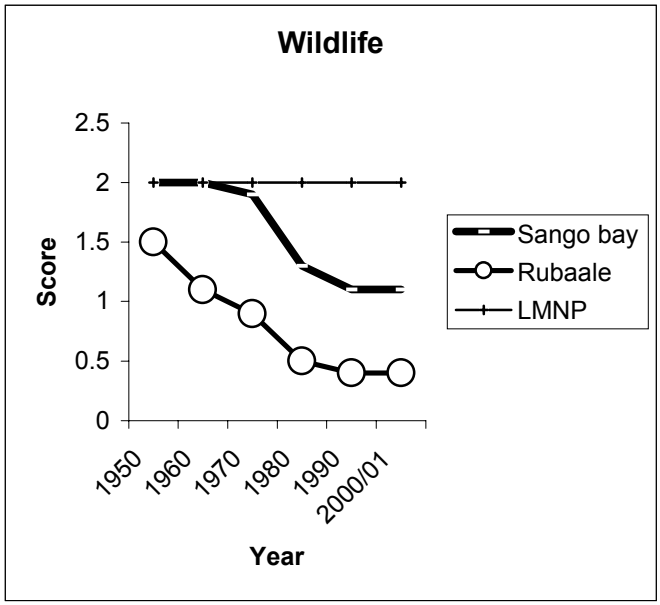
Of the plants being lost that people use as sources of income, the Rubaale site is losing them most quickly, and the Sango Bay site least quickly.

Figure 3: Trends of wild food plants



Plants that people use as wild foods are being lost most quickly in Rubaale than in Sango Bay. In LMNP, there are no wild foods.

Figure 4: Trends of wildlife



In Sango Bay, wildlife is decreasing steadily. In LMNP, it is constant, while in Rubaale it is extinct.

4.0 DISCUSSION

The trends in biodiversity loss as identified by human perception are shown in the graphs above. A general trend of biodiversity loss is found in all the sites. However, the magnitude of change varies within sites, and considerable variation is found between the study sites.

4.1 TRENDS OF MEDICINAL PLANTS

Medicinal plants, which were identified as in the process of disappearing in Rubaale and LMNP from the 1950's, have disappeared by 2001. Those plants, which are not in the process of disappearing, are being lost most rapidly in Rubaale. In Sango Bay and LMNP, their numbers are constant. The rapid loss in Rubaale can be related to the fact that the land there is privately owned and is mostly under cultivation. One rarely finds natural trees or other vegetation types in the area. Likewise, the land adjacent to LMNP is privately owned. The privately owned land adjacent to the Park is entirely bare of natural vegetation, in contrast to within the Park. The need for charcoal burning, settlement and expansion of agriculture has contributed to the clearance of vegetation adjacent to the Park. The medicinal plants whose numbers were said to be constant were only found in the Park. This shows a contrast in biodiversity status between the Park, which is a protected area, and the adjacent community, which is a non-protected area.

Whilst the total forest cover in Uganda, may be declining only slowly, there is good reason to believe that loss of plant biodiversity is a problem in many forests, particularly those that are smaller and not gazetted (Pomeroy, Mwima, Nanyunja and Chapman, 2002).

4.2 TRENDS OF PLANT SOURCES OF INCOME

Plants that are used as sources of income, which are not disappearing, are being lost most rapidly in Rubaale followed by LMNP. Those, which are disappearing, follow the same pattern. In Rubaale, the plants that are sources of income are agricultural commodities, such as bananas, onions and Irish potatoes. People said they don't earn income from any natural vegetation. Trees, natural grass and wetlands were cleared for charcoal, settlement and fuel wood many years ago. In Sango Bay, since it's a reserve, timber trees, medicinal plants and craft materials are extracted for sales remain.

During the 1960s and 1970s, the market for wood products was very selective. High value tree species such as Mvule (*Melicea exelsa*), Mahoganies, Elgon olive and *Lovoa spp* were removed from the natural forests through selective logging. Large volumes of what at the time were considered 'undesirable' or 'weed' species were cleared using the charcoal refining method or poisoned with arboricides. The logged areas were later enriched with desirable tree species. Much biodiversity was lost through this process of exploitation. Uncontrolled harvesting and poor harvesting methods from the 1960s to the mid 1980s also contributed to biodiversity loss although estimates of such losses have not been documented (NEMA, 2000/2001).

Pressures on biodiversity from habitat loss, climate change and other causes are particularly high in East Africa (Groombridge and Jenkins, 2002). Globally, the living planet index (WWF, 2002) shows a decline of 37% from 1970 to 2000, with the rate per decade at about 15% in the 1980s and 1990s.

4.3 TRENDS OF WILD FOOD PLANTS

Wild foods are being lost more rapidly in Rubaale than in Sango Bay. Rubaale land is privately owned, unlike Sango Bay, which is comprised of reserves of grasslands and forests. The difference in the two land management statuses, i.e. Sango Bay under reserves and Rubaale privately owned, explains the difference in change in biodiversity. The community adjacent to LMNP said there are no wild foods in the area because everything had been cleared. Their community is therefore not represented in the graph on wild food (Figure 3). The lack of wild food plants is explained by the intense human use of the land adjacent to the Park.

Through domestication and direct harvesting from the wild, Ugandans derive food, medicines and a wealth of raw materials from plants. Therefore, the importance of biodiversity to Ugandans is not only confined to natural ecosystems but includes agro-biodiversity especially in altered or anthropogenic ecosystems such as Rubaale (NEMA, 2000/2001). Meanwhile, human settlements are encroaching on protected areas such as national parks, forest reserves and wetlands. Uganda's population is growing very fast, at about 2.5% per annum, and this population is largely rural. Increased demand for food is resulting in new land being cleared for agriculture. Hence, large tracts of land are deforested annually (NEMA, 2000/2001).

4.4 TRENDS OF WILDLIFE

The numbers of wildlife species have been declining most rapidly in Rubaale, followed by Sango Bay, and least rapidly in LMNP. Poaching is carried out in Sango Bay despite it being a forest reserve. Most of the Rubaale area is cultivated and people there said the wildlife is extinct with remnants last seen in the early nineties. The factors, which could have led to the extinction of wildlife in Rubaale, include:

- Hunting for meat
- The clearance of forests, woodlands, bush and swamps, which had been the habitat for wild animals, for expanded agricultural settlement.
- Massive killing for settlement.
- The expansion of rural, semi-urban and urban settlements with accompanying markets, public services and other infrastructure (Gesit and Lambin, 2001) that led to the killings of wildlife.

In LMNP, the numbers of wildlife species was said to be constant. People gave the impression that it is constant because wildlife is being kept in the Park. Poaching is a common practice especially of animals that cross to private land. Access to the park is greatly restricted. Within wildlife-protected areas, poaching for both subsistence and commercial trade has been responsible in the past for the drastic reduction in wildlife populations. Fines for various wildlife offences are

insufficient to act as effective deterrents, and the enforcement of the wildlife protection laws is weak (NEMA, 2000/2001).

Comparing the status of wildlife between sites provides a picture of the importance of protected area status. For example, in the Lake Mburo National Park, where access is very restricted, wildlife numbers were said to be constant. Even if they are not constant, it is known that LMNP contains more wildlife than Sango Bay and Rubaale. In Sango Bay, a forest reserve, there is limited if restricted access, and it contains more wildlife than Rubaale and less than LMNP. In Rubaale, which is entirely private land, wildlife is rarely found. There is therefore less biodiversity, especially wildlife, in non-protected areas than in protected areas.

The loss of wildlife has been significant in Uganda. Although wildlife management was relatively efficient up to 1970, thereafter particularly during the 1970-1986 period, the status of wildlife was seriously undermined through indiscriminate poaching. This resulted in major reductions in the number of species and populations, for example, between 1960 and 1998; Uganda lost 71% and 76% of its antelope and other large mammals (UWA, 1999).

Although wildlife and wild plant resources in Uganda constitute a great asset, the country risks losing it altogether. Uganda's biodiversity decline is being experienced at the ecosystem, species and genetic levels. For example, both the northern white and the black rhino have been hunted for commercial purposes to extinction. Biodiversity is also being lost through the disappearance or alteration of habitats, and the introduction of alien species (NEMA, 2000/2001). Examination of a composite index of biodiversity (1970=100) revealed that Uganda's biodiversity richness declined steeply from the 1960s to the 1990s (NEMA, 2000/2001). Losses of biodiversity have been registered in forests and woodlands, wildlife-protected areas, wetlands, and aquatic ecosystems.

5.0 CONCLUSIONS AND RECOMMENDATIONS

The results of our study of changing biodiversity based on local human perception reveals a decline in all biodiversity categories across the study sites, with Rubaale being most degraded followed by areas adjacent to LMNP. To counter this, tree-planting programmes may be initiated in the study areas with immediate attention being given to Rubaale and LMNP. Trees of high interest to the community, such as those that are used as sources of income or medicine, may be prioritised.

The methods used in the study are important tools for monitoring and assessing change in biodiversity based on human perceptions. They could be improved in the future by incorporating more and different levels of indicators species such as for forest, rangeland or wetland ecosystem quality (Camacho-Sandoval and Duque, 2001).

Knowing the importance of indigenous knowledge in biodiversity conservation, assessment and monitoring, I recommend that a thorough survey may be carried out of the existing traditional conservation practices. This would be useful in biodiversity management planning and conservation.

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APPENDIX 1

HUMAN PERCEPTIONS OF INDICATORS OF BIODIVERSITY LOSS

District	Area	Category of indicator	Local name	Scientific name
Rakai	Sango Bay	Medicines which are disappearing	Omukakala	
			Omusa	
			Omusongola	
			Zindabikaka	
		Medicines which are not disappearing		
			Omuziku	
			Omukikimbo	
			Musizi	
			Omujaja	
			Omuwanula	
			Omululuza	
		Sources of income which are disappearing		
			Omusenene	*Podocarpus usambarensis*
			Ensasa	*Phoenix reclinata*
			Enjulu	*Marantocloa spp*
			Fish	
		Sources of income which are not disappearing		
			Musizi	
			Omwasa	
			Omukabira	
			Omutuba	
		Wild foods		
			Amatungulu	*Aframomum spp*
			Mushrooms	
			Honey	
		Wildlife	Buffalo	
			Leopard	
			Vervet monkeys	
			Elephant	
			Sitatunga	
Ntungamo	Rubaale grasslands	Medicinal plants which are disappearing	Kabakura	
			Obunyakashozi	
			Omwiha	
			Omujeeje	
			Kashaho	
		Medicinal plants which are not disappearing	Ekimara	
			Omululuza	
			Ekimuri	
			Omukongolani	
			Ekibombo	
		Sources of income which are disappearing	Kalitunsi	
			Emwanyi	
			Emirama	
		Sources of income which are	Ebijanjalo	

		not disappearing	Obulo	
			Amatoke	
			Ebinyebw	
			Obutungulu	
		Wild foods	Honey	
			Mushrooms	
			Enyonza	
			Enkyerere	
		Wildlife	Buffalo	
			Leopard	
			Vervet monkeys	
			Wild pigs	
			Rats	
Mbarara	Lake Mburo	Medicinal plants which are disappearing	Ekyoganyanja	
			Kabakura	
			Ntale yehamba	
			Amizi genyanja	
			Omuboro	
			Omujeeje	
		Medicinal plants which are not disappearing	Omujaja	
			Omululuza	
			Omuravumba	
			Ekishongashonga	
		Sources of income which are disappearing	Ekikindukindu	*Phoenix reclinata*
			Emitongole	
			Emisheshe	
		Sources of income which are not disappearing	Obugando	
			Ebijanjalo	
			Amatoke	
		Wildlife	Buffalo	
			Leopard	
			Vervet monkeys	
			Wild pigs	

APPENDIX 2

LOCAL NAMES OF BIODIVERSITY INDICATORS IN THE STUDY SITES

Medicinal plants (Local names)		**Plants of sources of income (Local names)**		**Wild food plants (Local names)**	**Wildlife (English names)**
Disappearing	**Not disappearing**	**Disappearing**	**Not disappearing**		
Omukakala	Omuziku	Omusenene	Omusizi	Amatungulu	Buffalo
Omusa	Omukikimbo	Ensasa	Omwasa	Enyonza	Elephant
Omusongola	Omusizi	Enjulu	Omukabira	Enkyerere	Vervet monkey
Zindabikaka	Omujaja	Kalitunsi	Omutuba		Leopard
Obunyakashozi	Omuwanula	Emwanyi	Ebijanjalo		Sitatunga
Kabakura	Omululuza	Emirama	Obulo		Wild pigs
Omwiha	Ekimara	Ekikindukindu	Amatoke		Rats
Omujeeje	Omukongolani	Emitongole	Ebinyebwa		
Kashaho	Ekibombo	Emisheshe	Obutungulu		
Ekyoganyanja	Omuravumba		Obugando		
Ntale yehamba	Ekishongashonga				
Amizi genyanja					
Omuboro					