Hornbills and Fragmented Forests of Uganda

A survey across central region, Uganda

Katebaka Raymond, Nkuutu David, Muhumuza Deogratius, Mwesigwa Richard

Pro-Biodiversity Conservationists of Uganda (PROBICOU)

Plot 181 Bombo Road, Crown House Building (Ku-Biiri),

P.O Box 34407 Kampala, Uganda.

Ref No: 01.08.08

2010

CONTENTS

List of Tables

List of figures and plates

ACRONYMS

CDM	Clean Development Mechanism
CERs	Certified Emission Reductions
CFR	Central Forest Reserve
FD	Forest Department
LG	Local Government
MWE	Ministry of Water and Environment
MWLE	Ministry of Water Lands and Environment
NAADS	National Agricultural Advisory Services
NDP	National Development Plan
NFA	National Forest Authority
PFE	Permanent Forest Estate
PMA	Plan for Modernization of Agriculture
RSGF	Rufford Small Grants Foundation
UWA	Uganda Wildlife Authority
PCs	Point Counts

ACKNOWLEDGEMENT

We are very grateful to the Rufford Small Grants Foundation (RSGF) for providing the financial support of this project. We extend our gratitude to National Forest Authority (NFA) to allow us collect this baseline data from the Central Forest Reserves (CFRs) which are under their management. We also wish to thank the Department of Botany at Makerere University which allowed the undergraduate students to participate in socio-economic data collection. Many thanks go to communities which were very supportive in providing socio-economic data, and also the youth who were willing to learn about avifauna identification.

1. SUMMARY

Uganda's forests are rapidly disappearing as a result of population increase and changing land uses. There has been rapid increase in demand for natural resource utilization world over. Land use impacts on biodiversity is multifold; some of these include clearance of natural habitats for new planting of exotics, tree cover felling for charcoal to satisfy the demands of the population in energy, expansion on land clearance for increased agricultural production among others.

The project collected data on the distribution of forest hornbills in fragmented forests by focusing on three species depending on the forests namely: Black and White Casqued Hornbill *(B.subcylindricus),* Crowned Hornbill *(T. alboterminatus) and* Pied Hornbill *(T.fasciatus*).The study concentrated in Central Uganda. The project aimed at understanding the impact of forest fragmentation on forest hornbills of Uganda and hence determines the approach to plan for their conservation in case of recorded threats. The project provides information and knowledge on the best land use practices that integrate the conservation of forests hornbills and other organisms.

Transects were laid across the selected fragmented forests in central Uganda. Point Counts (PCs) were used for general bird counts at a difference of 200m away from each point in the fragmented forests. For each point, we undertook a ten-minute count, recording all birds seen or heard into one of three distance bands (<25m, 25-50m and >50m from the point), we also recorded birds in flight as part of species recorded at a point but we were not certain if they use the habitat. We also collected data on vegetation at each point as canopy cover. Sites were selected basing on the Darwin Initiative and Luvurhulme project areas. A feasibility assessment was conducted on 27 sites but later concentrated on 22 potential sites where data could be generated. Data was collected in March 2009- August 2009. It was followed by collecting socioeconomic information from the communities adjacent on fragmented forests. This aimed at determining communities' dependency on the forests resources that leads to the fragmentation.

A total of 164 species diversity in the fragmented forests project area across the whole survey was recorded. 80 pairs of Black and White Casqued Hornbill *(B.subcylindricus)* were recorded across the project area with highest abundance followed by Crowned Hornbill *(T. alboterminatus)* and lastly by and Pied Hornbill *(T.fasciatus).* Species of conservation concern were also recorded in some sites.

The dependency on the fragmented forests was not comprehensively analyzed. However it was observed that 8.3% of the communities are less dependent on the forests for income, they recorded earning their income from salaries and wages. The study observed that almost each family in the project area utilizes fragmented forests in different ways. Medicinal plant collection is practiced by each family and was reported to contribute to forest fragmentation both directly and indirectly, because this is the time when they spot trees for timber and charcoal.

The study has highlighted a number of key research issues that need to be followed up in order to fully analyze the distribution of forest hornbills and impacts of forest fragmentation on biodiversity distribution. It is better to also understand more the underlying factors that cause fragmentations-both socioeconomic and environmental factors. Other issues may include continuous monitoring and geo-referencing of fragmented sites.

The analysis of the first survey of forest hornbills proposes integrative conservation whereby the hornbills and possible presence in consideration of sustainable use of large and fruiting trees in current land use systems. This is because a number of hole-nests were recorded more in modified landscape. However there are species of concern recorded in the forest than in the modified habitats.

2. INTRODUCTION

Uganda is located where seven of Africa's distinctive biologeographic regions or phytochoria converge (White, 1983). As such it has a high level of biological diversity arising from its location between ecological communities characterized by moist rain forests of West Africa, combined with high altitude ranges and drier East African savannas. Various threats exist targeting forest biodiversity; as a result several species necessitate conservation consideration as the habitats are disappearing at alarming rate. An estimated 5.8 million hectares are lost each year. The remnant forested areas are threatened by logging and other extractive uses. Overall, the chain of damaging consequences of these exploitations include the loss of ecological services (biodiversity, carbon sequestration and watershed protection), the loss of timber and non-timber forest products, and the loss of a means of existence for forest-dependant rural people (Babweteera 2006).

According to Kayanja and Byarugaba (2001), of the total forest area in Uganda, 70% is on private land, while 30% is in the Permanent Forest Estate (PFE) under the purview as some form of protected area, such as Forest Reserves (central and local), National Parks and Wildlife Reserves. Of the PFE's 1,881,000 ha, 1,145,000 ha (60.9%), are managed by the Forest Department (FD); National Forest Authority (NFA) today, as central forest reserves, 5,000 ha (0.3%) are controlled by local governments (LG) as local forest reserves and 731,000 ha (38.8%) are managed by the Uganda Wildlife Authority (UWA). Forests and woodlands cover approximately 4.9 million hectares in Uganda, about 24% of the total land area (Uganda Forest Policy 2001).

This project focuses on the assessment of the less studied forest hornbills and their distribution in fragmented forests. It assesses forest resources utilization as an intimidation to the forests. Kalina, (1988) studied the ecology of Black and White Casqued Hornbill *(B.subcylindricus)* in Kibale Forest National Park in western Uganda. The study concentrated on one individual species and did not investigate other forest hornbills. This study focuses on the less known information and distribution of species in fragmented forests of Central Uganda.

Hornbills are peculiar, large-bodied birds found only in the mature tropics that have been the focus of research in the last thirty years. Of the 54 species of hornbills known from the world (Kemp 1993), 16 are estimated to occur in Uganda (Stevenson & Fanshawe 2002). Besides that hornbills have been commonly recorded in less disturbed ecosystems. This study concentrates on three species of the 16 known to Uganda and includes Black and White Casqued Hornbill *(B.subcylindricus),* Crowned Hornbill *(T. alboterminatus) and* Pied Hornbill *(T.fasciatus*).

The project targeted Central Forest Reserves (CFR) and forest patches in inhabited areas of central Uganda. The project aimed at: (i) collection of baseline data to enable future monitoring of avifauna in fragmented forest systems, with particular reference to the identification of indicators (ii) identification of best land use management practice regarding sustainable conservation of hornbills in Uganda (iii) dissemination of best management of fragmented forests to organizations and local communities within Uganda. (iv) Capacity building of community members, especially youth.

3. PROJECT JUSTIFICATION

On assumption that forest cover (including tropical high forests and woodlands) is taken as a surrogate for Uganda's biodiversity, visibly the country has recorded significant loss. Drastic changes in the forest cover have taken place in Uganda during the past century. In 1890, forests covered approximately 10,800,000 hectares or 52% of Uganda's surface area. By 1996, forest cover had turned down to about 20%. Tropical high forest cover declined from 12% of total land area in 1900 to 4% by 2000 (FD, MWLE, 2003). Conservation efforts in Uganda are intended for the protected areas. The National Forest Authority (NFA) is the in charge of the country's forest resources, central forest reserves and plantations. The NFA is therefore aiming at establishing quality plantations for timber production to meet country's production demands (Mwima *et al*, 2004) (Plate 1).

Plate 1: aerial picture of Pine plantation currently under promotion as production forests in Mpigi Photo by Raymond Katebaka

Plate 2: Land use adjacent Mpanga Central Forest Reserve in Mpigi - Urbanization effect on forests Aerial pictorial By Raymond Katebaka

3.1 Study areas and the population growth in Central Uganda

Uganda's population was estimated at 25.2 million (UBOS National Census, 2002). It is now estimated at 32 million (Background to the Budget, 2009, MFPED). According to the Census, females outnumber males by about 800,000, thus they constitute 52 percent of the population. 88% resides in rural areas practicing peasant farming. The key issue about population is high population growth rate which is estimated at 3.4% annually. Continued high fertility rates - estimated at 7.4 births per woman-and a population structure of 52.4% below the age of fifteen constitute a high in-built growth momentum, even after considering the impact of HIV/AIDS epidemic toll.

The increase in population growth (Table 1) has a direct impact on the biodiversity through increased demand for products and services - food, energy, water, infrastructure, and social amenities. This is observed in project areas of (Mukono, Wakiso, Mpigi Masaka and Mubende districts). Available natural resources cannot support the growing population effectively. Economic growth has not matched the population growth and this has caused an imbalance in the provision of services.

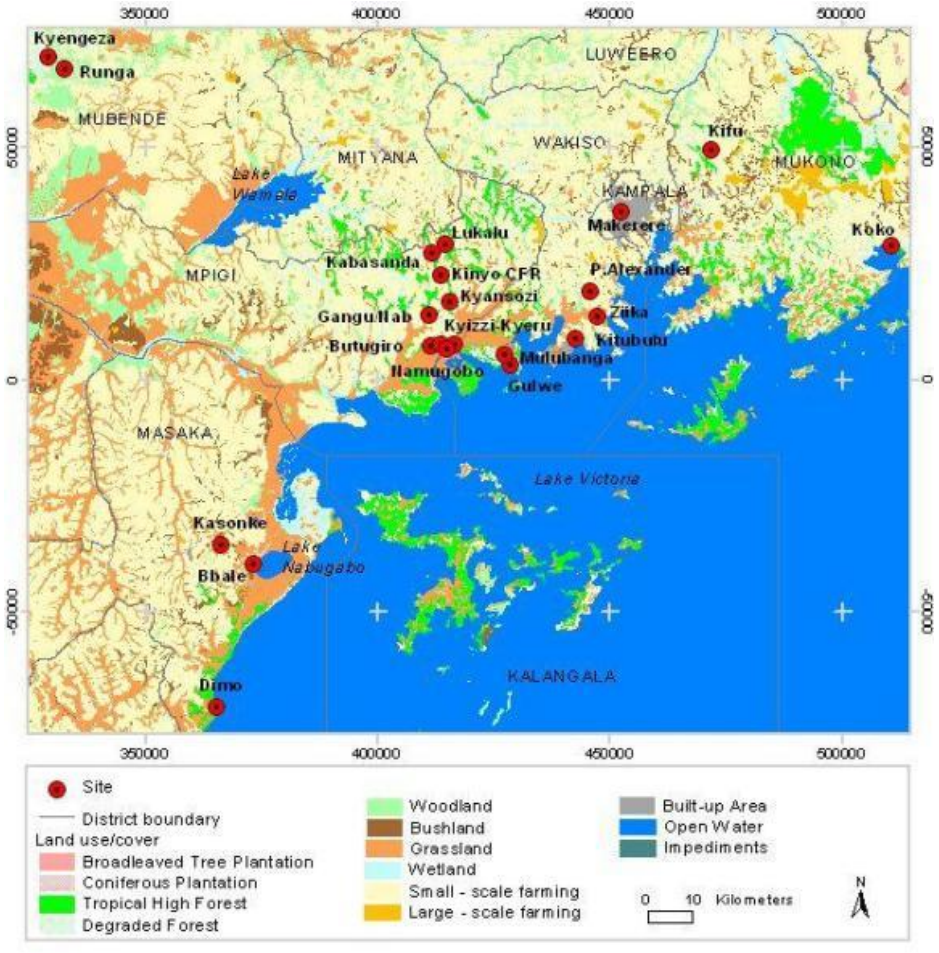

Figure 1: Map of Central Uganda indicating project sites. Source Biomass: Produced by David Nkuutu

Table 1: Uganda's Population Growth Trends, 1948-2006 is as follows

YEAR	1948	1959	1969	1980	1991	2001	2006
Total Population in millions	4.92	6.45	9.46	12.64	16.64	22.20	25.2
Annual Growth Rates in %	-	2.5	3.8	2.7	2.5	2.5	3.4

Source: UBOS Population Census Report 2006

Table 2: Districts current population estimates and number of sites

District	Current estimated population	No of study sites
Wakiso	1,259,716	1
Mukono	1,028,194	2
Mpigi	508,388	13
Mubende	559,109	2
Masaka	75,391	3
Kampala	2,458,543	1

Source: en.wikipedia.org (2009) project area districts

3.2 Fragmented forests and status of conservation

The National Biomass Study carried out in the late 1990's and early 2000's, and published in 2003, is the most comprehensive analysis of land use in Uganda. Uganda has a total area of 24,155,058 hectares, of which farmland (35%) is the most extensive land use. Tropical forests can be defined broadly as all forests occurring between the Tropic of Capricorn and the Tropic of Cancer, regardless of altitude or forest type. Under this definition, all forests in Uganda could be regarded as tropical. However, for the purposes of this analysis, Ugandan tropical forests are defined as humid lowland, broadleaf forest. There are approximately 924,208 hectares of tropical forests in Uganda, which represent approximately 4% of the country's total area.

Central Forest Reserves (CFRs) in Uganda fall in two main categories namely those for production and those for protection. Production forests which include savanna bushland and grassland areas were gazetted for supply of forest products and future development of industrial plantations. The protection forests include all the tropical high forests, savanna woodlands and/or

grasslands that protect watersheds and water catchments, biodiversity, ecosystems and landscapes that are prone to degradation under uncontrolled human use. The National Forestry Authority has characterized CFRs according to the following criteria: i) CFRs of ecological

value *(watershed protection, protection of water bodies and river courses);* ii) CFRs of biodiversity importance; iii) CFRs with tropical high forest; iv) CFRs of importance for industrial plantations *(especially timber and plywood)*; and v) CFRs subject to further consideration.

Generally, Uganda's forests and forest products are vital in terms of their contribution to rural incomes and livelihoods. Seventy five percent (75%) of villages sell tree products, communities with access to woodlands benefit from a wide range of tree products and services, and 93% of national energy consumption is from traditional biomass (MWE, 2007). Recent estimates indicate that forest cover had declined from 24% to about 15% from 1990 to 2007, due to the pressure from population expansion and demand for fuel wood and timber (MWE, 2007), pressure on forests from industry (Devine, 2004) and armed conflict in northern Uganda. As a result, there is an anticipated shortfall in the supply of wood products and services, within the coming years. Conservation of the remaining fragmented forests is therefore vital for sustainable supply of forest products and more importantly, protection of biodiversity of conservation importance, especially the hornbills.

Table 3: Conservation status of the sites covered by the project

Protected as a CFR	Inhabited areas	Forest patches/farmed areas
Koko	Makerere Campus	Runga
Gangu	Lukalu	Kyengeza
Kitubulu	Kyansozi	Park Alexander
Ziika	Gulwe	Namugobo
Kinyo	Mulubanga	
Kabasanda	Dimo	
Kifu	Namugobo/Ssanya	
Bbale	Butugiro	
Kasonke	Kyiizi-Kyeru	

3.3 Species of focus

Establishing the distribution of forest hornbills in fragmented forests has been the primary goal. By determining land use, tree abundance and diversity, we can monitor the effects of agriculture and other human impacts on the hornbill population. However, this information can be used as an index to measure pressures and impacts on other forests in Uganda. Before this study, very little was known regarding the distribution of forest hornbills in Uganda.

Three hornbill species of Black and White casqued Hornbill *(B.subcylindricus)* Crowned

Hornbill *(T. alboterminatus)* Pied Hornbill *(T.fasciatus*) with the rest of other bird species recorded along with the hornbills were determined for separate groups according to the habitat classification of Bennun *et al*. (1996); FF (forest interior species), F (species inhabiting a range of forest types including forest edge and secondary forest), f (species that visit the forest for food, although they are generally found in other habitats), G (generalist species not usually associated with forest). There were few 'G' species recorded, so these were pooled with the 'f' species category. We also kept records of the hole nesters because we assumed they are affected by comparable threats of their distribution in the fragmented forests. These include: Parrots, Starlings, Batises etc.

Black & White Casqued Hornbill

Crowned Hornbill

Plate 3 Hole-nests at Makerere campus

Ficus for feeding diet Park Alexander

Photo by Raymond Katebake

4. METHODS

4.1 Distribution of hornbills in the surveyed region

Fragmented forests in Central Uganda are described as those tropical forests that have been degraded in past two decades. They have reduced from their original surface cover and converted into farmed and productive areas. These forests harbor species of conservation concern in the region. They support local livelihood of the communities adjacent.

Central Uganda (Fig.1) is a region initially Buganda Kingdom that is predominantly occupied by Baganda tribe. The area was covered by the tropical rain forests. Due to increase in population Uganda allowed a decentralized system of governance. The system allows regions to use their

natural resources to develop. Today the region is subdivided into more than eight districts.

Establishing the distribution of forest hornbills in fragmented forests is one of our primary goals. By determining land use, tree abundance and diversity, the effects of agriculture and other human impacts on the hornbill population can be monitored. However, this information can be used as an index to measure pressures and impacts on other forests in Uganda. Before this study, very little was known regarding the distribution of forest hornbills in Uganda.

Survey methods were similar to those of Darwin and Luvurhulme projects from 2005-2008. Transects were laid across the selected fragmented forests in central Uganda. We located points for bird counts 200m away from each other. For each point, we undertook a ten-minute count, recording all birds seen or heard into one of three distance bands (<25m, 25-50m and >50m from the point), we also recorded birds in flight as part of species recorded at a point but we were not certain if they use the habitat. We also collected data on vegetation at each point as canopy cover to monitor future land use changes.

Spending much less time was also aimed at minimizing double-counting of individual birds. We divided the point count area into quadrants, and not recording birds of the same species twice from the same quadrant. However, observations suggested that most species were recorded in the first 3-5 minutes. We allowed starting after a settling-in period of 2 minutes at the point. We conducted two counts at each point in 2009.

Three hornbill species of Black and White casqued Hornbill *(B.subcylindricus)* Crowned Hornbill *(T. alboterminatus)* Pied Hornbill *(T.fasciatus*) with the rest of other birds recorded along with the hornbills were determined for separate groups according to the habitat classification of Bennun et al. (1996); FF (forest interior species), F (species inhabiting a range of forest types including forest edge and secondary forest), f (species that visit the forest for food, although they are generally found in other habitats), G (generalist species not usually associated with forest). There were few 'G' species recorded, so these were pooled with the 'f' species category. We also kept records of the hole-nesters because we assumed they are affected by comparable threats of their distribution in the fragmented forests. These include: Parrots, Starlings, Batises etc.

4.2 Socio-economic survey

To a very large extent human beings are central focus of all developments and environmental degradation. Within this view we focused on interviewing members of the community to ascertain the cause of forest fragmentation. To correlate forest fragmentation with livelihood dependency we employed tools that include:

Opportunistic Interviews: were conducted with community members involved in forests utilization to capture their socio-economic settings, status of the forests and their opinions on forests and other natural resource conservation issues. This targeted those found in direct harvesting of forest products.

Field observations: were used to supplement interviews and community workshops in the project area. This helped to get a quick understanding of the status of the forests and community utilization.

Meetings with local communities: Using prior knowledge of the area and in consultation with the District environment office and the District Forest services office, the socio-economic team mobilized for community workshops with communities in the project sites. Participatory approaches were used to gather data from the participants in the workshops. A checklist of issues was used (e.g. commonly used tree species in each forest, markets for forest products, average costs per product, among others) to establish levels of community utilization of fragmented forests. Community workshops were held in 19 sites of the project area. In attendance were mainly the local leadership and community members.

Plate 4: Some of the Focus group discussions (FGDs)/village workshop Photo by Deogratius Muhumuza

4.3 Analysis

Biodiversity Estimates program and Shannon Index was used to measure the abundance of hornbills in both degraded and intact forests. MVSP was used to analyze the similarity and closest fragmented forests in terms of species composition and diversity. Socio-economic survey aimed at assessing the communities' dependence on forests and the environment, rigorous statistical techniques were not employed. Instead information was manually extracted from the questionnaires; and simple additions employed to assess the number of responses to each particular question in the questionnaire and to build the picture of the situation.

5. RESULTS

A total of 164 species was recorded across the whole survey, 44 surveys were conducted in fragmented forests and in the analysis is considered as effort. A full list of species and total numbers per site is given in the appendix. A list of degraded and intact forests using species habitat codes is also given. We compared the similarity of intact and degraded forest by use of Shannon index; we used dendograms to show the relationships of the project sites. In particular we focused this assessment on three species of hornbills and the graph below indicates the composition of three species in the surveyed sites.

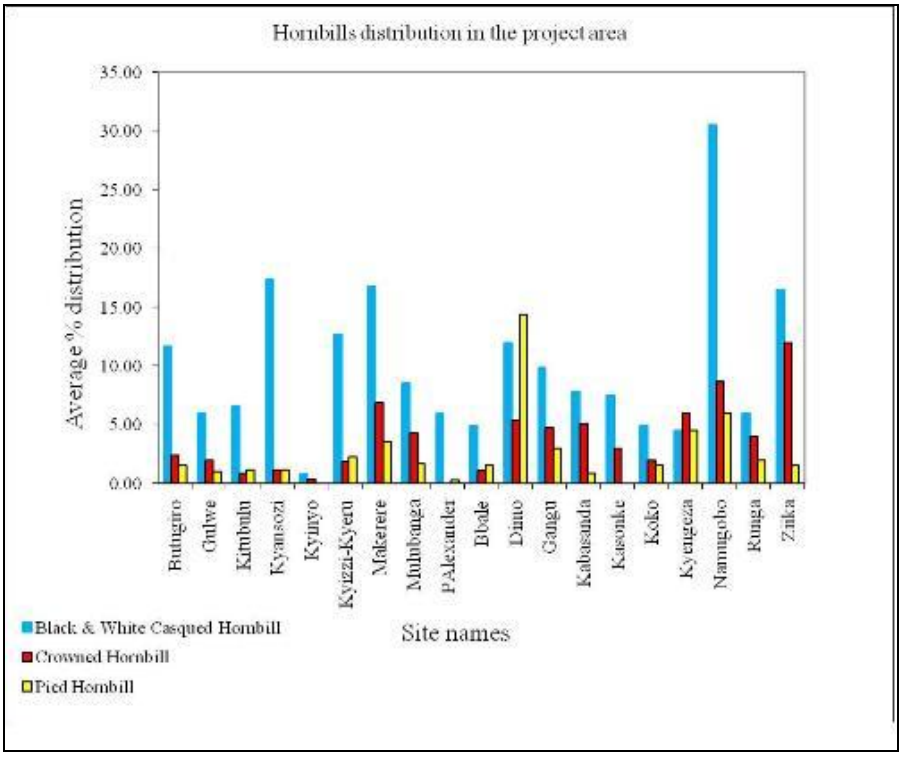

Figure 2: The average percentage distribution and abundance of Hornbills in the project sites

The distribution of Black and White Casqued Hornbills is more significant after the degradation of the forests. Over 11 sites were more intact and eight degraded but they demonstrated high abundance of the species distribution.

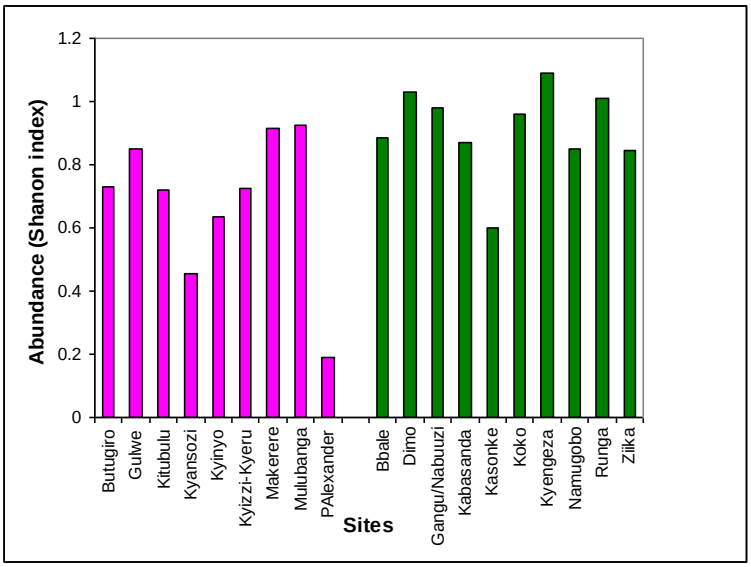

Figure 3: Distribution of Hornbills in the project area

Figure. 3 Shannon index was used to measure the abundance in the sites. Sites were divided to check those that are more degraded and those that are more intact. The first nine sites in the figure above are more degraded followed by ten that are more intact. It follows which sites have more hornbills of three species combined. For example Park Alexander has less abundance because of the increase forest reduction cover.

5.1 Similarities of Hornbills in intact and degraded forests of the project

The correlation of three species in the project area was determined by MVSP. Species were compared by their dependency on the two types of forest habitats-the degraded and intact.

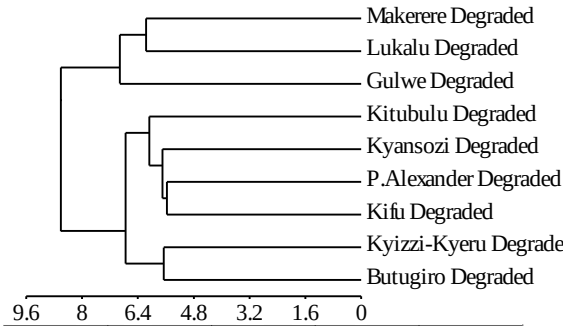

Figure 4. Distribution of Hornbills in the intact forests

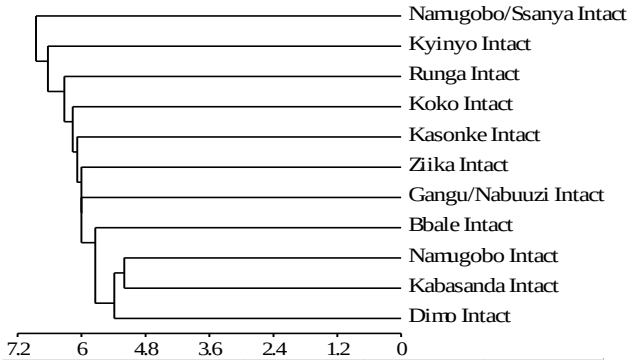

Figure 5: Distribution of Hornbills in the degraded forests

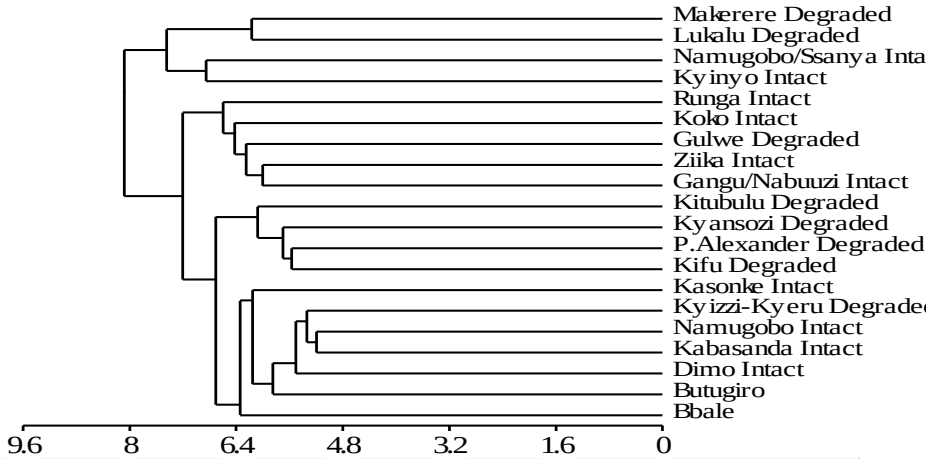

Figure 6: Overall comparison of recorded164 species

The principle of the figures is that when the sites a closely interlinked there related they are.

In Figure 4, the distribution of hornbills is more relative in the fragmented forests where we recorded the intact level. Species survival is presently recorded in less disturbed areas this is attributed to the food availability. The relativity depends on the tree species and species

abundance. Figure 5, presents results of the hornbills in a more degraded habitat and hornbills presence. The presence is determined tree diversity and the functionality of the individual trees. An example at Makerere overview there is increasing rate of land use change but hornbills' presence is determined by the tree species and size that is more abundant. It was recorded that this area may have more hole nests than other sites surveyed. Figure 6, presents overall species record comparison at site level. There were sites observed as more degraded but have more species than intact sites such as a case of Gulwe is degraded but present species can compare with those of Ziika intact.

5.2 Ecosystem services and Hornbills

Ecosystems provide society with a wide range of services – from reliable flows of clean water to productive soil and carbon sequestration. People, companies and societies rely on these services for raw material inputs, production processes and climate stability. The Millennium Ecosystem Assessment (2005) defines ecosystem services as the benefits people obtain from ecosystems. These include *provisioning services* such as food, water, timber, and fiber; *regulating services* that affect climate, floods, disease, wastes, and water quality; *cultural services* that provide recreational, aesthetic, and spiritual benefits; and *supporting services* such as soil formation, photosynthesis, and nutrient cycling.

The human species, while buffered against environmental changes by culture and technology, is fundamentally dependent on the flow of ecosystem services.

Many of these ecosystem services are either undervalued or have no monitory value at all. As day-to-day decisions focus on immediate financial returns, many ecosystems structures and functions are being fundamentally destabilized. In response to growing concerns, markets are emerging for ecosystem services in countries around the world. Formal markets – some voluntary and others mandated by law – now exist related to greenhouse gases (carbon), water and biological diversity collectively referred to as Payments for Ecosystem/Environmental Services (PES).

Different ecosystems provide ecological services that contribute to human welfare and livelihood. Forests for instance contribute to protection of water catchments, control of soil erosion, moderation of local climate and are a reservoir for biodiversity (NEMA, 2009). There has been a general loss of forest cover in Uganda since 1990 estimated at 2% annually. Central Uganda has been listed by the National Forestry Authority (NFA) as one of the areas with the highest acreage of tropical high forests. However, these are being degraded at a high rate. Much of this loss has occurred on forest reserves with serious implications for the biodiversity (including forest hornbills) that inhabits the forests as well as community livelihoods.

The drivers to forest degradation are mainly overharvesting of wood products mainly for business and the need to clear habitat for wild animals that raid crops. At the same time, these forest dependent communities have no incentive to conserve the forests because they perceive current land use options to provide better financial returns. Yet the forest provide a range of environmental services direct and indirect such as carbon sequestration, watershed protection services and biodiversity conservation – the forests in central Uganda provide habitat to biodiversity of high conservation importance, Hornbills inclusive. The proposal by CDM to pay

for ecosystem services can be a viable option to protect such natural resources and the associated services.

Plate 5: Logs for smoking fish at Namugobo Ssanya landing site Photo by Raymond Katebaka

Fragmentation, with its diverse causes and motivations, is the most powerful direct threat to forest biodiversity. As currently practiced, timber harvesting is among the next most serious threats followed by charcoal burning. The conservation of biodiversity is therefore best met by halting fragmentation and keeping commercial timber production out of the natural forests.

Table 4: Community utilization of resources and threats to fragmented forests

Products	General uses	Availability in the fragmented forests	Remarks
Firewood	For cooking, brick making, pottery, brewing	Some trees are felled for the purpose, some obtained stealthily from the forest	Access to firewood from the forest is allowed
Smilax	For staking of crops and craft making	plenty	Access from the forests is illegal
Wild food plants and fruits	Eaten during seasons when available	seasonal	Access to the resource from the forests is allowed
Medicinal plants	Used by a large section of the community	A few traditional healers have planted but continue to collect from the exiting fragmented forests	Access to medicinal plants from the forest is allowed
Wild honey	It is consumed by a few	Not much bee keeping in the area	Access from the forest is allowed
Craft material	Relatively important in the project area	Get materials from the forests by the nearby homesteads	Access to materials for making craft from the forest is illegal

Community dependency on forests in the study area is highly associated with the high poverty levels. According to MFPED (2000), poverty has many dimensions including low incomes and consumption, physical insecurity, poor health, low levels of education, disempowerment, a heavy burden of work or unemployment, and isolation (physical and social). Poverty in the districts covered by this project is high and as such it is a cause and consequence for forest fragmentation.

This assessment made a home visit of 154 families in five districts of the project area. These were complemented by 19 village meetings to establish the level of communities utilize fragmented forests. It was observed that the poor rural community members have been found to engage in subsistence farming with hardly any investment in soil conservation leading to soil degradation. The rural communities are also found to have limited alternative sources of income leading to adaptive mechanisms such as clearing forests for cultivation, tree feeling for sale and charcoal burning which are damaging to the forests.

Another coping mechanism that has been adopted in the survey area is cultivation in the forests and along forest edges in search for more land for cultivation, a threat to the viability of these fragile ecosystems. Lake Victoria is the main source of fish for the lake basin and surrounding districts (project area). There has been a lot of over fishing and fish catches require smoking that lead to collection of logs and this has contributed to the reduction exposing the communities to clear forests in search of firewood. Although on the short term this practice may not cause a big impact, considering continuous collection on a long term will be associated with significant effects.

Regarding forest utilization in the area, results indicate that forests in central Uganda are core areas for the wellbeing of the livelihoods of the surrounding communities. Business as a source of income, reported by 56.6% of the respondents in the whole project area has an impact on the forest because major businesses transacted are forest based such as drum making, charcoal selling and felling of trees for timber.

Only 8.3% are less dependent on the forests for income because they earn their income from salaries and wages. Some of most high ranked activities that contribute to the forests fragmentation were discussed in the same meetings. Figure 6 indicates number of families and the resources they extract per community. Table 7 shows sources of household income from fragmented forests in central Uganda. The study observed that almost each family in the project area utilizes fragmented forests in different ways. Although we observed that medicinal plant collection is practiced by each family and infrequently contributes to the forest fragmentation. However, it's this time when visiting the forest an opportunity is available to identify what they will come for next. There are fewer families that collect medicinal herbs for sale where us most of them are collected for domestically use and this was not well represented.

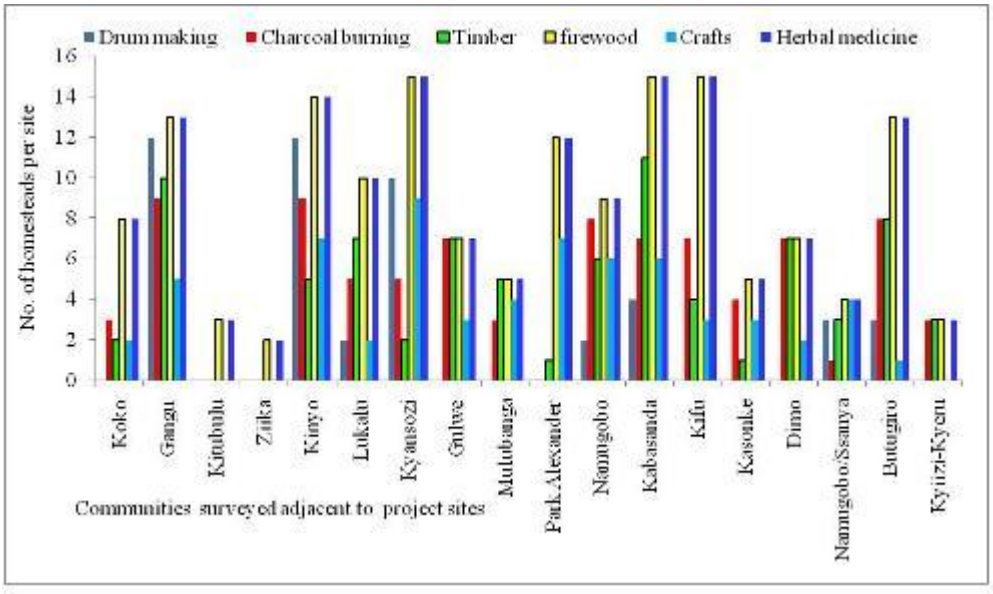

Figure 6: Common resources extracted from forests of Central Uganda

5.2.1 Drum making:

Deforestation, with its diverse causes and motivations, is the most powerful direct threat to forest biodiversity. The conservation of biodiversity is therefore best met by halting deforestation and keeping commercial timber production out of the natural forests. Tree harvesting for drum making is one of the main causes of deforestation in the study area. The study area being dominated by the Baganda tribe where drums are their main cultural instruments for drama and festivals, this practice has seen most mature trees of all species being cut down. During the survey, it was established that each household in the study area at least has a drum in their homes. In addition, drum making is one of the lucrative business enterprises both at the community level and in major towns like Mpigi, Wakiso, and Kampala city. This is evident at various trading centres along the high way to Kampala from Masaka.

Plate 6: Drum store at Masaka High way

5.2.2 Charcoal burning:

This is yet another major activity that threatens the existence and stability of the forests in Uganda and more so in central Uganda to supply the main Kampala city. Like drums, charcoal is used both locally and in major towns in the districts of Mpigi and Wakiso. Charcoal from this region also supplies Kampala city on which over 70% of the resident population depend on for bio-fuel.

Plate 7: Charcoal ready for the market and domestic use

5.2.3 Tree cutting for timber and logging for construction materials:

The resource has considerable valuables that are marketable locally, nationally and internationally. During the assessment we recorded that each piece of timber costs at a range of US $3-US$6 locally.

Plate 8: Tree logging for making timber in Kabasanda CFR and poles for local fencing
Photos by Deogratius Muhumuza

5.2.4 Crafts

Plate 9: Crafts at display on Masaka-Kampala highway
Photos taken by Raymond and Deogratius Muhumuza.

5.2.5 Firewood collection

Plate 10: Firewood collection, charcoal burns, tree felling in Central Uganda
Photo by Raymond Katebaka

5.2.6 Common tree resources of importance in the community of fragmented forests

Resource collection by communities targets specific tree species in the fragmented forests. This affects forage of hornbill and therefore, their distribution. This does not only affect hornbills, but the entire biological diversity.

Table 5: Common trees extracted by communities from the CFR of Central Uganda

Resources/tree species [Local names]	Scientific name	Est no. of trees extracted in a month per family	Products
Settala	*Polyscias fulva*	2	Timber, wooden mortars, furniture, drums
Sidula		3	
Enkoba	*Lovoa*	6	Medicinal
Mujugangoma		2	
Omusizi	*Maesopsis eminii*	10	Charcoal
Omutuba	*Ficus spp. (Several species)*	2	
Omusambya	*Markhamia lutea*	4	
Omusasa	*Sapium ellipticum*	2	
Enjuru	*Marantochloa leucantha*	1	
Empafu	*Canarium schweinfurthii*	3	Fruits (for selling and home consumption), timber

Most of these products are currently on sale in Mpigi region, however in other regions, charcoal and timber was the most resource collected from the fragmented forests.

5.3 Challenges in communities

Some forests are degraded by communities because they harbor problem animals that are very destructive and cause hunger to their families. In response families decide on clearing the forest to provide mitigation measures for their gardens.

There is also an issue of law enforcement that is stringent on resource collection such as firewood today and has caused communities to starting purchasing charcoal from the nearby trading centres. Considerable level of livelihood that is income levels which are low this will increase poverty in the rural communities that bordering fragmented forests.

There are problems that seem to affect a sizeable part of the communities especially those closer to the forests (25%) of respondents in the village workshops reported that they were affected). The common problem animals are bush pigs, monkeys and rodents. The community reported that the animals raid their crops such as maize, destroy cassava gardens, sweet potatoes etc. It is also important to note that hornbills have been observed in the communities eating chicks, feed on the

paw paws, ripe bananas, and feed on mangos, gavas, and avocado fruits. For some of these reasons they are not liked because they destroy their food and yet food is scarce.

During the time of data collection there were very few existing examples of schemes, and most are pilot voluntary initiatives financed by conservation and development NGOs. Most of these existing initiatives are not fully supported to exhaust the communication about conservation of forests utilization.

Currently some of these communities feel abandoned by the government because some of the government programs have failed to be implemented and can't help them at all. Some of the government programs including NAADS/PMA aiming at moving agriculture at the rural level which have not helped these communities.

5.4 Proposed interventions

5.4.1 Identified indicators

This survey was the first of its kind in Uganda following the studies by British Trust for Ornithology (BTO) from 2005-2008. The two projects aimed at conserving biodiversity in farmed landscapes carried out an analysis of distribution of birds in relation to crop yields. According to Chamberlain *et al* (2009), analyzed previous studies and concluded that they provided invaluable baseline to monitor future changes for abundance and distribution. However, the study recommended that this can be achieved by GPS referencing and extrapolating on point locations to be close and precisely matched. The project further recommended that there is a need to monitor land use and changes inhuman population.

The Rufford project identified three focal project species and the current rate of forest degradation that may be affected in terms of habitat loss.

All forest bird species in fragmented forests that have related behaviors with hornbills e.g. frudivores, hole-nesters need to be monitored as forest loss indicators. Monitoring these groups can produce guilds for proper analysis and provide reliable data to monitor land use practices.

There is a need to understand the indigenous knowledge of avifauna that is not currently well documented. There are species that are best biodiversity indicators and land use change processes but recognized by the learned group. Yet these species matter much to the communities. For example it was revealed in one community meeting in Gangu that when the *empafu* are ready in the forests, the Black and White Casqued Hornbill increase in the abundance. This links the communities so much to go and harvest fruits for sale and contribute to the livelihood in the area, nevertheless it's still complicated to demonstrate this linkage.

5.5 Best land use management practices

It is well understood that land conversion for agricultural production is necessary in order to produce food and other natural materials for local subsistence and trade. This depends upon the human population increase and more needs to support it. This project observed that as most of these communities are more dependants on converted biodiversity there will be an increase onto

biodiversity loss. Today it is still problematical to implement a proper management system in these areas. A comprehensive National Land use Policy has delayed for its operationalization as was proposed by NEMA in 1996. To present Uganda does not have one and as a result inappropriate land use activities are contributing to serious environmental changes. In the project area there is little known about proper land use systems. This project proposes that there is a need to raise awareness on best land use management practices. These practices will include planting trees aimed to contributing on fire wood, tree species that can fix nitrogen to improve on agricultural production. Planting of hedge rows in heavily farmed areas, Protect agro-biodiversity in farmed areas to contribute on crop yield hence reducing on poverty that leads to forest fragmentation.

5.6 Management of fragmented forests

Fragmented forests came as result of natural resource utilization factors. They include charcoal burning, timber extraction, conversion of land for agriculture among others. Uganda is continuously losing its forests cover although some forests are currently fragmented and others exist in patches. In Central Uganda today there is an expansion of pine plantations by international companies in the name of investors. These activities have replaced rain forests in the region. Despite the fact that environmental impact statements have been provided but the management plans are not fully implemented. The resultant concerns include habitat loss of forest biodiversity. The proposed management of fragmented forests by this project is building capacity of local communities in environmental management systems. The capacity can be packaged with efforts to establish demonstration sites accordingly.

These forests can be added a value of acting as carbon pockets growth in Clean Development Mechanism (CDM) projects under the Kyoto Protocol that remains uneven. The value will contribute to the conservation of forest hornbills as well as their habitats. Under the Kyoto Protocol's CDM, developed economies can offset some of their emissions at home, by investing in developing country projects in areas such as renewable energy and forestry schemes.

The projects can earn valuable, saleable credits called Certified Emission Reductions (CERs) whose value is linked to the traded price of carbon.

Plate 11: Common homesteads in the project area

Plate 12: Katumwa trained on bird identification in Rakai

5.7 Capacity building of community members especially youth

The Rufford project trained 12 youth on avifauna identification. They included three young ladies and nine young men from five districts of the project area. Plate 16 presents one of the youth trained. Today there is high level unemployment particularly among the youth. It is important to note that the age from 20-40 years and above is the one engaged in the acts that add to the forest degradation.

6.0 Key findings and Conclusions

This project has confirmed the presence of hornbills in the 22 sites as some forests are feeding sites, however it was observed that roosting sites are commonly found in inhabited areas making them vital for protection of birds' dependent on these forests. The most notable of these (Fig. 2) is the Black and White Casqued Hornbill. We estimated to have a population of 80 pairs averagely in the project area but most commonly in homesteads with nests. Crowned Hornbill follows which is mostly heard and recorded by its calls more often in areas outside urban areas. No nests belonging to this species was recorded any where on our point counts. The least was Pied Hornbill that was rarely recorded during the surveys. It is worth mentioning that this species was recorded to be more abundant in Dimo Forest.

This project proposes that there should be assistance for the communities' adjacent fragmented forests to establish village forests, community woodlots or individual tree planting. This will require identification of appropriate species, support for tree nursery development, and provision of seedlings, pesticides to control termites which destroy Eucalyptus and other tree seedlings and training in local land use planning.

This project has identified challenges that are at the site level; the next step is to identify the stakeholders and promote formal conservation within the communities to sustainably utilize few remaining forest patches.

Although some herbalists plant medicinal plants, there is a need for government agencies to explore the possibility of establishing a herbarium of medicinal plants in the villages since a number of herbal plants seem to be disappearing from the forests as raised by the communities.

The three species of hornbills studied exist in the fragmented forest in Central Uganda. At most the species use forests for foraging; perhaps breeding could be taking place around the forests as well. However it is not yet clear about the hornbill species contributions first to the general ecosystem, secondly to the communities.

We noted that the size of the forest determines the distribution and relative abundance. The degree of degradation will augment species threats in the region. Forest degradation will reduce the abundance (Fig. 3) if it continues at current rate. The rate of degradation is one way caused by the communities. It is concluded that hornbill's forest dependants may be vulnerable some years to come with the current reduction increase of forests. These species are good forest indicators for conservation activities if their abundance is well monitored and used in relationship with the forest covers. The EarthScan (2010), Poverty and Biodiversity

Conservation revealed that forest peoples and local communities are doomed to failure and such top down policy making often serves to reinforce the unequal status quo in forest politics at the international, national and local levels. In Central Uganda forests can easily be managed if communities are economically empowered. In some communities it was reported that politicians hire people and fell trees for timber. Nevertheless local politicians need to be used in forests management can be accountable for the continual degradation.

7. RECOMMENDATIONS

During the socioeconomic surveys it was observed that communities have adopted a new mechanism to conserve forests resources in their own land. However the challenge remains that as the population increase in comparison with the current small plots that each individual household occupy; they will need more resources to be generated for livelihood dependency. *Maesopsis eminii*, *Cordia milenii* were observed used for making drums. They are currently commonly preferred for collection from the forests. This resulted from government enforcement to limit the communities to access the forest resources. The communities have started planting them but on the small scale. To add on that, jackfruit tree was pronounced as a multipurpose as producing edible fruits but also the stem branches can be used for drum making. This project recommends that in future, developments should promote jackfruit growing as an intervention to reduce on the forest degradation. It is important that local communities be encouraged to promote farm forestry.

It is very necessary to educate the communities about the value of the forest remains in their areas. The best way is to link the forests with carbon-offset projects in Central Uganda. This will reveal a series of potential social, economic and livelihood benefits of local communities.

This project recommends raising awareness as means of educating the rural areas to reduce on the current observed impacts. This can be achieved by use of extension workers and working with district authorities to achieve district development plans in line with environmental protection.

There is a need to a great deal for private national and trans-national banks and individual governments to make clean energy investments more attractive through innovative loans and forward-looking policies and smart market mechanisms. By applying this in the communities will contribute to the reduction on the forest fragmentation.

The rural areas of five districts of this project in fragmented forests require recognition as conservation areas, and to reduce the impacts that inhabitants of Central Uganda have on the forests by providing alternative sources of fuel wood and increasing efficiency of natural resource use. Ultimately we recommend starting a small reforestation project and promotion of community tourism to some sites such as Kasonke CFR, Kabasanda CFR, Kitubulu, Ziika, Park Alexander, Gangu as an incentive to the inhabitants of the area to preserve the fragmented forests. Promotion of bio-rights will be improved if direct earning is observed from these fragmented forests.

There is need to increase the number of community youth trained from 12 to create opportunities of establishing eco-tourism sites in the region. During the consultations that were held a

discussion with the Director of Tourism, Wildlife, Antiquities and Cultural Monuments in the Ministry of Tourism Trade and Tourism Industry (MTTI). He recommended that there are still underutilized eco-tourism areas that can be avenues for rural development. Avi-tourism is one of the growing sections in tourism industry that once capacity is built in rural areas, it can support development by generating considerable small incomes. The National Development Plan (NDP) under tourism development strategies Uganda is proposing to diversify tourism products and one of the interventions is to promote bird watching.

References

African Forest Biodiversity: A field Survey Manual for Vertebrates**.** *Earthwatch Institute*. London.

Babweteera, F (2006).; Plantation forest development as a mitigation for loss of biodiversity in tropical forest. Adaptive Strategies for Climate Change and Disaster Management in the Commonwealth.

Bennun, L.A., Dranzoa, C. & Pomeroy, D. 1996. The forest birds of Kenya and Uganda. *Journal of East African Natural History* 85: 23-48.

Bibby, C.J., Burgess, N.D., Hill, D.A. & Mustoe, S.H.(1992). *Bird Census Techniques*. 2nd Edn. Academic Press, London.

Byaruhanga, A., Kasoma, P, K, Pomeroy.D, 2001.Important Bird Areas in Uganda. Nature Uganda, East Africa Natural History Society.

Chamberlain, D.E[1], Katebaka, R.[2]. Senfuma, I[3]. Pomeroy, D.[2] . Nalwanga-Wabwire, D[2]. Byaruhanga,A[4], Atkinson, P.W.[1]. & Vickery, J.A.[1]: 2009: Towards developing Sustainable Biodiversity-Rich Agricultural Systems in Uganda. *Research of British Trust for Ornithology (BTO) London*.

Erickson S.:1996: Briton Birds checklists of National Parks of Uganda. National Biodiversity Data Bank. Kampala.

Kalina, J. 1988. Ecology And Behaviour Of The Black-And-White Casqued Hornbill (*Bycanistes Subcylindricus*) In Kibale Forest, Uganda. Ph.D. Thesis, Michigan State University, USA.

Kemp, A. C. 1993. Conservation of Asian hornbills and their habitats: an introduction. Pages 4-23 in Manual to the conservation of Asian hornbills. *Edited by P. Poonswad & A. C. Kemp. Hornbill Project*, Thailand, Mahidol University, Bangkok.

Kayanja F. I. B. & Byarugaba.D. (2001). Disappearing forests of Uganda: The way forward. Current science, special section: science in the third world. Vol. 81, NO. 8.

Laube, I., Breitbach, N. & Böhning-Gaese, K. (2008). Avian diversity in a Kenyan agro-ecosystem: effects of habitat structure and proximity to forest. *J. Orn.* 149: 181-191.

Ministry of Water, Lands and Environment, 2001. The Uganda Forest Policy.

MFPED 2002. Uganda Population and Housing Census: Provisional results, Uganda Bureau of Statistics, Ministry of Finance, Planning and Economic Development.

Mwima P.M.; Gombya.W.S.; Eilu.G.; 2004: Forest Certification in Uganda.

Pomeroy E.D., 1992. Counting Birds: Technical handbook series. African Wildlife Foundation Nairobi-Kenya. Pg 8-12.

Poverty and Biodiversity Conservation; 2010. The EarthScan International Institute for Environment and Development. *Edited by Roe. D & Elliott .J. London*. Pg 341-353.

White, F. (1983). The vegetation of Africa. A descriptive memoir to accompany the NESCO/AETFAT/UNSO vegetation map of Africa. UNESCO, Paris.

Annex: List of Species recorded

Species	*Species habitat codes*	*Average point counts in 22 sites*
AFEP PIGEON Columba unicincta 344	F	1.86364
BLUE FLYCATCHER Elminia longicauda 963	f	0.04546
AFRICAN GOSHAWK Accipiter tachiro 111	F	0.18182
HARRIER HAWK Polyboroides typus 96	f	0.54546
AFRICAN HAWK EAGLE Hieraaetus spilogaster 128		0.04546
AFRICAN PENDULINE TIT Anthoscopus caroli 668	f	0.09091
SHRIKE FLYCATCHER Megabyas flammulatus 956		1.04546
AFRICAN THRUSH Turdus pelios 801	f	1.63636
AFRICAN WOOD OWL Strix woodfordii 416	F	0.13636
ASHY FLYCATCHER Muscicapa caerulescens 938	F	1.22727
AYRES'S HAWK EAGLE Hieraaetus dubius 126	f	0.04546
BAT HAWK Machaerhamphus alcinus 143	F	0.04546
BLACK & WHITE CASQUED HORNBILL Ceratogymna subcylindricus 513	**F**	**21.545**
BLACK AND WHITE FLYCATCHER Bias musicus 955	f	2.63636
BLACK CUCKOO Cuculus clamosus 396	FF	0.90909
BLACK CUCKOO SHRIKE Campephaga flava 688	f	0.40909
BLACK-BELLIED SEED-CRACKER Pyrenestes ostrinus 1254	F	0.59091
BLACK-BILLED TURACO Tuaraco schuetti 384	FF	0.95455
BLACK-FACED RUFOUS WARBLER Bathmocercus rufus 829	FF	0.18182
BLACK-NECKED WEAVER Ploceus nigricollis 1176	f	6.45455
BLACK-THROATED APALIS Apalis jacksoni 819	FF	1.13636
BLUE-BREASTED KINGFISHER Halcyon malimbica 474	F	5.40909
BLUE-HEADED CRESTED FLYCATCHER Trochocercus nitens 973	FF	0.22727
BLUE-SHOULDERED ROBIN CHAT Cossypha cyanocampter 750	F	1.59091
BLUE-SPOTTED WOOD DOVE Turtur afer 355	F	3.54546
BLUE-THROATED BROWN SUNBIRD Cyanomitra cyanolaema 1097	FF	2.27273
BLUE-THROATED ROLLER Eurystomus gularis 501	FF	0.18182
Bocages Bush-shrike *Malaconotus bocagei*	F	0.5
BROAD-BILLED ROLLER Eurystomus glaucurus 500		0.81818
BROWN ILLADOPSIS Illadopsis fulvescens 675	FF	0.68182
BROWN-CHESTED ALETHE Alethe poliocephala 736	FF	0.54546

Species	*Species habitat codes*	*Average point counts in 22 sites*
BROWN-EARED WOODPECKER Campethera caroli 581	FF	0.72727
Brown-throated Wattle-eye *Platysteira canea*	f	1.40909
BUFF-SPOTTED WOODPECKER Campethera nivosa 582	FF	1.04546
BUFF-THROATED APALIS Apalis rufogularis 826	FF	29.9091
CAMEROON SOMBRE GREENBUL Andropadus curvirostris 697	FF	1.5
CARDINAL WOODPECKER Dendropicos fuscescens 585		0.40909
CASSIN'S HAWK EAGLE Spizaetus africanus 125	FF	0.09091
CASSIN'S HONEYBIRD Prodotiscus insignis 572	FF	0.04546
CASSIN'S SPINETAIL Neafrapus cassini 455	FF	0.27273
CHESTNUT WATTLE-EYE Dyphorophyia castanea 958	FF	2.77273
CHESTNUT-WINGED STARLING Onychognathus fulgidus 1063	FF	0.40909
COLLARED SUNBIRD Hedydipna collaris 1080	F	3.72727
COMMON BULBUL Pycnonotus barbatus 732	f	11.7273
CRESTED GUINEAFOWL Guttera pucherani 188, 189	F	1.22727
CROWNED EAGLE Stephanoaetus coronatus 135	FF	0.36364
CROWNED HORNBILL Tockus alboterminatus 515	**f**	**6.7273**
DIDRIC CUCKOO Chrysococcyx caprius 388		0.45455
DOUBLE-TOOTHED BARBET Lybius bidentatus 534		0.86364
DUSKY CRESTED FLYCATCHER Elminia nigromitrata 972	F	0.86364
DUSKY LONG-TAILED CUCKOO Cercococcyx mechowi 385	FF	4.45455
DUSKY TIT Parus funereus 664	FF	0.36364
Dusky-blue Flycatcher *M. comitata*	F	0.18182
DWARF KINGFISHER Ceyx lecontei 477	FF	0.22727
EASTERN GREY PLANTAIN EATER Crinifer zonurus 376		9.09091
EMERALD CUCKOO Chrysococcyx cupreus 389	F	3.86364
FIRE-CRESTED ALETHE Alethe diademata 734	FF	3.09091
FOREST ROBIN Stiphrornis erythrothorax 789	FF	2.31818
FOREST WOOD HOOPOE Phoeniculus castaneiceps 504	FF	0.90909
GREAT BLUE TURACO Corythaeola cristata 372	F	16.5909
GREAT SPARROWHAWK Accipiter melanoleucus 106	F	0.90909
Greater Honeyguide *Indicator indicator*	f	0.5
GREEN CROMBEC Sylvietta virens 924	F	3.27273
GREEN HYLIA Hylia prasina 889		13.2727

Species	*Species habitat codes*	*Average point counts in 22 sites*
GREEN PIGEON Treron calva 358	F	4.31818
GREEN SUNBIRD Anthreptes rectirostris 1087	FF	1.18182
GREEN-BACKED TWINSPOT Mandingoa nitidula 1242	FF	0.86364
GREEN-HEADED SUNBIRD Cyanomitra verticalis 1130	F	2.54546
Green-tailed Bristlebill *B. eximia*	FF	3.18182
GREEN-THROATED SUNBIRD Chalcomitra rubescens 1120	F	1.22727
GREY LONGBILL Macrosphenus concolor 895	FF	1.04546
GREY PARROT Psittacus erithacus 371	FF	3.04546
GREY-BACKED CAMAROPTERA Camaroptera brachyura 837	f	12.2727
GREY-HEADED NEGROFINCH Nigrita canicapilla 1246	F	3.54546
GREY-HEADED SUNBIRD Deleornis fraseri 1081	FF	1.09091
GREY-THROATED BARBET Gymnobucco bonapartei 533	F	2.45455
GREY-THROATED FLYCATCHER Myioparus griseigularis 942	FF	1.81818
GROSBEAK WEAVER Amblyospiza albifrons 1134	f	2.04546
HAIRY-BREASTED BARBET Tricholaema hirsuta 538	F	8.59091
HELMETED GUINEAFOWL Numida meleagris 190		0.72727
HONEYGUIDE GREENBUL Baeopogon indicator 706	FF	0.54546
JAMESON'S WATTLE-EYE Dyphorophyia blissetti 957	FF	0.59091
JOYFUL GREENBUL Chlorocichla laetissima 711	FF	0.27273
KLAAS' CUCKOO Chrysococcyx klaas 391	f	4.09091
LEAD-COLOURED FLYCATCHER Myioparus plumbeus 946	F	0.5
LESSER HONEYGUIDE Indicator minor 566	f	0.31818
Lesser Striped Swallow *Hirundo abyssinica*		0.5
LEVAILLANT'S CUCKOO Oxylophus levaillantii 394	f	0.27273
LITTLE GREEN SUNBIRD Anthreptes seimundi 1121	FF	4
LITTLE GREENBUL Andropadus virens 705	F	62.1818
LITTLE GREY GREENBUL Andropadus gracilis 699	FF	3.27273
LITTLE SPARROWHAWK Accipiter minullus 107	f	0.09091
LIZARD BUZZARD Kaupifalco monogrammicus 129	F	2.31818
LONG-CRESTED EAGLE Lophaetus occipitalis 130	F	0.22727
MAGPIE MANNIKIN Lonchura fringilloides 1267	f	0.13636

Species	***Species habitat codes***	***Average point counts in 22 sites***
NARINA'S TROGON Apaloderma narina 462	F	4.31818
Northern Black Flycatcher *Melaenornis edolioides*		0.31818
NORTHERN PUFFBACK Dryoscopus gambensis 1000	F	0.63636
NORTHERN CROMBEC Sylvietta brachyura 921		0.04546
OLIVE SUNBIRD Cyanomitra obscura 1112	FF	6.63636
OLIVE-BELLIED SUNBIRD Cinnyris chloropygia 1094		0.40909
OLIVE-GREEN CAMAROPTERA Camaroptera chloronota 838	FF	2.36364
PALE-BREASTED ILLADOPSIS Illadopsis rufipennis 677	FF	1.5
PALM SWIFT Cypsiurus parvus 452		0.18182
PIED HORNBILL Tockus fasciatus 519	***F***	***4.4091***
PINK-FOOTED PUFFBACK Dryoscopus angolensis 998	FF	0.04546
PURPLE-HEADED GLOSSY STARLING Lamprotornis purpureiceps 1058	F	19.1364
PURPLE-THROATED CUCKOO SHRIKE Campephaga quiscalina 691	FF	0.40909
PYGMY KINGFISHER Ceyx picta 478	f	0.54546
RED-BELLIED PARADISE FLYCATCHER Terpsiphone rufiventer 967	F	9.22727
RED-CAPPED ROBIN CHAT Cossypha natalensis 752	F	0.54546
RED-CHESTED CUCKOO Cuculus solitarius 399		5.5
RED-EYED DOVE Streptopelia semitorquata 350	f	4.36364
RED-HEADED BLUE-BILL Spermophaga ruficapilla 1259	F	1.86364
RED-HEADED LOVEBIRD Agapornis pullaria 363	F	0.22727
RED-HEADED MALIMBE Malimbicus rubricollis 1155	FF	0.86364
Red-tailed Bristlebill *Bleda syndactyla*	FF	4.18182
RED-TAILED GREENBUL Criniger calurus 714	FF	4.54546
ROSS'S TURACO Musophaga rossae 377	F	7.27273
RUFOUS THRUSH Neocossyphus fraseri 790		4.77273
SCALY FRANCOLIN Francolinus squamatus 184	F	0.59091
SCALY-BREASTED ILLADOPSIS Illadopsis albipectus 674	FF	2.63636
Scarlet-chested Sunbird *C. senegalensis*	f	2.18182
SLENDER-BILLED GREENBUL Andropadus gracilirostris 698	FF	3.59091
Snowy-headed Robin-chat *C. niveicapilla*	F	1.13636
SOOTY BOUBOU Laniarius leucorhynchus 1007	FF	1.90909
SPECKLED TINKERBIRD Pogoniulus scolopaceus 553	F	22.6818

Species	*Species habitat codes*	*Average point counts in 22 sites*
SPECTACLED WEAVER Ploceus ocularis 1177	f	0.45455
SPLENDID GLOSSY STARLING Lamprotornis splendidus 1061	F	10.5455
SUPERB SUNBIRD Cinnyris superba 1125	F	0.54546
TAMBOURINE DOVE Turtur tympanistria 357	F	18.2273
TIT HYLIA Pholidornis rushiae 901	FF	0.04546
TORO OLIVE GREENBUL Phyllastrephus hypochloris 719	FF	1.09091
VELVET-MANTLED DRONGO Dicrurus modestus 644	F	2.09091
VIEILLOT'S BLACK WEAVER Ploceus nigerrimus 1175	f	2.68182
VIOLET-BACKED STARLING Cinnyricinclus leucogaster 1048	f	3
WHITE-SPOTTED PYGMY CRAKE Sarothrura pulchra 213	F	11.2273
WESTERN BLACK-HEADED ORIOLE Oriolus brachyrhynchus 647	F	7.13636
Western Nicator *Nicator chloris*	F	6.13636
WEYNS' WEAVER Ploceus weynsi 1188	F	68.0455
WHITE-BELLIED KINGFISHER Corythornis leucogaster 467	FF	0.04546
WHITE-BREASTED NEGROFINCH Nigrita fusconota 1247	F	3.95455
WHITE-BROWED COUCAL Centropus superciliosus 406		0.63636
WHITE-CHINNED PRINIA Schistolais leucopogon 911	F	1.13636
WHITE-HEADED ROUGHWING Psalidoprocne albiceps 639	f	1.40909
White-shouldered Tit *P. guineensis*		0.27273
WHITE-THROATED BEE-EATER Merops albicollis 479	f	7.5
WHITE-THROATED GREENBUL Phyllastrephus albigularis 718	FF	7.09091
WILLOW WARBLER Phylloscopus trochilus 908	f	0.54546
Wood Warbler *P. sibilatrix*		0.13636
YELLOW LONGBILL Macrosphenus flavicans 896	FF	1
YELLOW WHITE-EYE Zosterops senegalensis 1133	f	6.36364
YELLOW-BILLED BARBET Trachyphonus purpuratus 556	FF	3.5
YELLOW-BROWED CAMAROPTERA Camaroptera superciliaris 841	FF	1.77273
YELLOW-CRESTED WOODPECKER Dendropicos xantholophus 592	FF	1.36364
YELLOW-FRONTED TINKERBIRD Pogoniulus chrysoconus 549	f	0.36364
YELLOW-MANTLED WEAVER Ploceus tricolor	FF	2.04546

Species	*Species habitat codes*	*Average point counts in 22 sites*
1186		
YELLOW-RUMPED TINKERBIRD Pogoniulus bilineatus 548	F	7.59091
YELLOW-SPOTTED BARBET Buccanodon duchaillui 529	FF	9.31818
YELLOW-THROATED LEAFLOVE Chlorocichla flavicollis 709	f	0.90909
YELLOW-THROATED TINKERBIRD Pogoniulus subsulphureus 555	FF	6.68182
YELLOW-WHISKERED GREENBUL Andropadus latirostris 701	F	8.5
YELLOWBILL Ceuthmochares aereus 401	F	3.04546
XAVIER'S GREENBUL Phyllastrephus xavieri 731	FF	0.13636

The Briton code number and habitat description on the species name is the National Biodiversity Data Bank species Number.