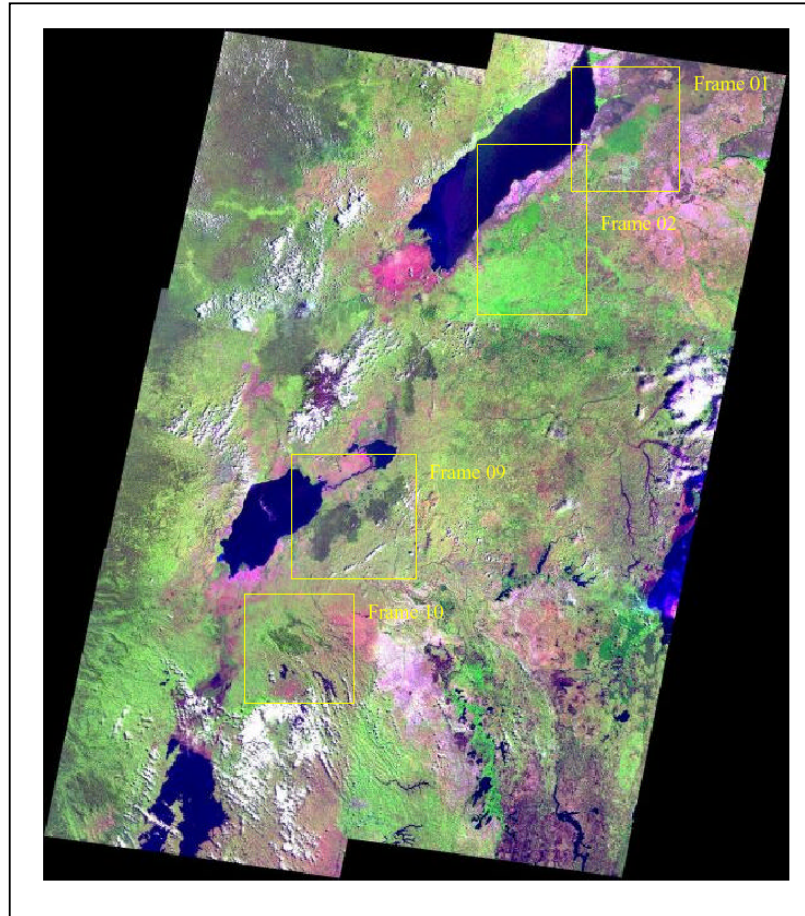# Extent and Status of the Forests in the Ugandan Albertine Rift

Andrew Plumptre
Wildlife Conservation Society

October 2002

Acknowledgements

Executive Summary

This report summarises the current status and extent of forests in western Uganda in what is called the Albertine Rift. The report evaluates the relative importance of the larger forest reserves (those greater than 50 km^2) for wildlife conservation and also evaluates the major threats that the forests currently face. A satellite image analysis shows the extent of forest cover in western Uganda based on satellite images from 1999-2002. The satellite analysis also compares forest loss since the mid 1980s in four areas of the rift and shows that most loss has occurred outside the forest reserves. The five forests that consistently rank high for biodiversity conservation are: Echuya Forest Reserve, Budongo Forest Reserve, Bugoma Forest Reserve, Kalinzu-Maramagambo Forests and Kasyoha-Kitomi Forest Reserve.

The threats faced by the forests are various but are primarily due to the following human activities:
1. Encroachment for Agricultural land
2. Hunting for bushmeat
3. Charcoal Burning
4. Timber harvesting (where it is illegal)
5. Mining

These threats are mapped for the larger forests in western Uganda and the relative intensities of the threats shown both between the forests and within the forest boundaries. More indirect threats to the forest are also discussed. Supporting the ability to control the illegal activities in these forests should be one of the main focuses of the GEF Albertine Rift project both through support to community management initiatives and also through support to law enforcement activities.

Table of Contents

Extent and Status of the Forests in the Ugandan Albertine Rift

Andrew J. Plumptre

Albertine Rift Programme,

Wildlife Conservation Society

A report under subcontract to the GEF PDFb Albertine Rift Project implemented by WWF

I. Introduction

The Albertine Rift is an area of great importance for conservation of biodiversity. It has been identified by Birdlife International as an Endemic Bird Area, by World Wildlife Fund as an Ecoregion and by Conservation International as a biodiversity hotspot. It also contains some of the richest areas in Africa for mammal and bird species. The Albertine Rift has been defined by different people in several ways. In general it extends from the northern end of Lake Albert down to the southern tip of Lake Tanganyika and encompasses the natural habitats within about 100 km of the Congolese border with Uganda, Rwanda, Burundi and Tanzania. The Uganda portion of the Albertine rift therefore extends from Budongo Forest/Murchison Falls National Park in the north down to Mgahinga National park in the south.

A total of 84 centrally managed forests occur in the Albertine Rift in Uganda (Appendix 1). Five of these are national parks and 79 are central forest reserves. In addition there are 21 local forest reserves managed by the districts. Many of the forest reserves are small in size, however, and only nine of them exceed 50 km^2 in size. Figure 1.1 shows the locations of the major forest blocks in western Uganda.

During the early 1990s the Uganda Forest Department surveyed 10 of these larger forests (eight greater than 50 km^2 and Echuya and Mafuga Forest Reserves which were deemed to be potentially important because they occur at high altitude) and four of the national parks to assess the relative biodiversity richness of each of them. These efforts produced species lists for each of the forests for five taxa: trees, birds, small mammals, butterflies and moths. Not surprisingly many of the forests in the Albertine Rift ranked high relative to other forests in

Uganda, not only for species richness but also for prevalence of restricted range or threatened species. Data from these surveys have been used in this report.
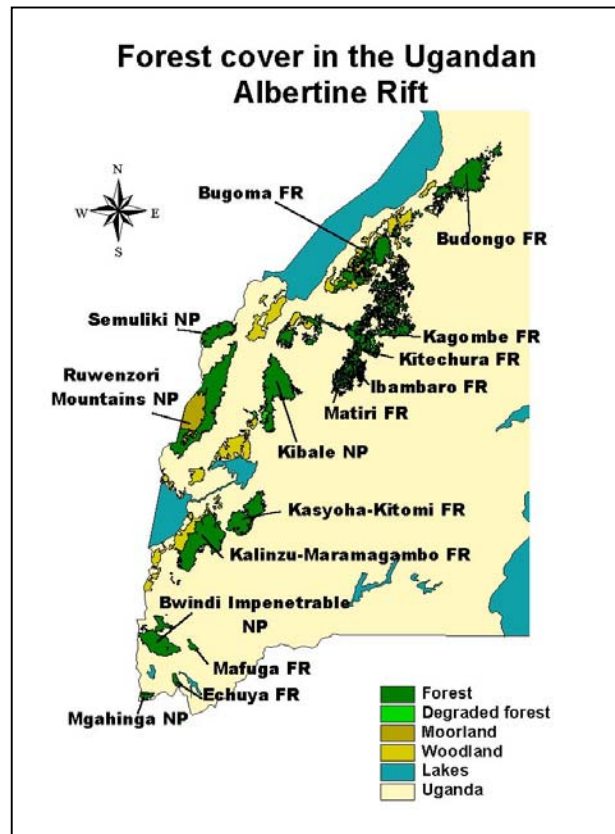
Figure 1.1. The distribution of the larger gazetted forest areas in the Ugandan Albertine Rift. The areas named are referred to in the text of this report.

The Wildlife Conservation Society (WCS) subsequently started a series of surveys of the forests in collaboration with the Jane Goodall Institute (JGI) in 1999. The aim of these surveys was to assess the distribution of larger mammal species across the forests and to analyse the current threats to the forests and their spatial distribution within the forests. These surveys are still ongoing but most of the large forest reserves in the Albertine Rift have been surveyed and preliminary results are presented here.

This report provides an overview of the extent and status of the forests in the Uganda portion of the Albertine Rift. In particular it highlights the relative importance of the larger forests for conservation, and analyses the threats each of them faces from human activities. The report is divided into two sections. The first section gives an analysis comparing all of the forests and the threats impacting them, and the second section (appendix) gives a more detailed

description of the larger forest reserves which are of interest to the GEF PDFb process (ie those forests that have not been receiving much donor support and which are not transboundary in nature).

II. Forest Cover in the Albertine Rift

II.1 Current forest cover

Satellite images of the Albertine rift in western Uganda were analysed by Nadine Laporte, Mirtoslav Honsak, and Didier Devers at the University of Maryland to provide an estimate of current forest cover (using images from 1999, 2000 and 2001) and also to analyse forest loss between the mid 1980s and the recent images. Landsat-7 images were georeferenced with less than 1 pixel (< 30m) accuracy into the EarthSat Corporation's GeoCover™ orthorectified Landsat-5 image base map using a 2nd order polynomial function and the Nearest Neighbor resampling scheme. The mosaic of the images was achieved using standard mosaicing techniques including histogram matching and feathering of the overlap areas for a better visual effect (Note: the original values of some of the images were significantly altered in order to match other images acquired at different solar times, under different atmospheric conditions and during different seasons). The images used are detailed in Table 2.1.

Table 2.1. Landsat Thematic Mapper data used to compare forest change. The dates of each image on each satellite path are given

Data Source	Landsat-5	Landsat-7
Path/Row	*1980's*	*1999/2002*
172-59	1986-01-17	2002-02-06
172-60	1984-07-06	2001-01-02
172-61	1984-06-20	1999-07-08
173-59	1987-08-07	1999-09-17
173-60	1987-08-07	2001-12-01
173-61	1987-08-07	2000-06-15

Figure 2.1 shows the existing forest cover in western Uganda based on the analysis of the most recent images (1999-2002). It shows that in south west Uganda the high density of people creates a region where the boundaries of gazetted forests are hard and there is little secondary forest/woodland in between the gazetted forests. However, in Kibaale, Hoima and Masindi districts there are still areas where there is quite a bit of woodland and forest (often
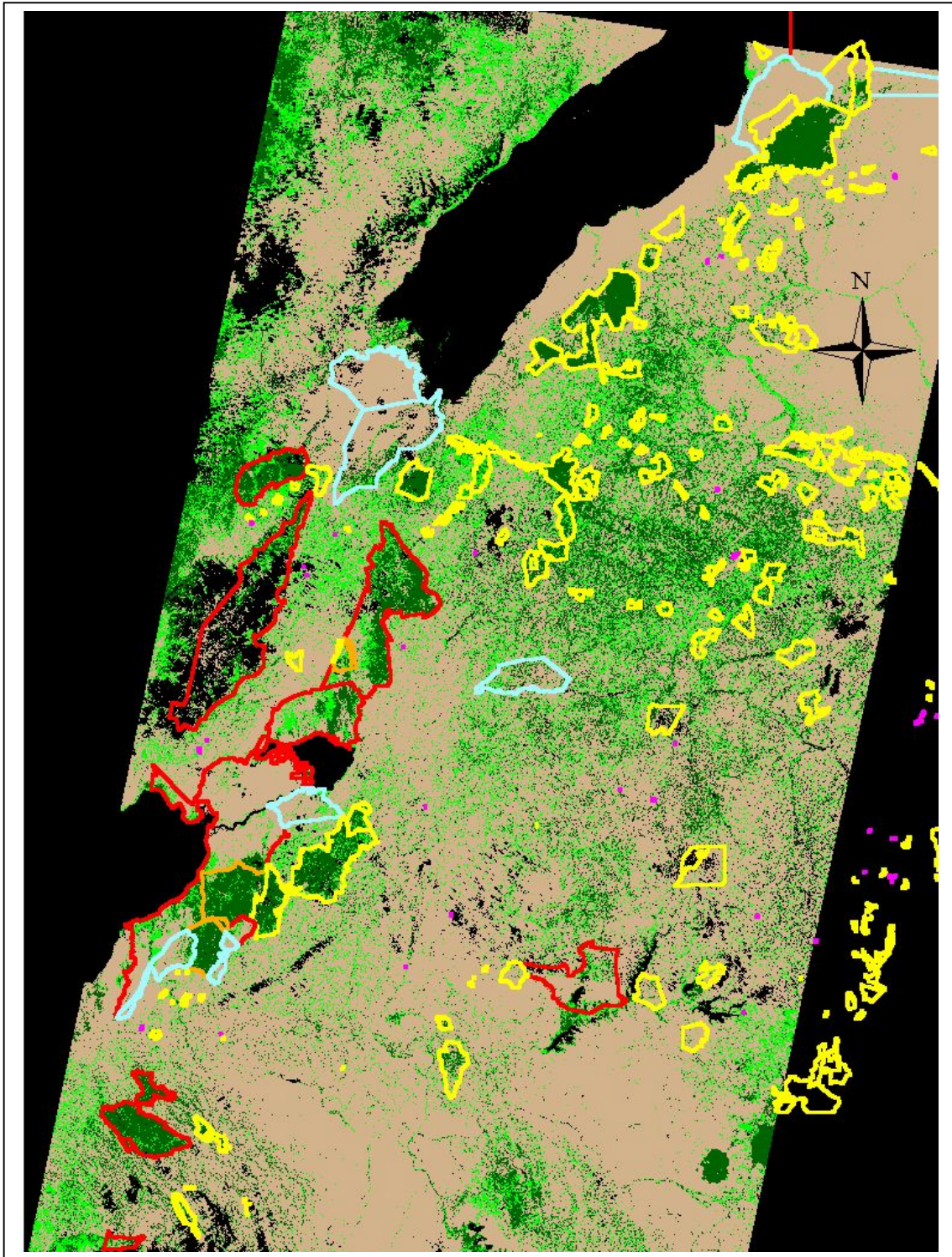
Figure 2.1. Forest cover in western Uganda. Dark green = primary forest; Light green = degraded/regenerating forest. The protected areas in this region are outlined in colour as follows: National parks – red; Central forest reserves - yellow; Jointly Managed areas – orange; Wildlife Reserves - blue and Local Forest Reserves - purple.

The image identifies forest cover well but care must be taken in the areas between Ruwenzori and Kibale national parks and around Bwindi and Mgahinga where the forest cover is primarily plantations rather then natural forest.

along rivers and streams) outside gazetted forest. This provides a degree of connectivity which might be important for species dispersal and gene flow and one recommendation of this study would be that the GEF PDFb for the Albertine Rift aims to work with local authorities and communities to ensure some this connectivity is maintained in future.

One species for which dispersal and gene flow could be important is the chimpanzee. Chimpanzees are classified as endangered under IUCN criteria, they occur at low densities compared with other animals and have slow reproductive rates. Surveys WCS has carried out with JGI in many of these forests show that most forests contain less than 500. A crude estimate of a population that is viable in the long term is one which has at least 500 individuals animals (Soulé 1987). Hence if the populations in these forests are to remain viable they need the connectivity between the forests to allow gene flow. Other species which may be in a similar situation (ie they are known to occur at low densities) include large carnivores (leopard, golden cat, servals), large ungulates (buffalos and large duikers – due to hunting pressures many are at low density – see below) and large birds of prey (although these can probably migrate between discontinuous forests).

II.2. Forest Cover Change Detection

Forest cover change detection was performed individually for four regions of the image around the major forest reserves of Budongo, Bugoma, Kasyoha-Kitomi/Kalinzu and Bwindi/Mgahinga parks. This approach was used to provide more accurate results than a method using the entire Landsat image (or mosaic) by reducing spatially variable atmospheric conditions and seasonal vegetation effects. The forest cover change detection consisted of two stages: (1) classification of individual images to obtain a cloud/cloud shadow mask, (2) classification of multi-temporal image data sets (masked for clouds/cloud shadows) in order to obtain a forest cover change map. A combination of supervised and unsupervised classification techniques combined with expert knowledge of how to sort clusters was used to obtain the forest cover change maps. Both classifications were performed using three spectral bands for each date, i.e., Landsat bands 3, 4, and 5. This combination of bands usually contains the most useful information when mapping vegetation cover. In the first stage, a maximum likelihood classification technique using class probabilities was used. A training data set was obtained for the following four classes: cloud, cloud shadow, land, and open

water. The classification accuracy was enhanced by restricting the classification into an area of interest, which was manually created as a mask prior to the supervised classification.

A spatially joined cumulative cloud/cloud shadow mask derived from both dates was subsequently applied to each image. In the same step the corresponding images were joined together into a 6-layer multi-temporal database. The cloud/shadow masking procedure resulted in an underestimation of the area covered by cloud and an overestimation of cloud shadows. These inaccuracies were usually eliminated during the second classification stage. In the second stage, an unsupervised Isodata classification scheme was employed to cluster the multi-temporal database. Depending on spectral variability of input data, 60 to 80 clusters were used to capture the land cover change variability. Using this initial result and expert knowledge of the area, each cluster was examined and assigned to one of the six classes of landuse cover. For each region the resultant image was recoded to its respective class and filtered (clusters of pixels of the same class smaller than four inter-connected pixels were eliminated). Only change from "mature forest" to "non forest" was considered a forest loss or deforestation. Land cover change from "degraded forest" to "non forest" was not considered robust enough to be kept in the deforestation class and the resulting areas were assigned to "non forest". Using this conservative approach we avoid overestimating deforestation - the rate can only be underestimated – thus the rates of conversion computed from this data set are likely to be more reliable and robust.

Figure 2.2 shows the four regions analyse for forest loss. These show that in the southwest of Uganda (around Bwindi and Kalinzu – Kasyoha-Kitomi), where human density is high, the degree of forest loss around the forest blocks is low because of the low level of forest cover here. Where forest has been lost it is primarily from plantation harvesting in this region. Forest loss around Bugoma and Budongo is more marked and has primarily occurred outside the protected areas on private or government owned land. Figure 2.3 shows how forest loss varies with distance from the boundaries of the major forest blocks. It shows that forest loss peaks between 2-4 km from the boundary for many of the forests. Budongo forest reserve is the exception with an additional peak around 15 km from the forest edge. This is due primarily to the development of the Kinyala sugar estate during this period which led to the clearance of woodland and forest for sugar cane. These peaks around 2-4 km do not occur for Bwindi and Kalinzu forests where human population density is high and where most forest patches outside the blocks are plantations.
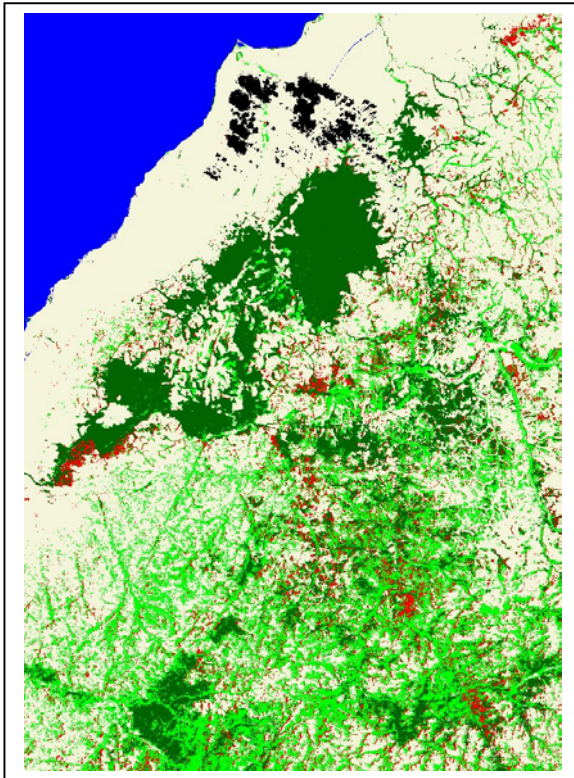
Bugoma Forest
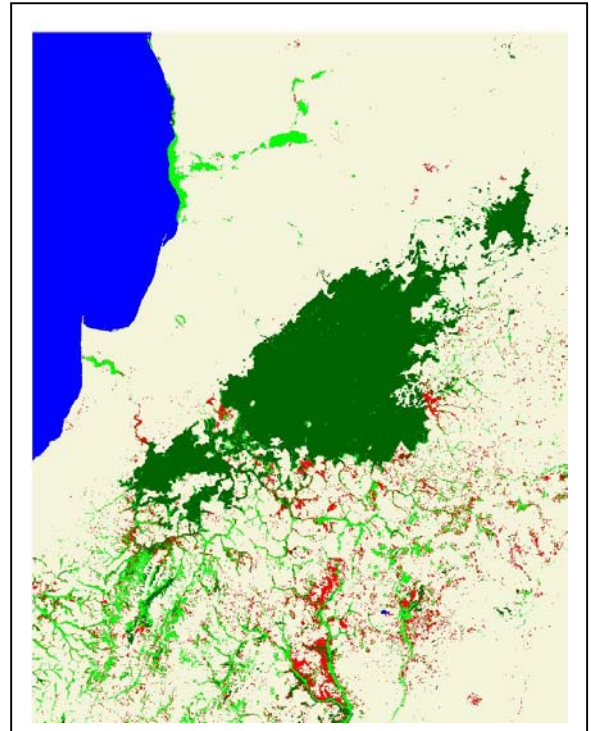
Budongo Forest
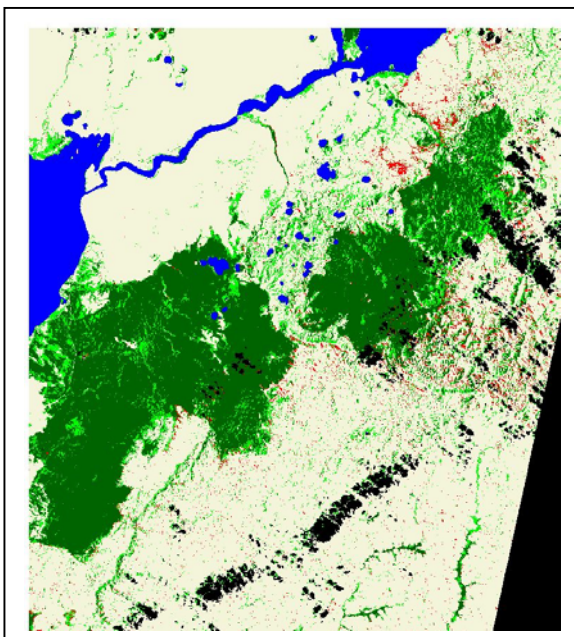
Kasyoha-Kitomi/Kalinzu forests
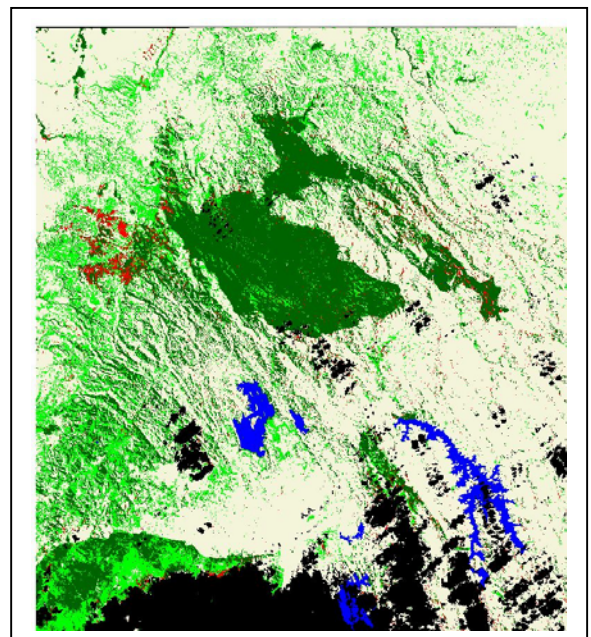
Bwindi/Mgahinga parks

Figure 2.2. Forest loss around four of the main forest reserve blocks in the Albertine Rift, Uganda. The images show the current extent of forest cover (green) and where forest has been lost since the mid 1980s (red).

Forest loss around forest blocks
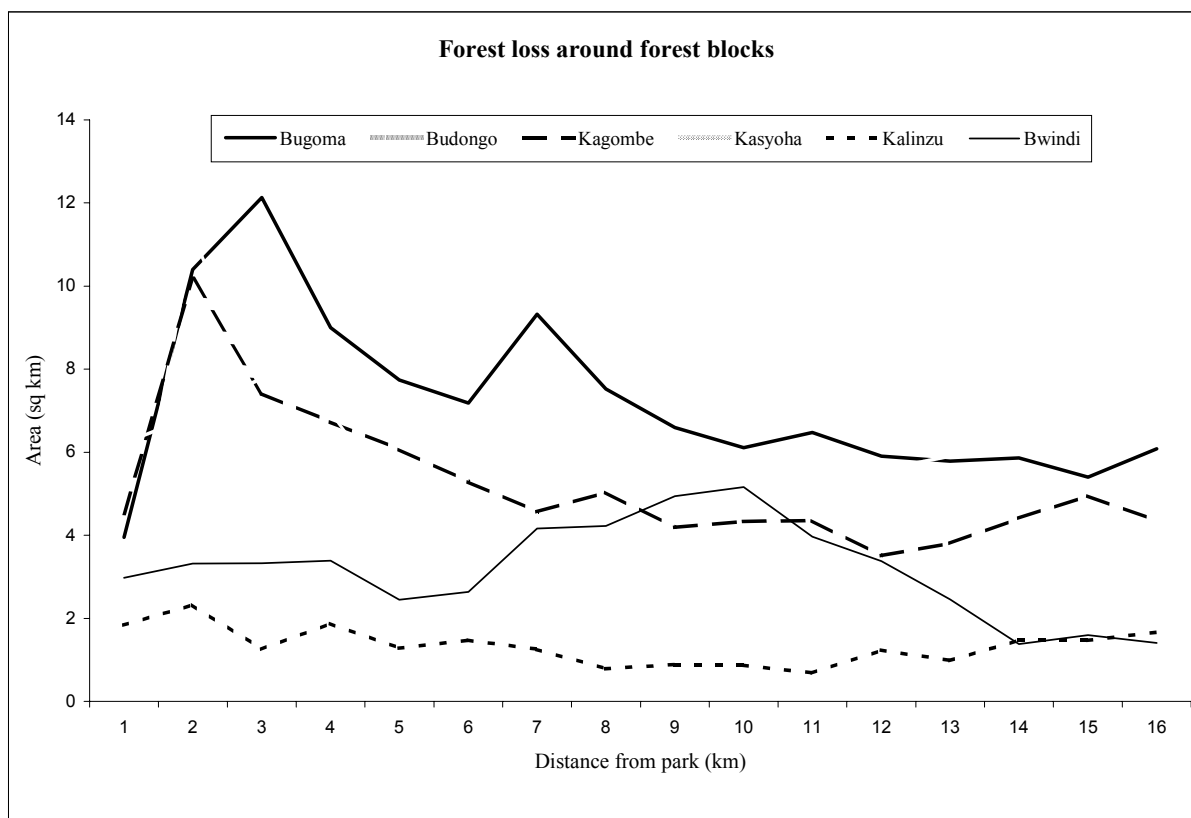
Figure 2.3 Forest loss with distance from the boundary of the major forest blocks.

Cumulative forest loss
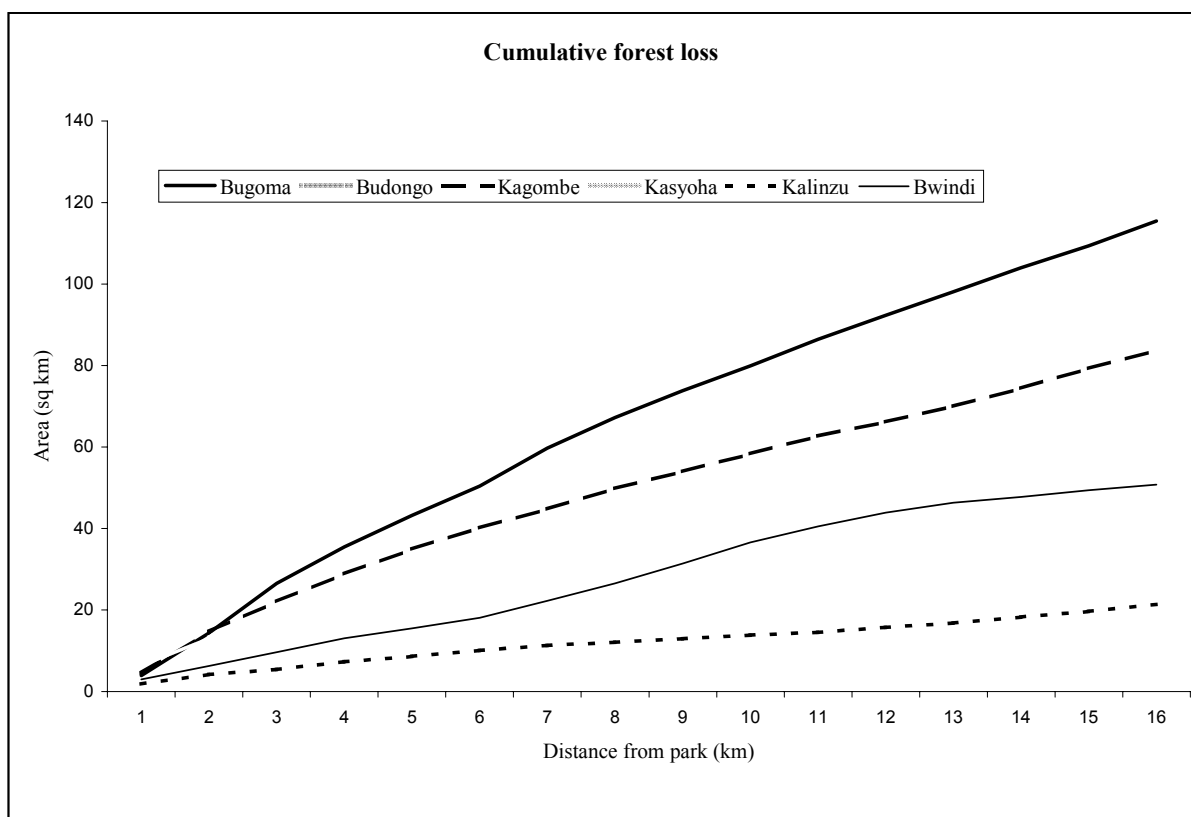
Figure 2.4 Cumulative forest loss with distance from the forest blocks.

The peaking in forest loss 2-4 km from the boundary may be an indication that people have been settling in this region between the mid 1980s and the present and clearing land for farming. Monitoring of images in future should be able to determine whether forest loss is increasing nearer the forest boundary as available land is taken up further away. Unless actions are taken to reduce forest loss around the forest boundaries, I would predict that the peaks will move closer to the forest boundaries for Bugoma, Budongo, Kagombe, and Kasyoha-Kitomi forests in the coming years.

If cumulative forest loss is calculated around the forest blocks (Figure 2.4), it can be seen that large areas of forest have been cleared since the mid 1980s. Over 110 km^2 has been cleared within 15 km of Bugoma for instance. A total of 435 km^2 has been cleared within 15 km of these six forest blocks since the mid 1980s and if we exclude Kalinzu and Bwindi (which will be mainly plantation clearance), a total of 360 km^2 of forest was cleared. A 15 km border around these selected forest blocks includes approximately 42% of the forest cover of Uganda's Albertine Rift. If the amount of forest loss around all forests in the Albertine Rift in Uganda is similar to the rates around these forests (excluding the loss of plantations around Bwindi and Kalinzu) then we can estimate the amount of natural forest loss to be about 860 km^2 since the mid 1980s.

III. Conservation value of the gazetted forests

Conservation value encompasses a variety of factors that need to be taken into account. A place can be valuable for conservation because it is *species rich*. However, in forests you often find more species where you have a mixture of secondary and primary forest interspersed with savanna compared with forest that is purely primary in nature. This higher species richness results from the inclusion of secondary and non-forest species found in more degraded forest. Therefore, on its own species richness is not always that valuable in measuring conservation value. More useful is the number of *restricted range sp*ecies and *rare/threatened species* found in the forest. These are species that tend to be of conservation concern. Their number gives a relative measure of the value of the forest in protecting these species. However, the simple presence of a species in a forest does not imply that it has a viable population in that forest and one forest may not be equivalent to another forest even if they have the same number of restricted range and rare/threatened species. In practice though we rarely have sufficient data to be able to judge this and most of the analyses presented here are based on simple presence-absence data because the relative abundance data do not exist. The Forest Department came up with a '*biodiversity importance*' score (Table 3.1) that combined species richness and relative rarity (based on how restricted the species range was) for the five taxa they studied in each forest (Forest Department 1999).

Complementarity analysis can also be used to assess the relative values of forests for conservation. This process assesses which is the most valuable forest using one of the criteria above and then assesses which forest then adds the most number of new species. The process continues until all species known to occur are represented by at least one forest. The assumption being made here is that resources are scarce for conservation and complementarity analysis is then used as a tool to decide which forests will conserve the most number of species with the minimum investment. The Uganda Forest Department used this tool in their survey of the major forest reserves across Uganda as a way of choosing the most valuable forests for conservation (Forest Department 1999). They used their Biodiversity importance score to choose the first forest (Budongo Forest Reserve) and then chose the forest that added most species to the list for Budongo (Bwindi Impenetrable National Park). The next forest added was Semuliki and so on (Table 3.1).

Which of the several scores in Table 3.1 do we decide is the one that we should use? This partly depends on what goals we have for choosing the forests. Are we more interested in rarity or a combination of rarity and species richness (biodiversity importance score) or are we interested in a minimum set of forests in which case we should choose the complementarity score. Given that for the moment the PDFb process has not started to select sites, I would advocate that we use the biodiversity importance score to rank the forests for intervention. However, the complementarity analysis rankings should be used to ensure we are not just protecting the same species in the sites we choose. What is clear is that the five forests; Budongo, Bugoma, Kasyoha-Kitomi, Kalinzu-Maramagambo and Echuya are consistently ranked higher then the other five forest reserves analysed. This is in part due to the larger sizes of the first four but interestingly Echuya also ranks highly even though it is only about 34 km^2 in size. This is due to the large number of rare and restricted range species that are found within it.

Table 3.1 The results of the Forest Department analyses of the conservation value for the forests they analysed in the Albertine Rift. Those in bold are the forest reserves for consideration under the GEF PDFb. The columns give the relative rankings of the forests for species richness, rarity, a combined biodiversity importance score of these two variables and the results of a complementarity analysis (including all savanna parks also).

Forest	Species Richness	Rarity Value	Biodiversity Importance	Complementarity analysis
Bwindi	2	3	1	2
Kasyoha-Kitomi	1	7	2	5
Budongo	3	5	3	1
Kalinzu-Maramagambo	4	8	4	8
Rwenzori	11	2	5	4
Kibale	4	9	6	6
Semuliki	7	5	6	3
Echuya	14	1	8	7
Bugoma	6	10	9	9
Mafuga	12	4	10	10
Kagombe	8	11	11	11
Matiri	8	13	12	13
Kitechura	10	14	13	14
Itwara	13	11	14	12

Certain areas may also be classified as of value for conservation not based on their species content but more on the fact that they provide linkages between other larger forests. Forests that could be included in this category include Kagombe, Kitechura, Muhangi, Wambabya,

Kasato, Kanaga, Ruzaire, Nyakarongo, Bujawe, Kyamurangi, Kijuna and Rukara. These small forest reserves provide linkages from Semuliki Wildlife Reserve to Kagombe Forest Reserve, up to Bugoma Forest Reserve and through riverine forest to Budongo Forest Reserve

IV. Threats to the forests

IV.1. Major threats

The threats faced by these forests are varied and depend on their location in the Albertine Rift. The human population density in this part of the world follows a gradient from being very high around the south west (near Bwindi, Echuya and Mgahinga) with levels between 3-500 people per square kilometer, dropping slightly around the Ruwenzori Mountains, Kasyoha-Kitomi and Kibale to lower levels still($1-200/km^2$) around Bugoma, Kagombe, Kitechura and Budongo. Land is very scarce therefore in the south west but demand for land is less of a pressure further north. There are five main categories of threat the forests face:

- Hunting of bushmeat
- Illegal harvesting of timber and other plant products
- Charcoal making
- Encroachment for farmland
- Mining

These threats have been quantified in the surveys undertaken by WCS and JGI for most of the large forests in the Albertine Rift: Budongo, Bugoma, Kagombe, Kitechura, Ibambaro, Matiri, Kibale national park, Kasyoha-Kitomi, Kalinzu-Maramagambo and Echuya. Ruwenzori, Mgahinga, and Itwara will be surveyed in the near future and Bwindi has similar data from the gorilla census held in early 2002 (data yet to be analysed). Here I will summarise what we know to date from the surveys that have taken place so far as they concern most of the forest reserves of interest to the GEF PDFb.

IV.2. Methods

The method used to quantify the threats to the forests was based on many kilometers of survey walks in each of the forests. We undertake a mixture of transect work and reconnaissance walks which aim to provide us with estimates of animal densities and also the distribution of the animals within the forests. Reconnaissance walks are what we use to

quantify human impacts on the forest as follows: Each field team in a forest comprises three groups of two field researchers who aim to enter every 2x2 km block of the forest. Researchers walk with a hipchain and thread which measures the distance they have walked and whenever they record some sign of human use they take a GPS location of the sign. They also take GPS locations every 250 metres so that we can map where each team has been. Measures of the encounter rates of human sign per kilometer walked are then calculated. The forest is divided into sectors and the data analysed for each sector separately and the results are mapped in a GIS to give a measure of spatial variation of the different human impacts on the forests.

IV.3. Mapping human threats

IV.3.1 Total human impact

Initially we compared the forests surveyed for all signs of human activity encountered per kilometre walked. This gives a good overview of the impacts man is having on the forest and where in each forest human activity is greater. However, it gives the same weighting to each activity when in practice felling trees has far more impact than harvesting rattan for instance. We present the total human sign here first and then break it up into its component parts.

Figure 4.1 shows each of the main forest blocks and the measure of encounter rate of total human sign for various sites within the forest blocks. As there was some sign of human activity in all sectors surveyed these figures also show where the sectors are located (site of each circle) which are useful for comparison with following figures which have no circles in some sectors where a human activity was not encountered.

The figures show that the forests where logging is legal (Budongo, Kasyoha-Kitomi and Kalinzu – Bugoma is an exception however) have the greatest number of signs of human activity. This is primarily due to logging activities but it can include other activities people engage in whilst in the forest. It should be noted that activities are present throughout these forests even though licensed timber harvesting occurs at one or two sites in each.
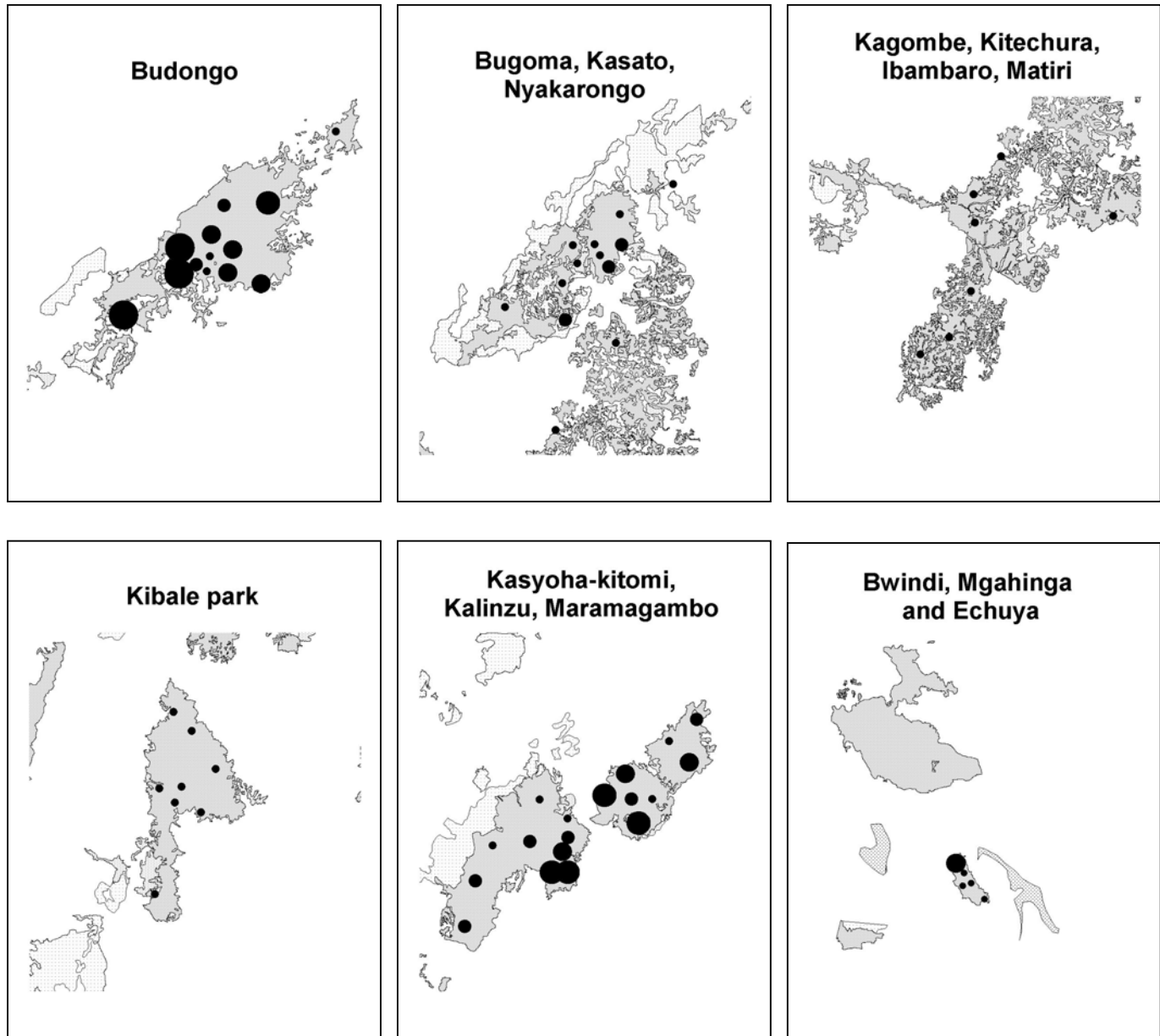
Figure 4.1 Maps of the six main forest blocks showing the relative intensity of total human sign. The larger the circle the larger the number of encounters per kilometre walked. Bwindi and Mgahinga have not yet been surveyed and hence show no signs in any of the maps.

IV.3.2 Hunting of bushmeat

Bushmeat hunting occurs in all of the forests we have surveyed. In many of the forests the predominant signs of hunting are the presence of snares and pitfall traps, although in some forests hunting with nets and dogs is more common. It partly depends on the level of law enforcement by the Uganda Wildlife Authority or Forest Department. Hunting with dogs and nets occurred in the forests that were more remote, and less intensively visited by staff. These forests included Kasyoha-Kitomi, Kagombe and Kitechura.

Figure 4.2 shows the relative intensity of hunting sign in the various forests surveyed. This figure shows that Bugoma and Budongo forests have the highest levels of bushmeat hunting, particularly along their southern edges where the human population density is higher. The Forest Department does not patrol the forests to try to stop bushmeat hunting unlike national parks, and although hunting of most species is illegal they do not have the manpower to be able to control it. The one national park for which data are shown here, Kibale, has lower signs of hunting than many of the other forests. Whether this pattern will also hold for other parks remains to be seen, however signs of hunting in Bwindi Impenetrable National Park during the 1997 gorilla census were low too (McNeilage et al. 1998), although the recent census earlier this year shows that the number of snares has increased threefold. Patrolling by rangers, however, does not necessarily ensure hunting signs are reduced. Censuses in Rwanda of the Virunga Volcanoes in the 1980s had very large numbers of snares collected despite there being a high density of park guards in the region (McNeilage et al. 1998).

Signs of large mammals are few in these forests and appear to be lower than the number of signs encountered in the mid 1980s when surveyed by Peter Howard (Howard 1991). Certain species, notably elephant, buffalo and bushbuck occur at very low densities where they are found. In Budongo forest, where the Murchison Falls National Park borders the northern edges of the forest, the sign of ungulates increases the nearer to the park you go indicating that distance from human habitation may be important in reducing hunting pressure. Few forests have more than about 10 km from the edge to the centre of the forest and this distance is easily walked by hunters setting snares.

One of the activities the GEF PDFb should think about is ways in which bushmeat hunting can be reduced in these forest reserves where there is currently no enforcement of anti-poaching laws. With the plan to reduce Forest Department staff dramatically at the creation of the Forest Authority there will be even fewer staff who can be relied on to patrol these forests. Setting of snares indiscriminately kills or maims other animals, including endangered species. For instance, many chimpanzees in Budongo and Kibale forests lack feet or hands because of snare injuries (between 25-35% of the population of habituated animals). Consequently there needs to be a strategy that aims to address this issue if the larger mammals (the primary targets at present) are to survive in these forests. Large mammals are

known to have important effects on the structure and composition of forests through selective
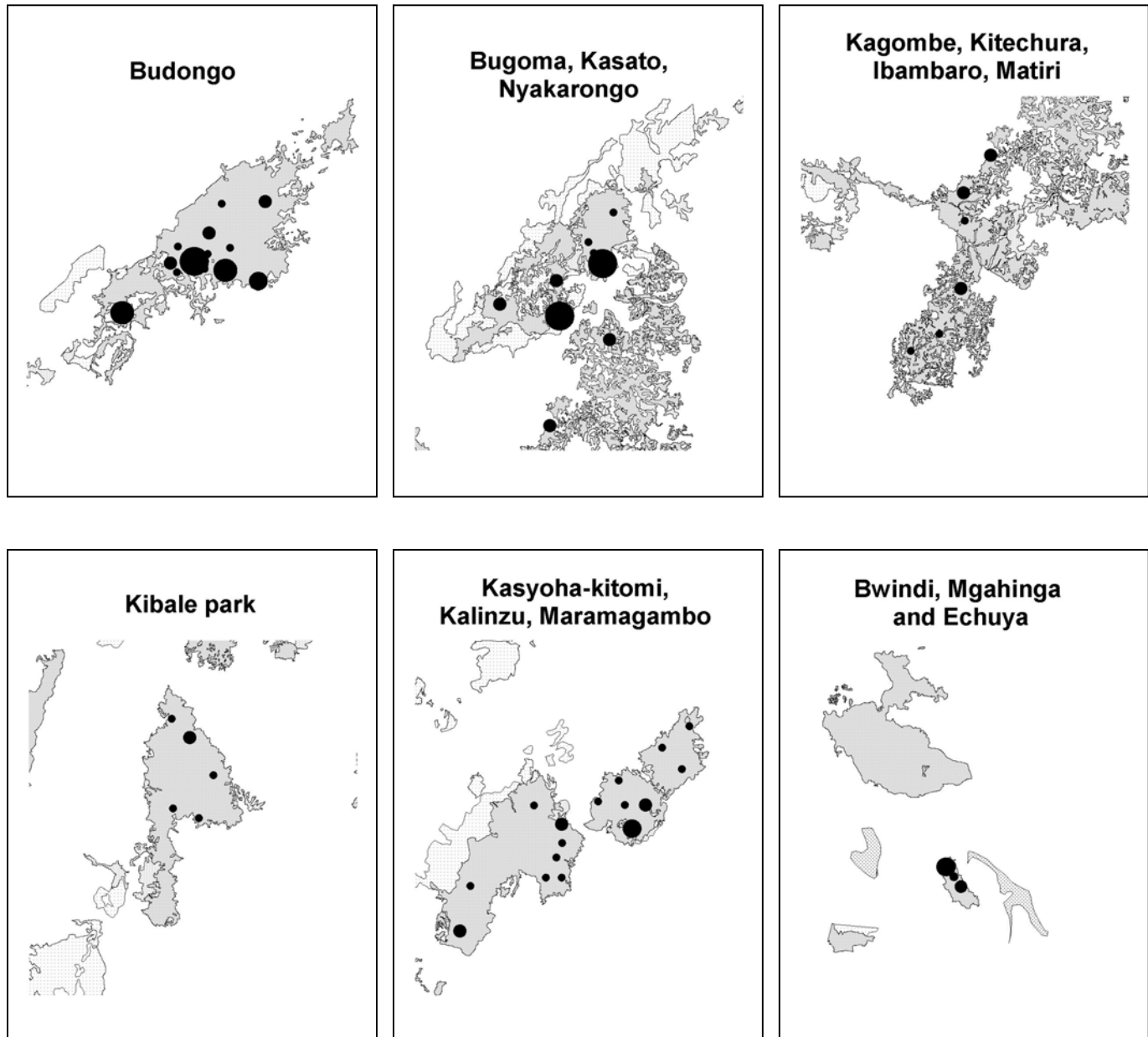
Figure 4.2 Hunting sign (encounter rate per km walked) in each of the forests surveyed. The larger the circle, the larger the encounter rate. Signs include snares, pitfall traps, hunters encountered, dogs and nets.

browsing and seed dispersal (Plumptre, Reynolds and Bakuneeta 1994). In Budongo Forest

for instance it is believed that elephants have strongly influenced tree composition within the

forest (Sheil 1996; Laws, Parker and Johnstone 1975). Loss of large mammals would

therefore potentially change the whole composition of certain forests over time and hence the

other biodiversity that is found in them.

IV.3.3 Charcoal burning

Charcoal burning is a specific use of wood in the forest reserves. In the past charcoal burning was legal in certain forests but today it is illegal in tropical high forest (although at the time of the survey in Kalinzu a small trial was being made to see if it could be reintroduced there). However it still goes on illicitly. Figure 4.3 shows the relative abundance of charcoal burning sites within each of the forests surveyed. It is clear that this activity is far less widespread than bushmeat hunting and is primarily found in Kasyoha-Kitomi and Kalinzu forest reserves, although in Kalinzu one site was legal charcoal burning.
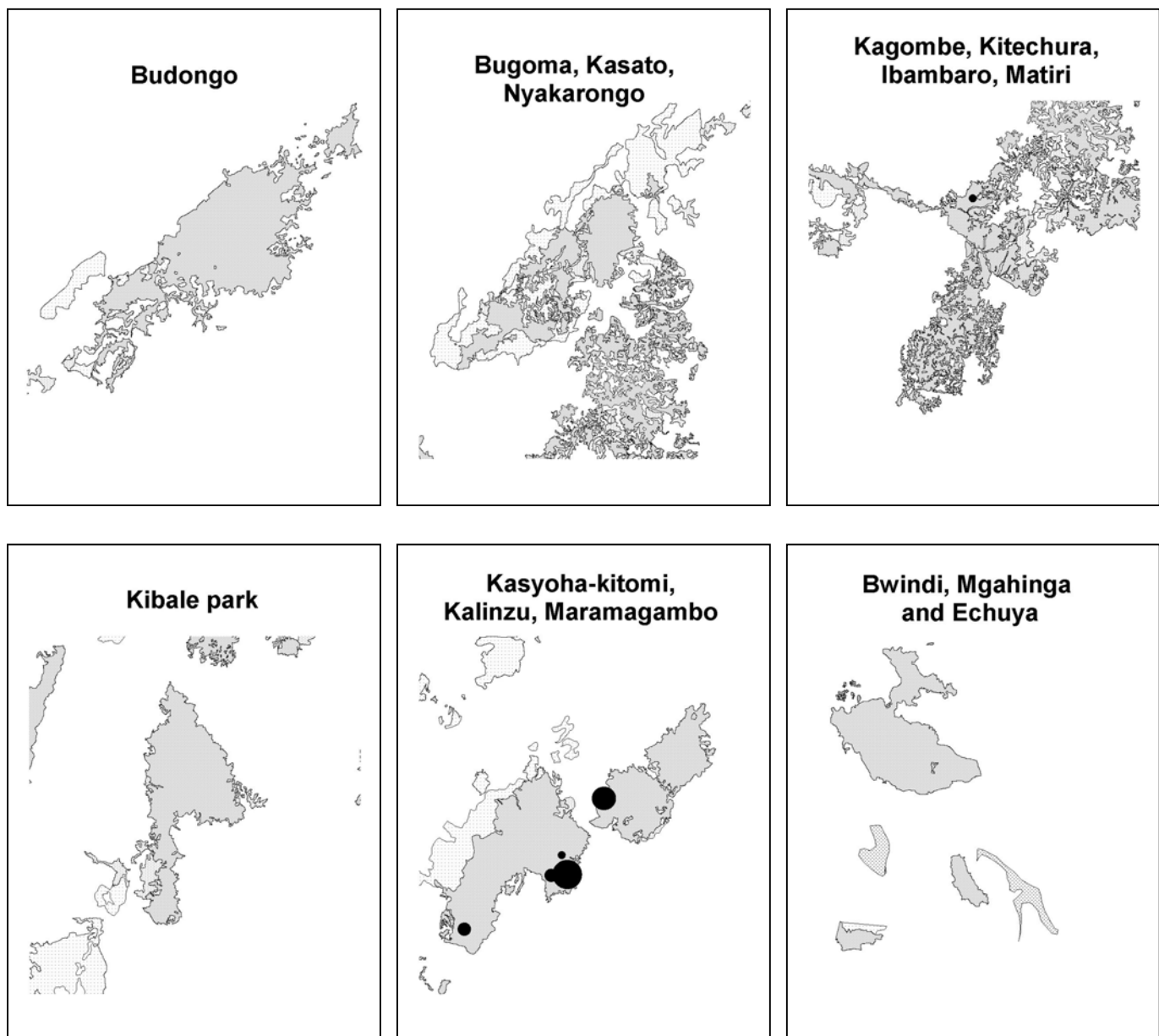
Figure 4.3 Relative encounter rates of charcoal burning sites in each of the forests surveyed.

IV.3.4 Timber harvesting

Harvesting of trees for timber is legal in several forest reserves, notably Budongo, Bugoma, Kalinzu and Kasyoha-Kitomi. Much of the harvesting is carried out using pitsawing rather than sawmills. However it is only legal in certain compartments within these forests. Illegal logging is present in many of these reserves, particularly those with the most valuable timber species such as the mahoganies *Khaya* and *Entandrophragma* such as Budongo and Kalinzu. Illegal logging sometimes takes place at night with lamps and is very difficult to control with the small number of staff Forest Officers have available to them. Consequently the signs occur throughout many of these forests (Figure 4.4).
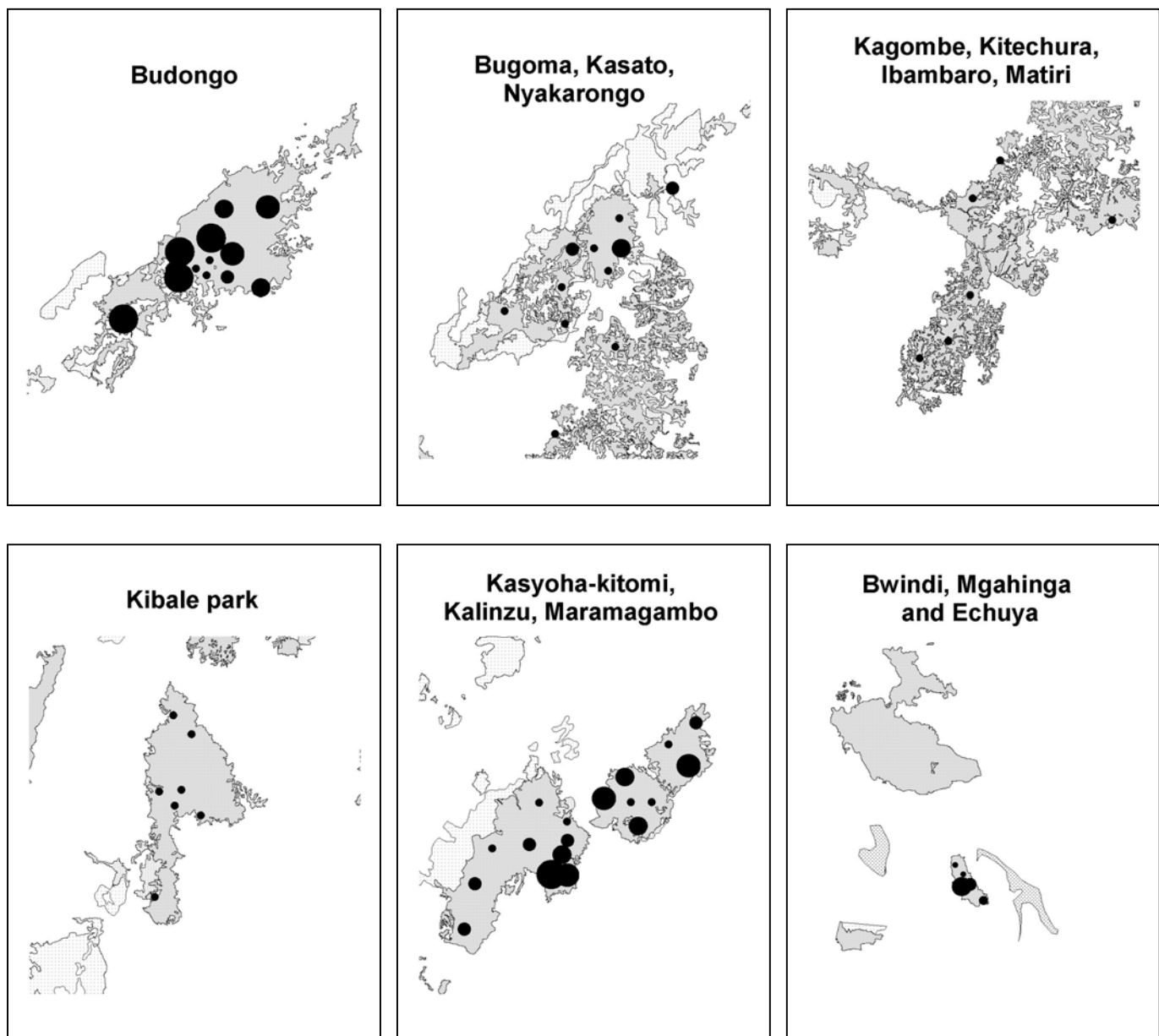
Figure 4.4 The relative encounter rates of signs of timber harvesting in each of the forests surveyed. Signs include pitsaw sites, felled trees, and pitsawing camps.

Tackling the illegal logging is of primary concern if these forests are to be managed for timber production in future. At present there is a push by the Forest Department to increase the number of species harvested in the forests to make sustainable management more financially viable. However, enlarging the market by including more species may lead to increased negative impacts on the forests if illegal logging cannot be controlled.

There is the potential to establish community management of the timber harvesting in these forests to provide incentives to the local people to manage the forest rather than illegally harvest the trees. However, there are certain issues that need to be examined carefully before any collaborative management is to be established. These include:

1. Who is doing the illegal logging? Often people from south west Uganda are brought in to log in the forests because they are hard working and will finish the job more quickly. The people bringing them in may be local politicians or businessmen and these people need to be targeted as well as the local communities if any collaborative management is to work. As people in villages realise more power under the decentralisation process they may become stronger at tackling these 'big men' but for the moment this is unlikely to happen in many sites.

2. Where are the local community from? For instance around Budongo Forest 70% of the local community come from elsewhere in the country (mainly Nebbi, Arua, Lira and Democratic Republic of Congo). If you talk with these people you find that few of them think of themselves as residents (even if they have lived there most of their lives) and all plan to return to their home area in the future. Consequently planning long term management of forests with people who do not plan to be there long term may prove to be pointless. Similarly many people around Kasyoha-Kitomi come from around Kabale-Kisoro and have homes in both places.

3. How will revenue from timber extraction be shared within the community and how will funds be managed for the community as a whole. Pitsawing is hard work and people do it because they benefit personally. At present only a few individuals benefit directly from this kind of harvest and the community only benefits indirectly from the 'trickle down' of money in bars, restaurants and shops. The management of resulting timber profits and who benefits will be crucial if collaborative management is to succeed.

4. How will timber harvesting be managed with local communities? There is a real need for reduced impact logging techniques in the tropical high forests to minimise damage and encourage regeneration. Many of these techniques are known and available. Training of

pitsawyers is needed and incentives developed to ensure that the techniques are implemented correctly.

A similar activity to logging that is pertinent to Echuya forest is the harvesting of bamboo. Bamboo is used for house construction, weaving mats and baskets and also bean poles. Of the forests reported here, Echuya is the only one with large stands of bamboo which is why there are not similar maps for the other forests. Bamboo is being harvested in an uncontrolled manner and the two forest rangers and Forest Officer at Echuya do not have the ability to prevent it. A programme of on-farm substitution needs to be developed around the forest to try to reduce the harvesting pressure which is intense at the moment, particularly in the north of the forest (Figure 4.5).
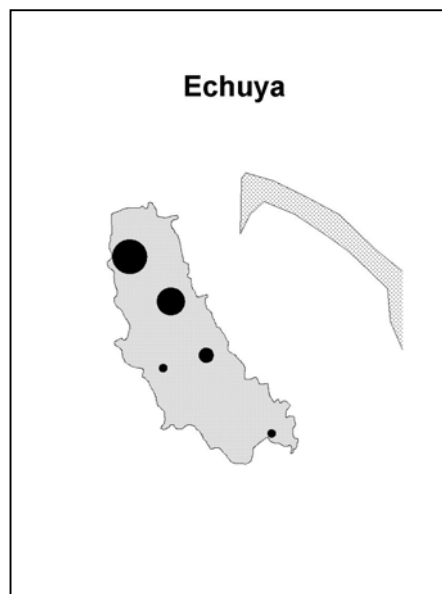
Figure 4.5 Bamboo harvesting intensity at various sites in Echuya forest.

Studies of aerial photos of the extent of bamboo in Echuya over the years have shown a marked decline since 1954 from 22% pure bamboo and 51% mixed bamboo in 1954 to 13% and 26% respectively in 1990 (Banana & Tweheyo 2001). Banana and Tweheyo attribute this decline to the exclusion of fire and loss of herbivores but fail to even mention the scale of harvesting of bamboo that occurs. As far as I am concerned the bamboo offtake by the local population is a more plausible explanation of the decline in bamboo cover. During the survey there were large areas of cleared bamboo and sounds of bamboo cutting daily in the forest.

IV. 3.5 Encroachment

The worst impact on the forests we have encountered is areas of encroachment where the forest has been completely felled and planted with crops. This was particularly bad in south east Kasyoha-Kitomi Forest where an area of at least 10 km^2 had been depleted of trees for agricultural land (Figure 4.5).
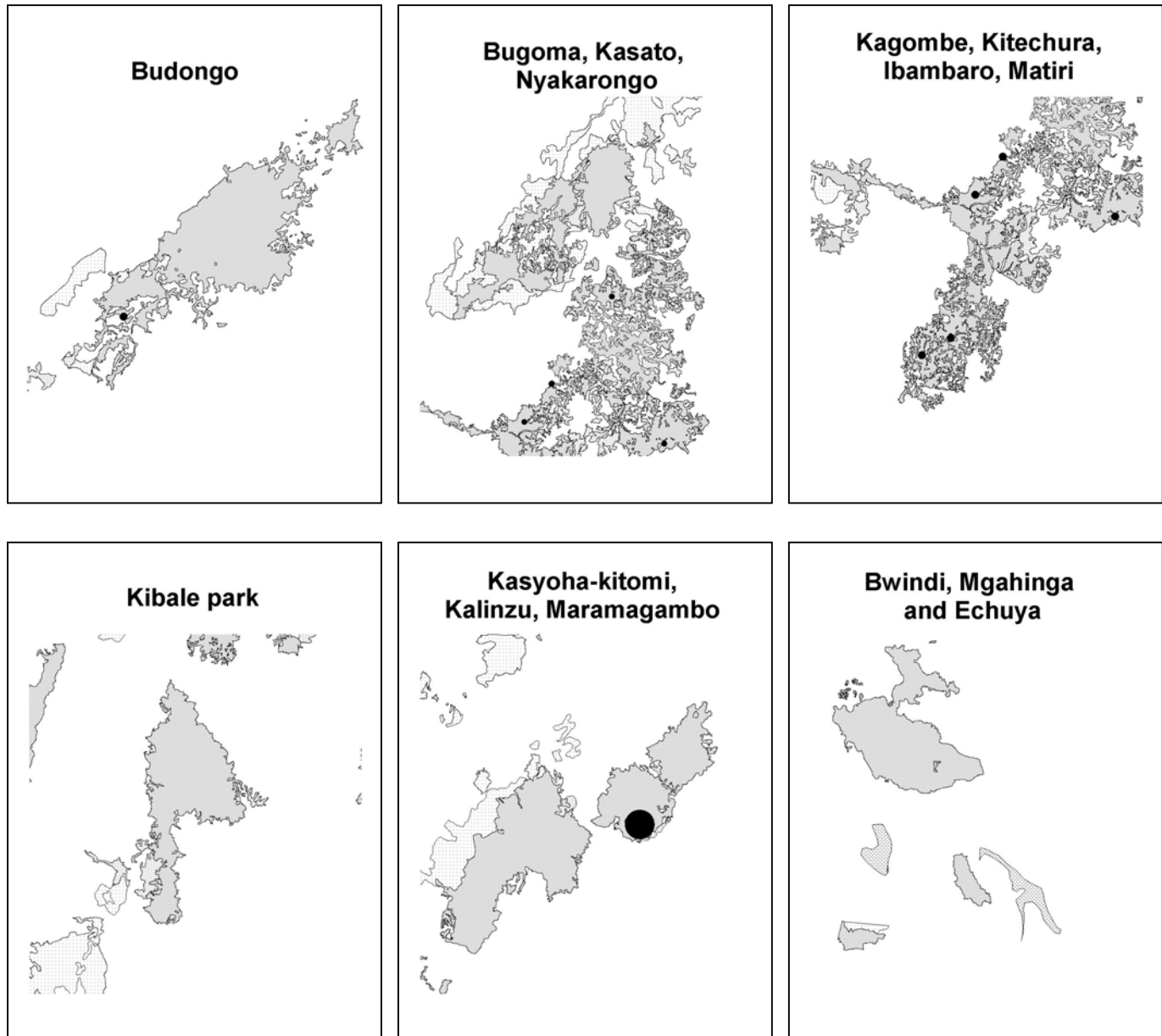
Figure 4.5 Encounter rates of encroached areas for cultivation within the forests surveyed.

The Forest Department is in the process of evicting these people at the moment. This is in an area where the human population density is not very high but the soil is very infertile and seems to lose its fertility quickly following deforestation. Improving farming techniques and soil enrichment is necessary to ensure that people do not want more forest.

IV. 3.6 Mining

Signs of mining were few and were primarily old (greater than 5 years). The only site which had signs of fresh mining activity was Kasyoha-Kitomi. This forest has been mined in the past for gold according to local residents but recently it has also been mined fairly heavily for Columbo-tantalite or Coltan as it is often abbreviated to. Coltan is a mineral used as a semiconducter in computer chips, particularly those used in cell phones. In 2000-2001 it was being mined heavily in eastern Democratic Republic of Congo (DRC) and Rwanda as it was fetching prices of over $80 per kilo and several kilos could be mined at some sites each day. Nyungwe forest in Rwanda had two sites with over 3,000 miners at one point in 2000. Miners in DRC were harvesting bushmeat around camps and leading to population crashes of elephants and gorillas. International pressure reduced the purchasing of Coltan in this part of the world as a result and the price has dropped considerably to about $10 per kilo or less. In Kasyoha-Kitomi the army was involved in much of the mining activity, although we met several people around Kasyoha-Kitomi who had stockpiled Coltan in the hope the price would increase in future (one admitted to having 500 kilos!). At present most Coltan is purchased from mines in Australia and there is pressure to encourage companies to recycle cellphones and reprocess the Coltan. It has the potential to lead to problems in this forest in future though if world prices rise again.

IV.4. Ranking the threats

 From the spatial distribution and relative intensities of the different threats we can rank the threats faced by each of these forests. Table 4.1 gives the ranks for each of the major forest reserves in the Ugandan Albertine Rift. To some extent the rankings are arbitrary and depends on how you prioritise activities. I have used rankings that are based on an assessment of the impact the activity can have on the forest structure and composition. Therefore any harvesting of timber or bamboo ranks highly because it has more of an immediate impact on the integrity of the forest than other activities such as bushmeat hunting.

These threats are ranked within the forest and cannot be compared across forests. In other words a threat of 1 in forest A is not necessarily the same as a 1 in forest B. The figures given above should be used to assess the relative intensity of threats between forests.

Table 4.1 Rankings from 1 (highest) to 5 (lowest) of the various threats to each of the forest reserves studied.

Forest	Bushmeat	Illegal Timber extraction	Bamboo Harvesting	Charcoal production	Encroachment	Mining
Budongo	2	1	-	-	-	-
Bugoma	2	1	-	-	-	-
Kagombe	2	1	-	3	-	-
Kitechura	2	1	-	-	-	-
Ibambaro	2	1	-	-	3	-
Matiri	2	1	-	-	3	-
Kibale NP	2	1	-	-	-	-
Kasyoha-Kitomi	3	2	-	4	1	5
Kalinzu-Maramagambo	3	1	-	2	-	-
Echuya	3	2	1	-	-	-

The threats listed above are threats based on human activities within each of the forests which directly affect the composition of the forests. There are other more indirect threats that also exist which could affect these forests:

1. *Political pressure to degazette or change the landuse of forest reserves*. The recent case of Butamira forest reserve being converted to sugar cane is of concern to forest managers and conservationists. Here a forest reserve which provided fuelwood and other products to local communities was given over to a plantation for conversion to sugar cane production. This was despite intense lobbying in the courts to prevent it and the support of the local community to keep it as a forest. In the end the forest was not degazetted but its landuse was changed so that sugar cane is grown. This sets a legal precedent that allows forest reserves to be cleared of trees for farming. The Plan for Modernisation of Agriculture is promoting cash crops elsewhere in the country - oil palm plantations, cocoa, coffee, tea etc and we are likely to see similar pressures on forests in the Albertine Rift, particularly those that are small and of less conservation value – the ones linking Budongo to Bugoma and to Semuliki wildlife Reserve for instance.

2. *Human – animal conflict.* With the increasing cultivation of cash crops in the country land is being taken for cultivation where in the past it was relatively wild, particularly in Hoima, Kibaale and Masindi districts. There are increasing problems with human animal conflict in these areas. Certain species have been classified as vermin and can legally be killed on farmland whilst raiding crops(eg. baboons, vervets, bushpigs). However, problems occur when endangered species raid crops, such as chimpanzees and elephants. As a signatory to CITES and the convention on biodiversity Uganda has stated it will protect species of conservation concern. Chimpanzee crop-raiding is a problem around Budongo forest where they raid sugarcane (on the Kinyara plantation and in out-growers fields), around Bugoma forest where they raid cocoa crops, and around Kibale forest where they raid bananas in people's shambas. Elephants are a concern around Bwindi and Kibale national parks and around the northern part of Kasyoha-Kitomi where they enter the forest from Kyambura Game Reserve. Crop raiding increases the negative relations between local communities and the authorities responsible for forest management and probably leads to increased illegal activities.

3. *Fire.* The surveys we made showed that forest fires had occurred in several forests but none of these covered a very large area. Grassland fires around the forests particularly in Hoima, Masindi and Kibaale probably do have an impact in preventing forest expansion and possibly even leading to a steady erosion of the forest at their edges. An assessment should be made of the impacts of fire around these forests and recommendations made on ways of reducing their frequency if necessary.

4. *Reduction in Forest Department staff.* The plan to reduce existing Forest Department staff from about 1,200 to 400 people could be a major threat to the integrity of the forest estate. There is the hope that by reducing numbers but paying them a more reasonable wage that performance will improve, they will be more active and hence a fewer number of people will have the same impact. This is probably true to some extent but it is also true that many forest reserves are seriously understaffed at present to be able to tackle the threats. For example in Budongo Forest Reserve, the Forest Officer has about 7 rangers and a few additional temporary staff to work with. . These few people are responsible for a myriad of activities including overseeing licensed pitsawyers in the forest, stock mapping and inventory, marking trees for harvesting, stamping timber that is leaving the forest, organizing slashing of the boundary, and also patrolling for illegal pitsawyers, who have caused personal injury to rangers in the past. At present, there is nobody who can consider tackling the bushmeat hunting problems as a result.

5. *Oil drilling*: Systematic seismic prospecting for oil has been ongoing since the early 1990s. Only recently have concessions been developed and two have been assigned for exploratory drilling. One concession which includes Semuliki Wildlife Reserve and Semuliki National Park has been given to Heritage Oil and Gas company, a Canadian based company. The second concession which includes part of Bugoma forest and Budongo Forest as well and the grassland at the base of the escarpment to Lake Albert has been given to Hardman Resources. If significant amounts of oil are discovered this could form a potential threat to the whole corridor plan if it is not monitored carefully. On the other hand it could potentially provide significant sums for conservation if taxation mechanisms are built into the contracts.

IV.5. Possible solutions to the threats

It would be naive to think that all these threats have simple solutions and that I could prescribe a list here that would solve all the problems. Tackling these threats will require an integrated approach involving government, local communities, biologists, social scientists, NGOs (national and international), and even then it is unlikely they will be completely solved. Even in Bwindi where a Trust fund is providing 60% of the interest to local community projects and thereby effectively paying the community not to go into the forest, there are still illegal activities taking place in the forests. The aim should therefore to be to reduce the threats so that their impacts on the integrity of the forests and forest health are minimised. I do not pretend to have all the answers but here are some suggestions of activities that could be tried:

1. *Illegal timber/bamboo harvesting*. The Forest Authority, when it is established, aims to address this issue in the main tropical forest reserves in the country, particularly those where timber extraction is important for the national economy (Budongo, Bugoma, Kalinzu and Kasyoha-Kitomi). They aim to involve local communities in the management of the forest to a greater extent so that they see some benefit from the trees in the forest and hence support the Forest Authority in managing the forest and preventing illegal activity. This strategy alone will not work for many of the sites in the Albertine Rift. There are major political pressures by businessmen and politicians to illegally harvest timber and unless the Government of Uganda is willing to take these people to court when caught and demand hefty fines or imprisonment it is unlikely that local communities will be able to stop them on their own. Many studies of the effectiveness of community conservation projects around the world are coming to the conclusion that

community conservation/joint management alone often does not yield the desired results. Where it is combined with effective law enforcement the conservation results tend to be improved. If we assume the Forest Authority or the EC Natural Forest Management and Conservation Project is going to take on the task of establishing a programme of joint forest management then one role that the GEF Albertine Rift project could take on is the support of law enforcement and monitoring. In particular training rangers that are in the forest to collect information that can allow managers to target interventions is needed. UWA has developed a good system of ranger-based data collection which needs to be better implemented but has great potential. Perhaps the Forest Department could implement a similar programme to better enable managers at the DFO/FO and headquarters level to plan their interventions. For those forests that border national parks or wildlife reserves, there should be increased collaboration between UWA and the Forest Authority with joint patrols. UWA staff can carry guns and initially this may be necessary to stop illegal pitsawing activities where they are threatening forest rangers lives.

2.   *Bushmeat hunting*. Here again law enforcement is one possible solution to the hunting that takes place in the forests. The setting of snares is probably the most destructive aspect of the hunting that takes place because of its indiscriminate nature of trapping whatever species steps in the noose. Developing law enforcement teams that remove snares will address part of the problem but it doesn't address the root cause; the people setting the snares. Some education is needed in the villages around the forest about the law pertaining to hunting to make everyone aware of the law. Similarly the awareness of local authorities such as the police needs to be raised about this issue as often they are unaware of the existing laws on hunting. Targeting hunters to form part of the law enforcement teams would reduce the incidence of hunting. Paying for such teams that focus on bushmeat will be problematic. However, zoos in Europe and the USA are looking for small projects to support and the Jane Goodall Institute has effectively collaborated with zoos to support snare removal operations in Kibale National Park and Budongo Forest. This is potentially one source of regular long-term funding.

In Hoima and Masindi hunting has some cultural significance and this is possibly true elsewhere. Given the problem with crop-raiding by bushpigs it might be possible to envisage certain days of the year when group of people are allowed to hunt this species as a cultural activity in certain areas of the forest. Provided they use nets and drive the

animals into these and provided that the days are few each year I doubt this would significantly impact the population whilst at the same time allowing the cultural aspects of the hunt to take place. This is an idea and needs evaluating, discussing with communities, starting pilot projects and establishing monitoring programmes to assess the impacts on the bushpig populations and also on the attitudes of the local communities. A pilot project is needed first to assess whether a few days a year will lead to changes in hunting behaviour or not. If not then the project should not be started.

3. *Charcoal burning*. Here again law enforcement combined with increasing plantations around the forest which can be used to make charcoal would help reduce the problem. The main areas of charcoal burning occur in Kasyoha-Kitomi and Kalinzu where there are few woodlots outside the forest. Therefore a project that increased these would probably reduce this threat. The GEF Albertne Rift Project could target this as an activity but during the planning phase close liaison should be made with the USAID PRIME/WEST programme that is being planned as this area is one they will be considering for activities and this activity could be supported by their programme.

4. *Encroachment*. This basically needs to be halted completely. Where it has occurred it has been with the knowledge of the forest department staff, who have taken bribes to look the other way, and hopefully the change in payscale and the regular evaluations of performance that are planned under the Forest Authority will eliminate encroachment.

5. *Political pressure to degazette*. Part of the role of the GEF Albertine Rift Project should be to ensure the global importance of the forests of the rift are well known at all levels of government and by the public at large. The process of the PDFb and the early work of the project should prioritise sites and define those that are of global and national importance. To some extent much of this has been achieved by the Forest Department biodiversity surveys (see section III) but decisions need to be made about connectivity/contiguity between forests and a larger landscape analysis is needed. Which smaller forest reserves are of importance not because they are rich biologically but because they connect the larger forests and form corridors? These forests should rank more highly than those that are isolated and of low diversity value. The GEF project should create a vision and plan that looks at the landscape and push this in the political arena (in Kampala, at the District

level and at the village level). Having this plan and vision will help reduce the random degazetting of small forests by local businesses.

6. *Human – animal conflict.* Where the animals causing the problems are classed as vermin there is less of a problem and the project should not address these issues. However, where the animals are endangered or threatened the GEF project should try to address this issue in the areas it selects to work. In some sites it may be possible to offset the loss of crops by developing activities that bring in funds to the region as a result of the animals – eco-tourism activities such as chimpanzee viewing may be one possibility although there are already several sites offering this in Uganda. Developing other ecotourism activities that are not currently on offer in Uganda may be a better solution to bring people in. These could include hikes and camps in the forests over several days, school camp sites for the richer schools in Kampala, trailbiking courses and possibly horse riding safaris where you have grassland and forest adjacent to each other (Hoima, Kibaale and Masindi Districts). Working with farmers to grow less palatable crops and helping them identify markets for these may be another solution. Given the decreasing cocoa prices in the world and the fact that in Cameroon many farmers are giving up on growing cocoa it is surprising that farmers are growing this crop in Hoima district. It should be possible to find a better alternative to this as a cash crop. A programme of working with farmers to develop better guarding strategies is also needed. Often each farmer guards his own crop and there is no communal effort to chase off animals. Creating groups within the village who are responsible for guarding everyone's crops and helping the village organise itself better has proved to work well in Zimbabwe against even elephants (F. Osborn pers. comm.).

7. *Fire*. An assessment of the importance of fire, its frequency, why or how they occur and its impact on forest edges is needed for areas in Kibaale, Hoima and Masindi. This assessment would also need to provide possible solutions for reducing negative impacts on the forests.

V. Site selection for the GEF project and development of strategies

V.1 Site selection

Site selection for the GEF project will depend on several criteria and also on the activities of other donors, NGOs and government. A suggested list of criteria is given here and which forests it would select as a result:

1. *Biodiversity/conservation value*. Section III identified five forests as consistently having high biodiversity value however the value was measured. These were Budongo, Bugoma, Kasyoha-Kitomi, Kalinzu-Maramagambo and Echuya Forests. If we use biodiversity as the key criteria to select forests to work with then we should select these five forests.

2. *Poverty alleviation*. Forests that have the potential to earn income for local communities may be another criteria that should be assessed. This could be forests with timber potential (Budongo, Bugoma and Kalinzu), ecotourism potential (Budongo, Kalinzu, Kasyoha-Kitomi and possibly Bugoma), or carbon trading schemes (large forests such as Budongo, Bugoma, Kalinzu-maramagambo and Kasyoha-Kitomi).

3. *With low human population density around the forest*. There would be advantages of targeting forests with low population density adjacent to them as this will allow easier development of activities and the pressures by the local community will be less. Bugoma, Budongo, Kagombe, Kitechura, Ibambaro, Matiri, Itwara, Kasato and Muhangi would be good candidates under this criteria.

4. *Creates a corridor linking reserves*. Two potential corridors exist in the Ugandan Albertine Rift (Figure 5.1): a) the Murchison Falls-Budongo-Wambabya-Bugoma-Kasato- Kanaga-Ruzaire-Nyakarongo-Bujawe-Kyamurangi-Kijuna-Rukara-Kagombe-Kitechura-Muhangi-Semuliki Wildlife Reserve-Semuliki National Park-DRC corridor and (red in figure 5.1) and b) the Kibale NP-QENP-Kyambura WR-Kasyoha-Kitomi-Kalinzu Maramagambo-Virunga park (DRC) complex of sites (Purple in figure 5.1). Many of the reserves in the first corridor are small ones that could potentially be linked and formed into a larger unit, depending on whether people are living around them or not. The second corridor is composed primarily of parks and wildlife reserves with Kalinzu and Kasyoha Kitomi as the forest reserves. If the GEF Albertine Rift project must focus on forest reserves and this criteria is chosen as important then focussing on the first corridor may be more important.
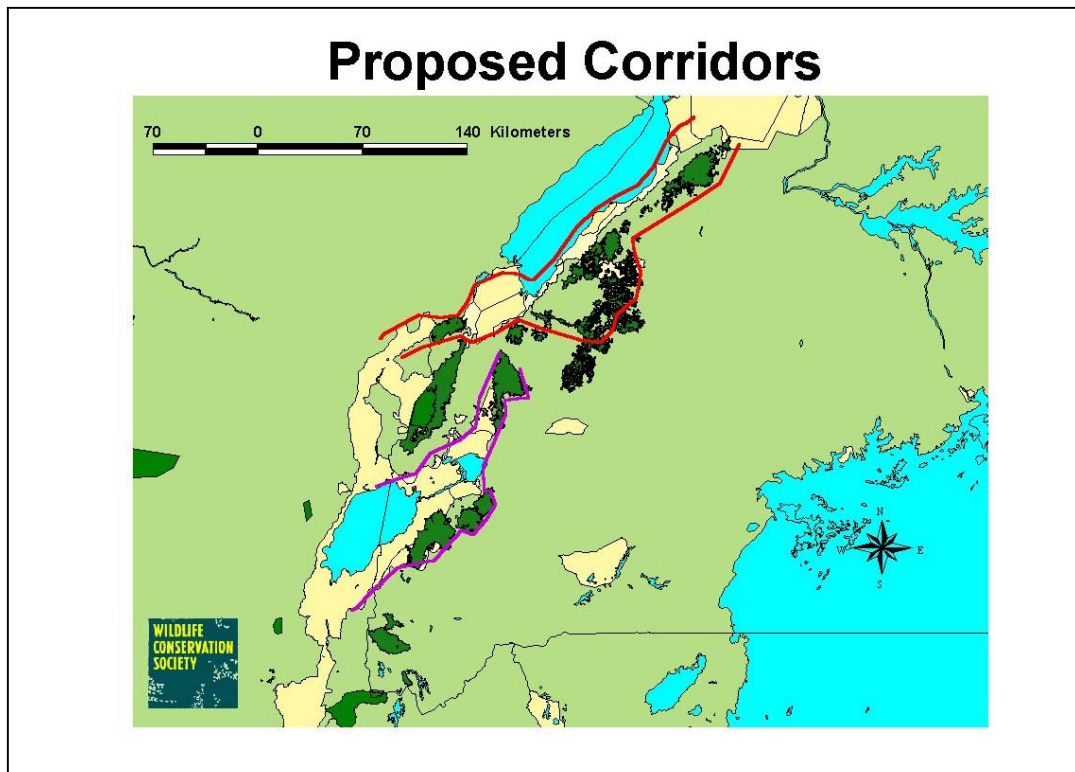
Figure 5.1. The two proposed corridors in Uganda's Albertine Rift.

5. *Piloting strategies*. If the GEF projects thinks of a variety of strategies it wants to pilot, for instance developing community law enforcement or encouraging community involvement in conservation of these forests for instance, then different strategies might be piloted at various sites where the strategy would be most appropriate. Selecting sites depends on the strategies that are developed.

Other criteria could be listed but I feel that these are likely to be the most useful ones to consider.

V.2. Developing Conservation Strategies

Developing a conservation strategy for the Albertine Rift in Uganda will depend on which of the criteria suggested above are adopted. At the inception workshop it was made clear that a 'vision' is needed that is exciting and will attract attention when the proposal is submitted to GEF for consideration. Personally I feel that the last two criteria, the corridor idea and conservation of the larger landscape and the piloting strategies idea are the two that might be more interesting. It might be possible to combine these both into one and pilot strategies to promote the conservation of one of the corridors.

The workshop in June focussed on what the objectives and goals of the GEF Albertine Rift programme would be. However, this was not very specific given that the area of focus had not been narrowed down. It now appears that the northern corridor concept will be the focus of the programme and therefore it is easier to be more specific. Given the extent of the forests, the fairly rapid loss of forests outside forest reserves and the threats detailed above I would propose some of the following actions for the GEF Albertine Rift Project:

V. 2.1. Actions at national level:

1. *Manage for ecosystem conservation*: At present most forest reserves under the Forest Department's jurisdiction are managed for timber production. This is despite the fact that they have produced a world class "conservation master plan" based upon the biological surveys they undertook in the early 1990s. Forests have been zoned as part of the plan but most activities by rangers still focus on the timber production zones. Over the last year nature reserves have been logged illegally because there is little law enforcement in these areas. This is either due to insufficient staff to be able to manage all areas of the forest; unmotivated staff who are concerned about job losses in the near future or due to the fact that patrolling the nature reserves is not a priority. Developing a focus on the management of the major forest reserves for timber production, firewood and NTFP collection, bushmeat hunting, charcoal production and conservation is essential if these forests are to be conserved in the long term. This should be part of the role of management planning. However, despite many years of planning on developing management plans few have been produced for the forest reserves. Training managers in assessing threats and opportunities to their reserves and then developing management actions based on these will help them develop their own management plans. GEF should support training of senior and mid-level managers to develop management plans. This training should involve both the senior managers at headquarters and mid level ones at DFO and FO level.

2. *Monitoring of implementation of management plans*: Unless regular monitoring takes place in the main forest reserves, managers will not be able to target interventions effectively or adjust management actions as it becomes clear the management strategy is not working. Managers should be trained to view management as an experiment that will need testing and modifying in the light of results. The Uganda Wildlife Authority has developed a ranger-based data collection system and software (MIST) for analysing the data. At present it is only really functional in two parks and there are problems with the

program crashing at regular intervals but as a monitoring system that is easy to use it has great potential. Implementing a similar programme in the Forestry Department would lead to better management provided managers are trained to understand the role of monitoring in the management cycle and can interpret and use the results. This is a need that the EU Forestry Support Programme has also identified and GEF would be an ideal donor to support this.

3. *Research to better manage*: More detailed monitoring and analyses of the effectiveness of management actions could be undertaken by research stations in the region. The Budongo Forest Project (BFP), Institute for Tropical Forest Conservation (ITFC) and Makerere University Biological Field Station (MUBFS) could all play a role in more detailed studies of management interventions if supported to do so. BFP currently undertakes research in Budongo and in the surrounding forest patches but might be able to expand its activities to include Bugoma forest. ITFC undertakes research in Bwindi, Mgahinga and Echuya forests. MUBFS currently focuses its activities on Kibale park and island forests around it but might be persuaded to include Itwara and other nearby forests in the northern corridor. These detailed studies could include studies such as the effectiveness of patrolling to stop snaring and the frequency needed, measuring the attitudes of communities and how they change with different management actions that are piloted, analysing the dispersal of various species and use of forest patches along corridors to better understand the shape and size that are needed for corridors and analysing the impacts of forestry activities on the forests to develop better models for timber and NTFP management. GEF could contract one or more of these institutions to undertake more detailed research on the pilot strategies that will be implemented as part of the programme.

V. 2.2. Actions specific to the northern corridor

1. *Focussing on key areas within the corridor*: It is unlikely that the GEF project can focus on the whole corridor and at the same time there is a risk that if all efforts are put in the corridor then the conservation of the major forest blocks will be at risk of being neglected. I would suggest focussing activities in four key areas (Figure 5.2):

    • The area that links Bugoma to Kagombe with the forest and grasslands between

    • The linkage between Bugoma and the grasslands at the base of the escarpment

    • the linkage between Budongo and Bugoma via the grasslands or riverine forest

- Widening the Kagombe-Muhangi forest strip to Itwara

Although these areas are still large they do not include the large areas of forest and woodland patches of south of Kagombe or to the south east of Kagombe and Bugoma forests. Although potentially valuable these areas are not vital for the forest corridor and hence of less value than maintaining the connections that are vital for the functioning of the corridor.
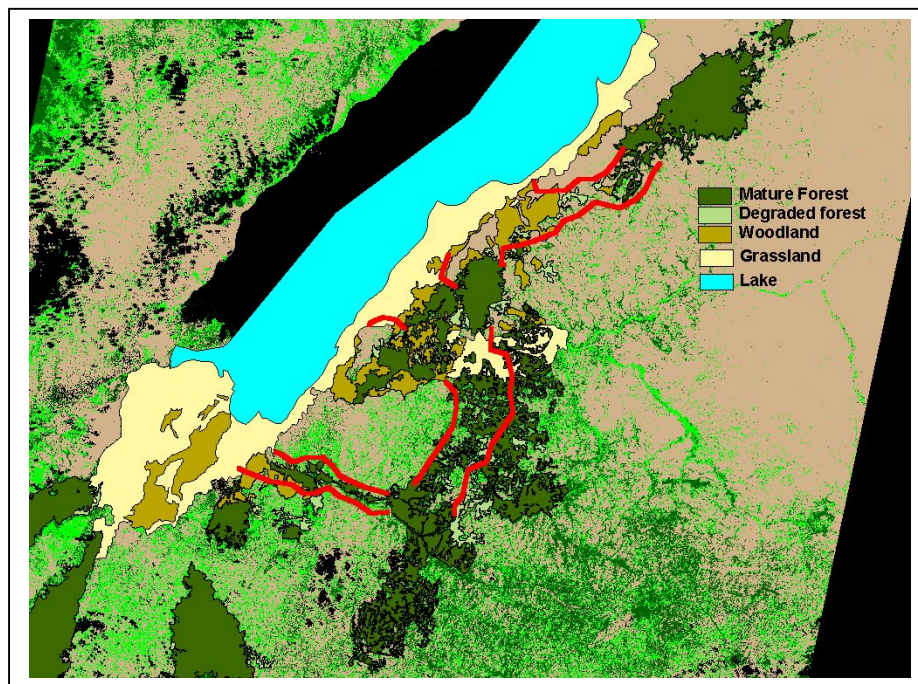
Figure 5.2. The areas that need to be a focus of the corridor development (borders in red).

2. *Develop district land-use plans that support the maintenance of the corridor*: If the corridor idea is to work then a key component will be the support of the idea by the district authorities. A programme of support to district level planning for land use and also trans-district boundary planning will be necessary to ensure that linkages continue to exist or are developed between forest patches within and between districts. Training is needed for district environmental officers to develop and implement such plans and to develop inter-district coordination.

3. *Work with private land owners to conserve forest*: There is a need to develop incentives for private land owners to conserve forest on their land. This needs to take place at several levels. Developing a policy of incentives at the level of Government such as tax

breaks for conserving forest would be one way to support this. Identifying and developing mechanisms for income generation at the district level to support the wise use but not destruction of the forests on private land would be another area to target for interventions.

4. *Undertake research and monitoring*: It is important to identify and understand the needs of key species that use the corridor. Chimpanzees are likely to be one of these species because they are a) at low density in the forest blocks and the populations will require dispersal from other forests if they are to remain viable and b) they are known to be in these small forest patches. Other possible species include large forest birds (hornbills, crowned eagles, tauracos), cats, mongooses and genets and monkey species. Understanding what aspects of the forest they require such as the width of corridor they will move through, the tolerance of human activity, the need for certain food plants, the distance they are willing to cross on the ground and other types of vegetation they will use are essential to the development and management of the corridor. Monitoring the extent and connectivity of the corridor will be needed as well as community attitudes towards conservation of forests in the corridor. Monitoring could be carried out through satellite analysis and surveys with communities.

5. *Target crop raiding in this region to reduce conflict*: Crop-raiding is a major source of conflict with local people and is a threat to forest conservation. Identifying crops and methods that reduce the damage to crops and reduces the conflict with local communities is essential if the corridor approach is to succeed. Developing shared guarding strategies with the communities can help greatly and also incorporates the culture that it is their problem and they can solve it rather than relying on outside help (F. Osborn pers. comm.). Developing alternative crops that are rarely eaten and helping develop markets for these should be a focus of this aspect.

V. 2.3. Actions specific to Budongo, Bugoma, Kagombe and Itwara forest reserves

1. *Strengthening conservation activities by Forest Department*: These forests have little support for conservation activities at present and there is a need to strengthen this. The zoning of the forests should be completed as soon as possible so that nature reserves and buffer areas are clearly marked. Patrol activities need to be developed by rangers so that they monitor these areas relatively regularly so that illegal activities can be picked up quickly. Support to training rangers and managers to patrol efficiently and effectively could be given under the GEF programme.

2. *Improve relations with local communities*: At present relations between forestry staff and local communities is poor. Forest rangers have been attacked and badly injured in several forests over the last few years and there is a need to build better interactions with the local communities. Ideally the Forest Department would create a community officer for each major forest who would work with them to reduce conflict. Local liaison committees could be developed around the forest reserves that help forestry liaise with the community at large. GEF could support aspects of this work.

3. *Develop new, and strengthen existing projects that are managed by local communities*: At present there are two ecotourism projects in Budongo forest that are managed by local communities. These need help in better development of infrastructure and marketing as well as better training in management. Attracting tourists from Budongo/Murchison down through Hoima is potentially possible but requires other activities or sites to visit on the way. Developing tourism activities that are not offered elsewhere in Uganda needs investigating. Horse riding or camel safaris might potentially be possible here as there is quite a bit of wild land left and the grasslands at the base of the escarpment could attract this type of activity. Developing links with the private sector and incentives to support training of local community tourism staff could be supported by GEF. In addition, projects are being piloted by Forest Department to attempt joint forest management by communities. These need assessing and where successful they should be taken to other sites.

V. 3. Conclusion

The forests of the Albertine Rift in Uganda are being subjected to a variety of threats at present. Certain species of large mammal such as elephants, buffalo and pigs have been reduced significantly in number as a result over the past 50 years. What long term impact this will have on the forests can only be guessed at. However, despite the impacts on large mammals the integrity of the large forest reserves has remained pretty constant and it is likely that much of the biodiversity that was there 50 years ago is still in place. Forest clearance is still high around the forests and over the past 15 years it is estimated that about 850 km^2 of forest has been lost. This is an area about the same size as Budongo and Bugoma combined. With less forest outside protected areas there will increased pressures on the main forest blocks for timber, firewood and NTFPs. This Albertine Rift Project supported by GEF will help conserve forest both in the main forest blocks but also in corridors outside. As a result, if it is successful, it will reduce the pressures on the main forest blocks in the long term.

References

Banana, A.Y. and Tweheyo, M. (2001) The ecological changes of Echuya afromontane bamboo forest, Uganda. *African Journal of Ecology* **39,** 366-373

Forest Department (1999). *Forestry Nature Conservation Master Plan*. Ministry of Water, Lands and Environment, Uganda

Howard, P.C. (1991) *Nature Conservation in Uganda's Tropical Forest Reserves*. IUCN, Gland.

Laws, R.M., Parker, I.S.C., & Johnstone, R.C.B. (1975) *Elephants and their Habitats.* Clarendon Press, Oxford.

McNeilage, A., Plumptre, A.J., Brock-Doyle, A. and Vedder, A. (1998) *Bwindi Impenetrable National Park, Uganda Gorilla and Large Mammal Census, 1997*. WCS Working Paper, 14.52pp.

Plumptre, A.J., Reynolds, V. and Bakuneeta, C. (1994) *The contribution of fruit eating primates to seed dispersal and natural regeneration after selective logging*. Report to ODA.

Sheil, D. (1996) *The ecology of long term change in a Ugandan rainforest*. Unpublished D.Phil. thesis, University of Oxford.

Soulé, M. (1987) Viable populations for conservation. Cambridge University Press.

Appendix 1. The gazetted forest areas in the Ugandan portion of the Albertine Rift.

Name	District	Protected area Type *	Area (ha)
Forest Reserves			
Budongo	HOIMA	CFR	664.08
	MASINDI	CFR	80996.43
Bugoma	HOIMA	CFR	39949.22
Buhungiro	KABAROLE	CFR	1048.16
Bujawe	HOIMA	CFR	4965.05
Bundikeki	BUNDIBUGYO	CFR	400.81
Butebe	KABAROLE	LFR	6.79
Butiti	KABAROLE	LFR	2.33
Bwambara	RUKUNGIRI	CFR	37.00
Echuya	KABALE	CFR	2863.07
	KISORO	CFR	723.31
Fort Portal	KABAROLE	CFR	71.59
Fumbya	MASINDI	CFR	422.75
Guramwa	KIBALE	CFR	1526.11
Hoima	HOIMA	LFR	4.90
Ibamba	HOIMA	CFR	311.38
Ibambaro	KABAROLE	CFR	3700.81
Ibanda	MBARARA	LFR	14.37
Ihimbo	RUKUNGIRI	CFR	477.37
Itwara	KABAROLE	CFR	8680.37
Kabale	KABALE	CFR	132.61
Kabango-Muntandi	BUNDIBUGYO	CFR	360.78
Kabwohe	BUSHENYI	LFR	3.09
Kagadi	KIBALE	CFR	12.34
Kagogo	RUKUNGIRI	LFR	2.52
Kagombe	KIBALE	CFR	17750.54
Kagorra	KABAROLE	CFR	4301.84
Kahunge	KABAROLE	LFR	4.89
Kahurukobwire	HOIMA	CFR	1047.33
Kakasi	KABAROLE	CFR	780.84
Kakumiro	KIBALE	LFR	25.84
Kalinzu	BUSHENYI	CFR	13983.91
Kanaga	KIBALE	CFR	660.22
Kandanda-Ngobya	HOIMA	CFR	2563.25
Kaniabizo	RUKUNGIRI	CFR	38.90
Kanyampara	KASESE	LFR	62.36
Kapchorwa	KAPCHORWA	CFR	6.02
Kasato	KIBALE	CFR	2600.18
Kasokwa	MASINDI	CFR	69.36
Kasongoire	MASINDI	CFR	1231.59
Kasyoha-Kitomi	BUSHENYI	CFR	34327.80
	MBARARA	CFR	4138.72
Katenta	KABAROLE	LFR	5.10
Kebisoni	RUKUNGIRI	LFR	6.48
Kibale	KIBALE	LFR	1.45
Kibego	KABAROLE	CFR	1274.66
Kibeka	MASINDI	CFR	9627.95

Name	District	Protected area	Area
Kigulya Hill	MASINDI	CFR	411.63
Kihaimira	KIBALE	CFR	550.56
Kihihi	RUKUNGIRI	LFR	35.86
Kijubya	HOIMA	LFR	27.08
Kijuna	KIBALE	CFR	1158.64
Kikumiro	KABAROLE	CFR	721.15
Kisangi	KABAROLE	CFR	141.55
		JM	1181.15
	KASESE	CFR	339.40
		JM	3695.51
Kitechura	KABAROLE	CFR	5330.87
Kitonya Hill	MASINDI	CFR	299.16
Kooga	BUSHENYI	LFR	10.93
Kyahaiguru	HOIMA	CFR	427.23
Kyamugongo	HOIMA	CFR	118.70
Kyamuhunga	BUSHENYI	LFR	7.83
Kyamurangi	KIBALE	CFR	422.66
Kyantuhe	RUKUNGIRI	CFR	203.74
Kyehara	KABAROLE	CFR	481.24
Mafuga	KABALE	CFR	1830.14
	RUKUNGIRI	CFR	1867.26
Maseege	MASINDI	CFR	937.85
Mataa	BUNDIBUGYO	CFR	106.81
Matiri	KABAROLE	CFR	5472.21
Mburamaizi	RUKUNGIRI	CFR	504.85
Mpanga	HOIMA	CFR	548.25
Mpara	KABAROLE	LFR	1.21
Mubuku	KASESE	CFR	1689.38
Muhangi	KABAROLE	CFR	1880.90
Muhunga	KIBALE	CFR	412.17
Mukihani	HOIMA	CFR	3671.73
Muko	KABALE	CFR	167.18
Musoma	MASINDI	CFR	270.82
Nakuyazo	KIBALE	CFR	348.20
Nkera	KABAROLE	CFR	750.38
North Maramagambo	BUSHENYI	JM	29294.34
North Rwenzori	BUNDIBUGYO	CFR	3531.58
Nsekuro Hill	MASINDI	CFR	130.76
Nyabigoye	KIBALE	CFR	477.90
Nyabiku	KIBALE	CFR	373.80
Nyabirongo	KASESE	LFR	16.12
Nyaburongo	BUNDIBUGYO	CFR	172.12
Nyabyeya	MASINDI	CFR	355.12
Nyakarongo	KIBALE	CFR	3490.28
Nyakigumba	KABAROLE	LFR	10.83
Nyakikindo	BUNDIBUGYO	LFR	38.64
Nyakinoni	KABAROLE	LFR	5.25
Nyakunyu	MASINDI	CFR	460.89
Nyamakere	MASINDI	CFR	3934.11
Nyantungo	KABAROLE	LFR	5.78

Name	District	Protected area	Area
Oruha	KABAROLE	CFR	344.45
Rukara	KIBALE	CFR	449.89
Rukungiri	RUKUNGIRI	CFR	24.18
Rushaya	RUKUNGIRI	CFR	28.77
Ruzaire	KIBALE	CFR	1194.94
Rwengeye	KIBALE	CFR	323.54
Rwengiri	RUKUNGIRI	CFR	155.00
Rwensama	MASINDI	CFR	121.68
Rwensambya	KABAROLE	CFR	671.99
South Maramagambo	RUKUNGIRI	JM	15307.69
Wambabya	HOIMA	CFR	3421.95
National parks			
Bwindi Impenetrable	KABALE	NP	32020.74
Kibale	KABAROLE	NP	74396.82
Mgahinga	KISORO	NP	3852.54
Mt. Rwenzori	KASESE	NP	99510.00
Murchison Falls	MASINDI	NP	386747.99
Queen Elizabeth	KASESE	NP	180455.71
Semuliki	BUNDIBUGYO	NP	22050.12
Wildlife Reserves			
Bugungu	MASINDI	WR	36275.40
Chambura	BUSHENYI	WR	15522.39
Karuma	MASINDI	WR	82573.29
Kigezi	RUKUNGIRI	WR	18370.91
Semliki Flats	BUNDIBUGYO	WR	38835.26

 *CFR = Central Forest Reserve; JM=Jointly managed by UWA and Forestry; LFR=Local Forest Reserve; NP = National park; WR=Wildlife Reserve

Appendix 2. Description of the larger Forest Reserves

The following section provides brief descriptions of the larger forest reserves in the Albertine Rift in Uganda and why they are important for conservation.

1. Budongo Forest Reserve

Forest Department status: Central Forest Reserve and Prime Conservation Forest
Size and location: Area of 825 km^2 which includes about 430 km^2 of forest and 395 km^2 of grassland/woodland. Located on the escarpment above lake Albert in the district of Masindi. (1°37'-2°03' N and 31°22'-31°46' E).
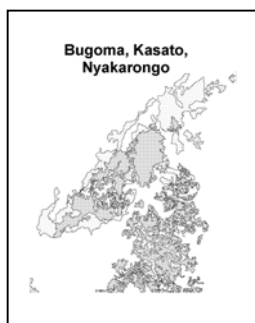*Establishment:* Established in parts since 1932 to 1968

Forest types: Medium altitude moist semideciduous tropical high forest dominated by *Cynometra-Celtis* with *Combretum* savanna in the grasslands.
Economic Importance: The forest is the richest in Uganda for timber production and provides much of the mahogany timber for Kampala. It has potential for ecotourism also with chimpanzee viewing at one site and bird tourism at a couple of others. Bird tours come from Kenya to visit Budongo especially and tourism could be developed here more than it is at present.
Biodiversity values: This forest is contains 42 species unrecorded from any other forest in Uganda, including 32 trees, 4 birds, 4 moths and 2 butterflies according to the Forest Department surveys. It is also an important forest for the conservation of two endangered species: Chimpanzee and Nahan's Francolin. Three trees and two butterflies endemic to the Albertine Rift occur in this forest. It represents the largest block of medium-altitude semi-deciduous forest in Uganda.

2. Bugoma Forest Reserve

Forest Department status: Central Forest Reserve and Core Conservation Forest
Size and location: Area of 401 km^2 of which 65 km^2 is grassland. Located in Hoima district above the escarpment overlooking Lake Albert. (1°07'-1°25' N; 30°48'-31°,07' E)
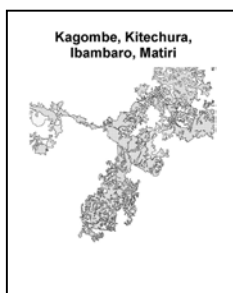*Establishment:* 1932

Forest types: The majority of the forest is Medium altitude moist semideciduous tropical high forest dominated by *Cynometra-Celtis* forest, similar to Budongo forest.
Economic Importance: The forest is an important source of timber and it has some potential for ecotourism as it is on the road between Murchison Falls and Kibale National parks.
Biodiversity values: This forest supports 9 species found in no other forest in Uganda (7 butterflies and 2 large moths). One mammal is endemic to Uganda and one butterly endemic to the Albertine Rift.

3. Kagombe Forest Reserve

Forest Department status: Central Forest Reserve and no conservation status
Size and location: Area of 113 km^2 located in Buyaga county in Kibaale district (0°34'-0°54' N; 30°32'-30°58' E).
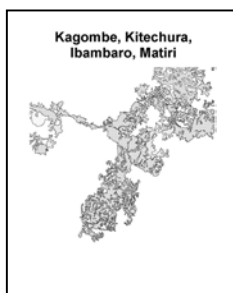*Establishment:* 1953

Forest types: Medium altitude moist semi-deciduous forest dominated by *Albizia-Markhamia* forest.
Economic Importance: Little economic importance nationally but is of value for fueld wood and some timber locally
Biodiversity values: Three Albertine Rift Endemics recorded (1 tree, 1 small mammal and 1 butterfly).

4. Kitechura Forest Reserve

Forest Department status: Central Forest Reserve and Scondary Conservation Forest
Size and location: Area of 53 km^2 in Kyenjojo district south of Kagombe forest reserve.
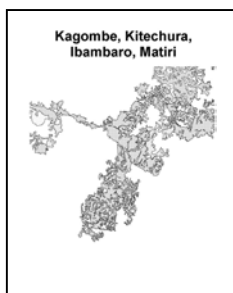*Establishment:* 1953

Forest types: Forest/savanna mosaic with *Albizia-Markhamia* and *Combretum-Cymbopogon* habitat.
Economic Importance: No timber production but used by local community for fuelwood, building poles etc.
Biodiversity values: Two butterflies were only recorded in this forest but there were no Albertine Rift endemics recorded.

5. Matiri Forest Reserve

Forest Department status: Central Forest Reserve and no conservation status
Size and location: Area of 54 c in Kyenjojo district south of Ibambaro Forest Reserve which is south of Kitechura Forest.
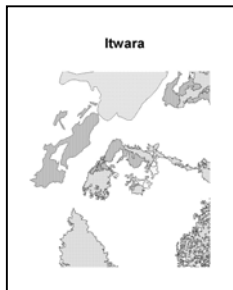*Establishment:* 1953

Forest types: Forest/savanna mosaic with *Albizia-Markhamia* and *Combretum-Cymbopogon* habitat.
Economic Importance: No timber production but used by local community for fuelwood, building poles etc.

Biodiversity values: No unique species and one Albertine Rift endemic butterfly recorded. The forest has been bisected by the Fort Portal-Kampala road and has been encroached also to the south of the road. This area likely will disappear in the future.

6. Itwara Forest Reserve

Forest Department status: Central Forest Reserve and Secondary Conservation Forest
Size and location: Area of 87 km^2 in Kabarole district north of Kibale National park.
Establishment: 1932

Forest types: Primarily *Parinari* forest.
Economic Importance: Has been a source of timber in the past but limited value now. Largely surrounded by tea estates it is protected by much community use.
Biodiversity values: One tree and one butterfly are unique to the forest and one Albertine endemic tree has been recorded here.

7. Kasyoha-Kitomi Forest Reserve

Forest Department status: Central Forest Reserve and Core conservation forest.
Size and location: Area of 399 km^2 in Bushenyi, Mbarara and Kabarole districts.
Establishment: 1932 with some realignments in 1963

Forest types: Primarily *Parinari* medium altitude moist evergreen forest with medium altitude moist semi-deciduous *Albizia-Markhamia* forest. Hill tops contain *Pennisetum* grasslands.
Economic Importance: An important source of timber and an important watershed for Lake George (one of the most productive fisheries in the world). High human population density around the forest leads to a lot of harvesting of products for local use.
Biodiversity values: 14 species were found here and nowhere else in the Forest Department surveys (11 butterflies and three trees). Five Albertine Rift Endemics occur here (2 trees, 1 bird, 1 small mammal and 1 moth).

8. Kalinzu-Maramagambo Forest Reserve

Forest Department status: Central Forest Reserves and Core Conservation forests
Size and location: Area of 584 km^2 in the districts of Bushenyi and Rukungiri.
Establishment: 1932

Forest types: Primarily *Parinari* and *Cynometra-Celtis* medium altitude moist forest.
Economic Importance: Kalinzu is an important source of timber but Maramagambo is in Queen Elizabeth national park and cannot be harvested legally. Kalinzu also provides building poles and fuel wood to local communities.
Biodiversity values: The Forest Department surveys recorded 12 species found nowhere else in Uganda (9 butterflies, 1 small mammal and 2 trees) and 10 species endemic to the Albertine Rift (4 trees, 3 birds and 4 butterflies).

9. Echuya Forest Reserve

Forest Department status: Central Forest Reserve and Core Conservation Forest.
Size and location: Area of 35 km^2 on the border between Kabale and Kisoro districts.
Establishment: 1939

Forest types: A mixture of *Hagenia-Rapanea* montane forest and bamboo (*Arundinaria alpina*).
Economic Importance: Not important for timber but used much by the local community for bamboo poles. Also an important watershed with Muchuya swamp acting as a resevoir draining to the north.
Biodiversity values: The Forest Department surveys found 10 species that occur nowhere else in Uganda (5 trees, 4 butterflies and 1 bird) and 18 Albertine Rift endemic species (1 tree, 12 birds and 5 butterflies)