Albertine Rift Technical Reports NO. 5

BIODIVERSITY SURVEYS IN THE MISOTSHI-KABOGO AND MARUNGU REGIONS OF EASTERN DEMOCRATIC REPUBLIC OF CONGO.

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WILDLIFE CONSERVATION SOCIETY
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ICCN INSTITUT CONGOLAIS POUR LA CONSERVATION DE LA NATURE
WWF

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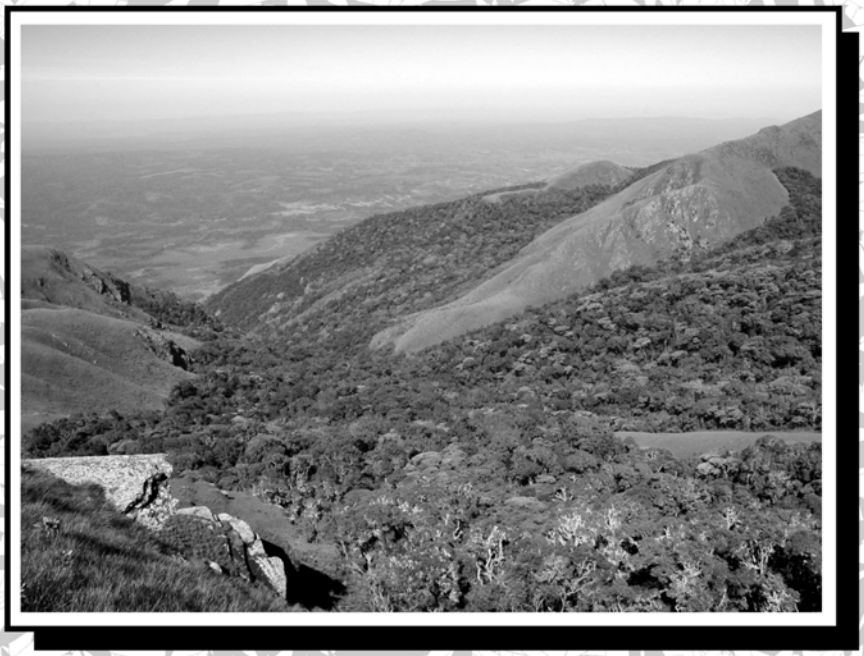

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WCS's Albertine Rift Programme

The WCS Albertine Rift Programme is working to conserve some of Africa's most biodiverse sites for the future generations of Africans and the global community. The Albertine rift stretches from the northern end of lake Albert down to the southern end of lake Tanganyika and encompasses the forests, savannahs, wetlands and mountains to be found in the rift and on the adjacent escarpment in Uganda, Rwanda, Burundi, Tanzania and Democratic Republic of Congo (DRC). This area of Africa contains 52% of all bird species and 39% of all mammal species on the African continent. Many species are endemic to this part of the world and it has been identified as being of global conservation importance by several global priority-setting exercises (it is an endemic bird area, ecoregion and a biodiversity hotspot). The Albertine Rift Programme focuses on three main goals:

1. The provision of science-based information to enable protected area managers to better manage conservation sites within the region. Current research includes biological surveys of Albertine Rift sites, monitoring of mammal and bird populations in Bwindi Impenetrable National Park, Virunga Volcanoes, Nyungwe National Park and Kahuzi Biega National Park, and more detailed studies of threatened species such as Grauer's rush warbler, golden monkey and chimpanzee. We have completed the first nationwide censuses of chimpanzees in Uganda, Rwanda, Tanzania and Burundi, building on a history of monitoring ape populations through support to the mountain gorilla surveys since 1960. WCS recognises the importance of good science-based information to make sound management decisions.
2. Building capacity of African nationals to be able to use a scientific method in their approach to protected area management, particularly focusing on staff of protected area authorities in the region (UWA, ORTPN, TANAPA and ICCN). WCS is supporting a programme of training wardens of the Uganda Wildlife Authority and in Tanzania's National Parks (TANAPA) to develop sensible monitoring and research programmes in all of Uganda's protected areas. WCS has also been supporting the development of ORTPN and ICCN staff where it works in Rwanda and DRC respectively.
3. Supporting management authorities to manage certain sites within the Albertine Rift through financial support for the basic operating costs, planning, training, transboundary collaboration, monitoring and research programmes. WCS is committed to site conservation over long periods of time because we recognise the need for long term support. We are currently supporting some of the management costs of Nyungwe National Park, Kibira National Park, Virunga National Park, Bwindi Impenetrable National Park, Murchison Falls National Park, Queen Elizabeth National Park, Rwenzori Mountains National Park, and Kahuzi Biega National Park.

To learn more about the programme visit: www.albertinerift.org

Cover Photos

Photo of the high altitude region of Misotshi-Kabogo looking down to the gallery forest to the west. A.J. Plumptre.

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This survey was generously funded by the Daniel K. Thorne Foundation, The Field Museum, Chicago, John D. and Catherine T. MacArthur Foundation, US Fish and Wildlife Service Great Apes Conservation Fund, Wildlife Conservation Society and the WWF, the global conservation organisation. The Centre de Recherche en Sciences Naturelles de Lwiro also provided several of its staff to help with the surveys. Many people took part in the surveys and it is impossible to thank them all here. Dr A.J.Plumptre, Andre Baruti and Nabert Mutungire and Paluku Nyembo led the large mammal survey teams; Hamlet Mugabe, Albert Masanga, Deo Kujirakwinja, Charles Kahindo and Ben Marks collected data on birds; Mike Huhndorf, Prince Kaleme and Benjamin Ndara Ruziga studied small mammals; Julian C. Kerbis Peterhans confirmed the identifications of the small mammal collections made in Misotshi-Kabogo. Elia Mulungu and Joseph Matunguru collected frogs and reptiles; and Ben Kirunda, Julius Kyamanywa, Pathos Kipantwa and Gratien Bashonga led the botanical teams.

We are grateful to several people in Kalemie who helped us organize the survey, particularly General Lukole and Guy Marie Mwanakasala, Liaison Officer of UNOCHA/Kalemie. General Lukole provided two soldiers to help escort the teams, Katembo Omari and Kolobo Tambwe. We are very grateful for their guidance and help with introducing the survey teams to the village chiefs along the lake.

The field teams were supported by many porters at each site from the various villages where we disembarked. We were also supported by four cooks: Maxime Kisimba, Jean Nzika, Ndayi Jerôme and Kumwimba Joseph. Joelle Badesire helped the teams enormously with logistical support from Goma and in organizing permits and visas.

We are grateful to Nadine Laporte and Jared Stabach for putting together maps for the field teams from satellite imagery and for generating values of forest cover and extent. We are also grateful to Danny Meirte from the Africa Museum at Tervuren for generating a list of amphibians and reptiles from their database for the two survey areas.

We are very grateful to the ECHO flight that allowed us to transport all NGO personnel to Kalemie from Goma for free. We are grateful to the Centre de Recherche en Sciences Naturelles de Lwiro for helping us obtain export permits where necessary to allow specimens to be identified by experts at external museums.

EXECUTIVE SUMMARY:

The Misotshi-Kabogo region and the Marungu Massif of eastern Democratic Republic of Congo (DRC), formerly called Mt Kabobo, has not been visited by any survey team since the late 1950s. As a result of rebel activity the Misotshi-Kabogo region has been impossible to visit for over 50 years and it is only recently that a survey such as the one described here has become feasible. The Wildlife Conservation Society led a team of researchers from the WCS Uganda and DRC, The Field Museum in Chicago, ICCN and WWF to survey this large forest block that was known to occur on the escarpment above Lake Tanganyika north of the town of Kalemie. This forest was visible from satellite imagery and is 800 km^2 in size. The focus of the surveys was on chimpanzees but the opportunity was also made to collect data on other species and human impacts because of the long time period since this forest had last been visited by any scientist.

Initial aerial surveys were made of the two regions and it was soon obvious that the Marungu Massif had been almost totally converted to pastureland and agriculture. There was nowhere that was worth surveying left that we could find. However, to the north of Marungu was a large area of Miombo woodland and riverine forest around the Muganja Hills. The aerial survey showed the Misotshi-Kabogo region to be very promising. As a result field teams surveyed this area and the Muganja Hills area.

The findings of the surveys are summarized here and provide estimates of chimpanzee numbers and distribution, large and small mammals that can be found in the forest, birds, frogs and reptiles and plant species. These findings show that the Misotshi-Kabogo Forest and the region of gallery forest and woodland around it is extremely rich in species, and contains many endemic species. Four mammal species were discovered that were new to science and an additional two frog species are new. Plant species number over 1,100 which is high for the Albertine Rift region, making Misotschi-Kabogo the fifth richest site in the Albertine Rift.

Human impacts have been relatively minor, artisanal gold mining being the most threatening to the biodiversity of the forest. Most of the gold mining is carried out by migrants from Bukavu and Uvira as the local people do not feel that they can obtain enough from the mining to make it worth their while. Consequently the returns on the mining are minimal. It would be relatively easy to stop the mining if any protected area were created in the region. Many of the village chiefs and elders in the villages we visited thought that creating a protected area would be a positive step for their region, bringing a focus to their region and possible development impacts also as a result. There is certainly a potential for tourism in the Misotshi-Kabogo region although access to the forest is hard.

We believe that conservation of the Misotshi-Kabogo region is important and that some form of conservation area should be gazetted. This should be made in collaboration with the local communities who live in the area to minimize any conflict and to look at ways they could benefit from the creation of such an area.

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CHAPTER 1. The Misotshi-Kabogo and Marungu regions

A.J.Plumptre and D.Kujirakwinja

Introduction

The Albertine Rift region of Africa has been identified as an Ecoregion, Endemic Bird Area and is part of the Eastern Afromontane Biodiversity Hotspot (Plumptre et al., 2007). Six major landscapes in the Albertine Rift have been identified as part of a strategic planning process for the conservation of the biodiversity of this highly species rich region of Africa (Plumptre et al., 2007). The Marungu Massif and the region around an area that has historically been called Mt Kabobo in the Democratic Republic of Congo (DRC), south and north of the town of Kalemie respectively, formed part of the 6th landscape (figure 1). However, this region is the least known of all the landscapes having been difficult to access for many years because of civil strife in the DRC. Mt Kabobo appears to have been poorly named (see section on history and nomenclature below) but we use the name here when referring to this region as it would have been referred to in the literature but use the proposed name Misotshi-Kabogo in the rest of the report.

The Marungu Massif occurs in the south east corner of the DRC on the shore of Lake Tanganyika. Although poorly surveyed to date, it has one of the earliest records of chimpanzees (Thompson, 1997; 2003). A recent taxonomic revision of chimpanzees by Colin Groves split the eastern chimpanzee (*Pan troglodytes schweinfurthii*) into two. This subspecies is now recognised as occurring in northern DRC across to the Ituri region. Chimpanzees found further south in DRC and east in Uganda, Rwanda, Burundi and Tanzania have been named *P.t.marungensis* after the first skeletal material from this region. This poorly known population of chimpanzees is the only one known of south of the Congo River and its tributaries in DRC, as the river separates chimpanzees from Bonobos (*Pan pansicus*). This population either came around the southern end of lake Tanganyika from Tanzania during a wetter period when forest cover would have been greater or they must have crossed the Lukuga river, that leaves Lake Tanganyika at Kalemie and joins the Congo River west of the town, at some point when it dried in the past. Since the collection of skeletal material in the early 1900s there has been little work on these chimpanzees or in this region.

Mount Kabobo to the north of the Marungu highlands was another region which had been poorly surveyed and it wasn't known if it contained chimpanzees. This was a potentially interesting massif which has been separated from the Itombwe Massif to the north by the Kilombwe River, which formed a valley about 10 km wide, which is thought to have existed for about 10,000 years. This region has been identified as an important bird area (Fishpool and Evans, 2001) because of the endemic Kabobo Apalis which is only found in this region.

Both of these highlands were potentially important for the conservation of other species also and were known to contain species endemic to the Albertine Rift Ecoregion. However the last surveys of any biodiversity had been made in the 1950s and little was known about the current state of these two areas.

The Wildlife Conservation Society (WCS) has been undertaking surveys of all the forested sites in the Albertine Rift and wanted to visit this region because of its potential importance for conservation and because little was known about the sites. WCS put together a team with the Field Museum of Chicago, Lwiro Research Centre, Bukavu and the World Wide Fund for Nature East Africa Regional Program Office to undertake surveys of this landscape in 2006/2007.

Goals and Objectives

The overall goal of the project was to assess the conservation value of the Marungu Highlands and Mt Kabobo, with particular emphasis on the chimpanzee, *P.t.marunguensis*. Three specific objectives were identified:

1. To undertake an aerial survey of the Marungu Highlands and Mt. Kabobo to identify access routes, potential sites with chimpanzees and key villages and towns.
2. Survey chimpanzee populations in the Marungu highlands to estimate a density and potential population size. Assess whether chimpanzees occur in Mt Kabobo and if so survey this population also.
3. Survey other biodiversity to assess the importance of the two regions for conservation.

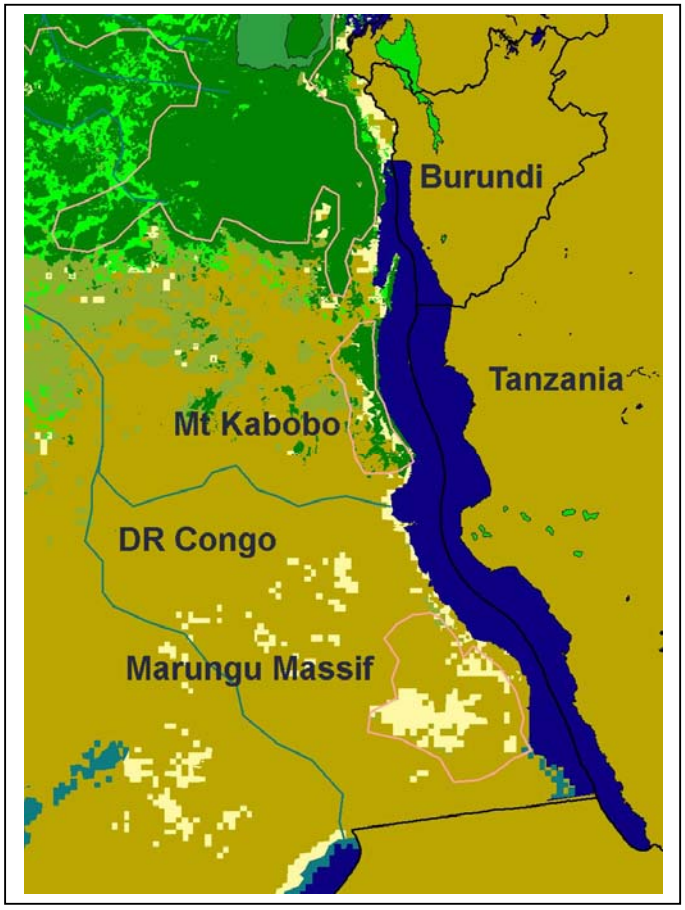


Figure 1.1. Map of the region west of Lake Tanganyika showing the location of the Marungu Massif and Mt Kabobo.

Aerial Reconnaissance

In June 2006 an aerial reconnaissance was made of the region and a visit made to Kalemie, the regional administrative centre, to make contacts with relevant officials and discuss the necessary logistics that would be needed to undertake the surveys.

The flight commenced from Goma with three observers, Dr Andrew Plumptre (WCS Albertine Rift Program), Deo Kujirakwinja (WCS Goma) and David Moyer (WCS Flight Program) and headed over the mountain sector of Kahuzi Biega National Park, skirted the Itombwe massif and went down over Mt Kabobo to Kalemie. The next day

the Marungu Massif was surveyed and also the region south of Kalemie and north of Marungu. On the third day the lake shore and the edge of the Mt Kabobo region was surveyed on route back to Goma (figure 2).

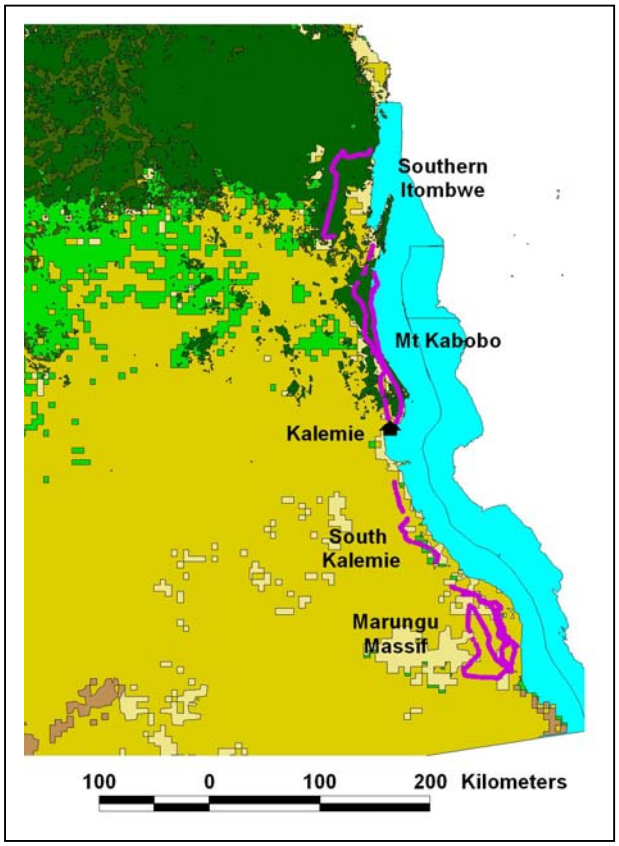


Figure 1.2. Map showing the flight paths (purple lines) taken over Mt Kabobo and Marungu Massif.

Marungu Massif

While made over a short time period this survey was incredibly useful. In particular we were able to determine that the Marungu Massif had lost most of the natural habitat as a result of human activity (Photo 1). It became very clear after flying around much of the massif that most natural habitat had been converted to farmland, either for cattle (grassland areas) or for crops (forested areas). While we had known that this region was an area where Belgians had settled to farm cattle in the past we had hoped to find pockets of forest where chimpanzees might still be present. However there was nothing we could find that looked like it might be worth surveying.

Photo 1. A typical view of the landscape on the Marungu Massif. Where forest used to occur in galleries it is being cultivated and elsewhere most of the grassland has been converted to pasture land.

As a result of the survey over Marungu Massif we also searched a bit more intently in the area south of Kalemie and south of the Lukuga river which becomes the Congo River downstream. This region did show some areas of relatively intact natural habitat which we decided to survey. Interviews with people in Kalemie also indicated that chimpanzees might still be found in this region. So we believed that there were still chimpanzees south of the river but that it was highly unlikely that any remained on the Marungu Massif itself. As a result we decided to survey an area called the Muganja hills to the north of the Marungu Massif.

Mt Kabobo

It was very clear from the aerial survey that Mount Kabobo was much more interesting and could potentially be an important site for conservation. The forest is relatively large and intact (Photo 2a) and stretches over about 100 km along the escarpment above lake Tanganyika (figure 1). It is much larger than the forest in Mahale Mountains National Park in Tanzania and as a result it is the largest block of forest on Lake Tanganyika. The only sign of human settlement was a few fishing villages on the lake shore although there was evidence of mining in the forest on the escarpment above the villages. West of the forest there was little sign of human presence (Photo 2b). Of particular interest was the fact that forest exists down to the lake shore at several sites along the lake and therefore ranges in altitude between about 770 and 2,750 metres. There are few places in the Albertine Rift where you can still find continuous forest that spans this elevation range.

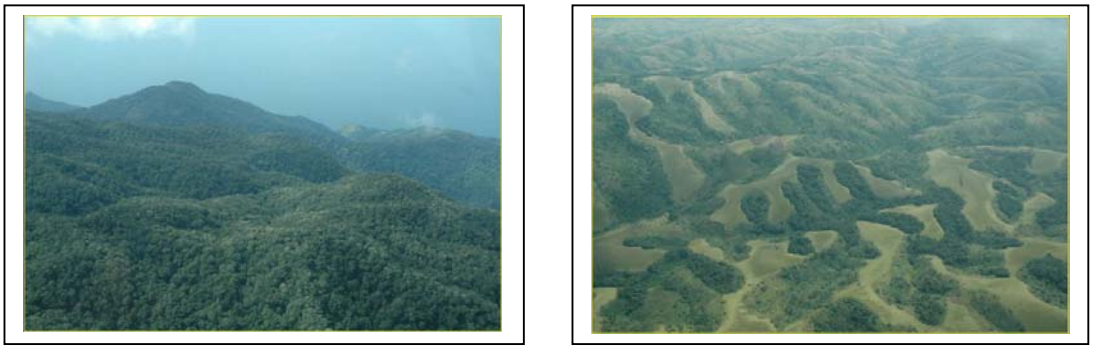


Photo 2. Aerial photos of Kabobo forest. a) Left shows the view east across the forest looking towards the escarpment above lake Tanganyika. b) Right shows the view west towards the Congo river showing the gallery forest and savanna.

Some notes on the history of the Kabobo/Misotshi-Kabogo forest and nomenclature

The forest on the escarpment above lake Tanganyika stretches over 100 km from about 30 km north of Kalemie up to the peninsula that projects into Lake Tanganyika (figure 1). It varies in width but most of the forest is between 10-20 km wide. The first peoples to inhabit this region were the Baoloolo, a people closely related to the pygmies of the congo forest basin. The Babembe people moved into this region and displaced them several hundred years prior to colonisation. The Babembe claim to have governed all the region of South Kivu down to Kalemie but just prior to Belgian colonisation of DRC they were pushed back by several tribes (particularly the Baluba) to the current border between Katanga and South Kivu (just north of Mt Kabobo) which is why the boundary was fixed at this point. However most of the names of the region are Babembe names. When DRC gained independence from

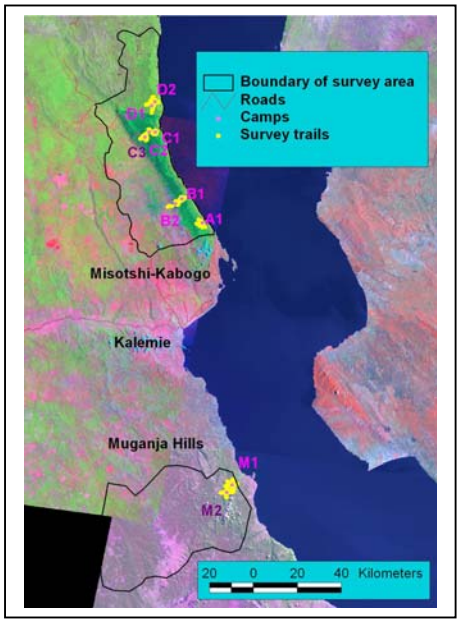
Belgium in 1960 Patrice Lumumba, the first President, was assassinated soon after gaining power, with involvement of the Belgian Government and CIA. President Mobutu Sese Seko replaced him and proceeded to govern the country up to 1996. Almost immediately rebel groups loyal to Lumumba established themselves in the east of the DRC to try to regain control. Laurent Desire Kabila established one such group in South Kivu and he resisted Mobutu for 20 years, hiding out much of the time in the forest on the escarpment above lake Tanganyika, where he mined gold to fund his rebel activities. He came to prominence in 1975 when he kidnapped two American Researchers from the Gombe Field Station in Tanzania, Jane Goodall's field site, and ransomed them. In 1980 Mobutu drove Kabila with a large military attack on the forest (bullet cases can still be found strewn across the hillsides). Although he succeeded in driving Kabila to Tanzania, there were always pockets of resistance in the forest which made it insecure. However Kabila continued to work towards his goal of liberating DRC from Mobutu. Kabila came to power and became President in 1996 with support from Rwandan and Ugandan forces who overthrew Mobutu, forcing him into exile where he died of prostate cancer. Laurent Kabila was assassinated in 2001 and replaced by his son Joseph Kabila.

Some biological surveys were made of the Kabobo region in the 1950s. Prigogine sent a field team to collect bird specimens in 1954, 55 and 57 (Prigogine, 1960). Laurent also collected amphibians in the forest (Laurent, 1952). Specimens were sent to the Africa Museum at Tervuren in Belgium. The bird surveys concentrated their efforts primarily around a hill top that was called Kabobo by the Belgians. They discovered that there was an endemic species of Apalis, which was called the Kabobo Apalis (*Apalis kaboboensis*). The surveys we made however throw into question the nomenclature of this region. According to the Babembe the Belgians misheard the name Kabobo. There is a river and region near the source of this river called Kabogo after a spirit (Kabogo means 'power' in the Babembe language) that is believed to inhabit the river. It is said to manifest itself as a ghostly boat that appears occasionally on lake Tanganyika at night, guaranteeing good fishing if fishermen sight it. The hill which was named Kabobo by the Belgians is near the source of this river but is by no means the highest peak (2,650 metres). There is a higher peak (2,725m) which is locally called "Antenne" because it used to be the site of a large radio mast which was constructed by the Belgians but which has long disappeared. However, according to Babembe culture the most important peak in the chain along the lake is Misotshi, named after the most powerful spirit believed to inhabit the mountains. Nobody climbs this mountain without permission and ceremonies are held by the Babembe where they 'enter a door' in the hill side (probably a cave) to undertake the ceremony. Our surveys required both permission from the local chiefs and an escort of two of the chief's men to climb part of this mountain but we were unable to reach the peak. The belief in this spirit also extends to the Tanzania coast of Lake Tanganyika where any spirit worship of the spirit that inhabits Mt Kungwe in Mahale Mountains National Park requires authorisation from the regional chief and Shaman who consult Misotshi before giving permission for a ceremony to proceed. It is clear that under Babembe culture Misotshi is therefore the most important peak in the chain of peaks. We asked the local chiefs which would be the most appropriate name to give to the forest that is found along the escarpment and it became obvious that they have no name for the whole area; individual hills and rivers have names but not the whole forest. They suggested 'Misotshi-Kabogo' forest as a name but this should be discussed amongst all the regional chiefs. We therefore use this name throughout the rest of the report instead of Mt Kabobo. Interestingly there are several Taboos associated with the spirit Misotshi which include a taboo against the killing of chimpanzees in the forest and also a taboo against destroying the forest.

Fieldwork

Two field teams were formed to survey large mammals, birds, plants and human impacts at each site we visited in the forest. In addition we had one team looking at small mammals, another at reptiles and amphibians and a third collecting butterflies for identification. Researchers from the Field Museum in Chicago also collected bird and small mammal specimens for identification and comparison with other areas in the Albertine Rift. Deo Kujirakwinja went to Kalemie ten days in advance of the rest of the field team to sort out the logistics of transporting the teams in early January 2007. As the road infrastructure had deteriorated over the period of the war in DRC we had decided to access the forest from the lake side, using fishing boats to transport the field teams. This also allowed us to access areas that had never been surveyed by scientists before. The teams met in Goma where some explanation of the logistics were made and then were flown to Kalemie. Here we spent 3-4 days sorting out logistics and covering all the field survey methods in detail. Teams were then transported up the lake and the two teams dropped at different fishing villages where they could hire porters to access the forest. After about two weeks the teams returned to the village and were collected and transported further up the lake to two further villages where we spent nearly three weeks. The team with the small mammal and bird trapping equipment was less mobile because of the amount of equipment and they established three camp sites, one from their first village and two from their second village. The other team however was able to visit two sites from their first village and a further three from the second. This enabled the team to cross the escarpment and descend some of the western side of the massif. The surveys of Misotshi-Kabogo took place between 28th January and 26th February 2007.

After finishing at the second villages many members of the teams continued north up the lake to Uvira and then by taxi to Bukavu and boat to Goma across lake Kivu. A smaller team returned to Kalemie to survey the region between Kalemie and the Marungu Massif where we had identified some natural vegetation which might contain chimpanzees. This region, the Muganja hills, was surveyed for large mammals and birds as well as human impacts. These surveys took place between 4th and 18th March 2007. Details about the methods used in each of the surveys are given in the respective chapters that follow.



The areas surveyed are mapped in figure 1.3. A larger area was measured for forest cover at the two sites (Misotshi-Kabogo and Muganja Hills) and densities of chimpanzee nests extrapolated to these two areas.

Figure 1.3. Satellite image of Lake Tanganyike showing areas surveyed (yellow) and boundary of areas for which forest cover was calculated (black lines). Camp labels (A1, B1, B2 etc) are shown in pink.

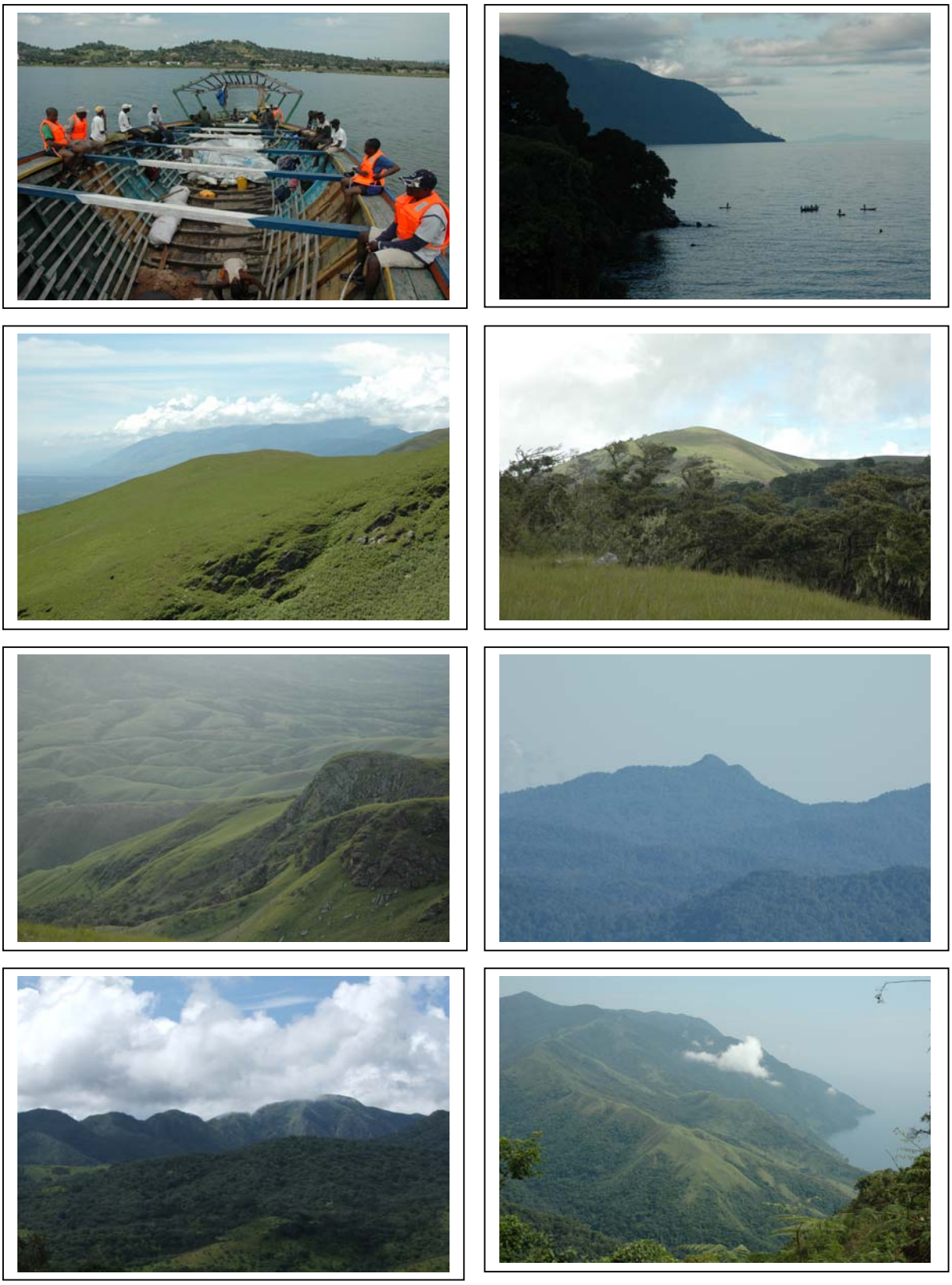


Photo 3. Clockwise from top left. a) boat used to transport field teams and equipment, b) escarpment down to lake Tanganyika, c) Mt Kabogo, d) Mt Misotshi from the west, e) forest view below Kabogo, f) woodland in Muganja region south of Kalemie g) view down escarpment on western side of Kabogo, h) view towards Kabogo showing western side of escarpment.

CHAPTER 2: Chimpanzee and Other Large Mammal Surveys

A.J.Plumptre, D.Kujirakwinja, A. Baruti, and N.Mutungire

Introduction

The Misotshi-Kabogo region is known to contain some interesting species of large mammals from previous survey work there. Prigogine (1960) records 17 species including the endemic subspecies of Angolan Colobus (*Colobus angolensis progoginei*) that is only known from the Misotshi-Kabogo region. Distinguished from other subspecies by its completely white tail it was a species we were particularly interested in finding more about. He also recorded Bongo (*Tragelaphus euryceros*) and we were interested to ascertain if this species still existed in the forest.

Methods

We used a combination of methods to ascertain which large mammal species occur in the Misotshi-Kabogo forest. We worked with hunters in the forest as well as two soldiers who had fought with Kabila in the 1970s and later. These people were interviewed about which large mammal species they had seen in the forest and where they saw them. We used Kingdon's guide to Large Mammals of Africa to show these people pictures of the animals and then cross checked their identifications by asking them about the behaviour of the animal. We also asked people in villages to show us any skins of animals to cross check the list obtained by talking to hunters. This process provided us a list of mammals known from the area. However, we also attempted to collect quantitative data on large mammals where we surveyed as follows:

Training

The field surveys commenced in January 2007. Training of the two mammal survey teams was made in Kalemie. Field data collection methods included training in the use of:

1. Hip chain and topofil thread to measure distance traveled
2. Range finders to measure perpendicular distances when these were greater than 30 metres (30 metre tape measures were provided to each team).
3. Use of GPS units. Garmin II Plus and 12 XL units were used to collect positional data.
4. Completion of data sheets

Sampling methods

Teams were also trained in how to sample the forest when they were in the field situation. It was decided to focus transect effort on the forest areas because of the need for chimpanzees to be associated with this vegetation type. Data on gallery forest sampling was separated from the data from the main Misotshi-Kabogo forest block.

In gallery forest we used a sampling method that we had used in western Tanzania in 2005. Transects were walked in fixed compass directions from the camp site. Where only gallery forest existed zig-zag transects were walked to maximize the time spent in this forest type before moving towards the next patch of forest. These zig zag transects extended beyond the forest by 500 metres before returning back to the forest. In this way some sampling was made in the woodlands around the gallery forests but most of the effort was concentrated in the forests (fig. 2.1). Densities

could be calculated for forest and the surrounding 500 metres of woodland from these data and a satellite image analysis was made that enabled us to measure the area of forest with this 500 metre buffer in the study region. Once a patch of forest had been surveyed with the zig-zag transects a walk was made following a fixed compass direction to the next patch of forest. Data were collected on these walks also and analysed to obtain estimates of nest density in woodland within 2 km of forest separately.

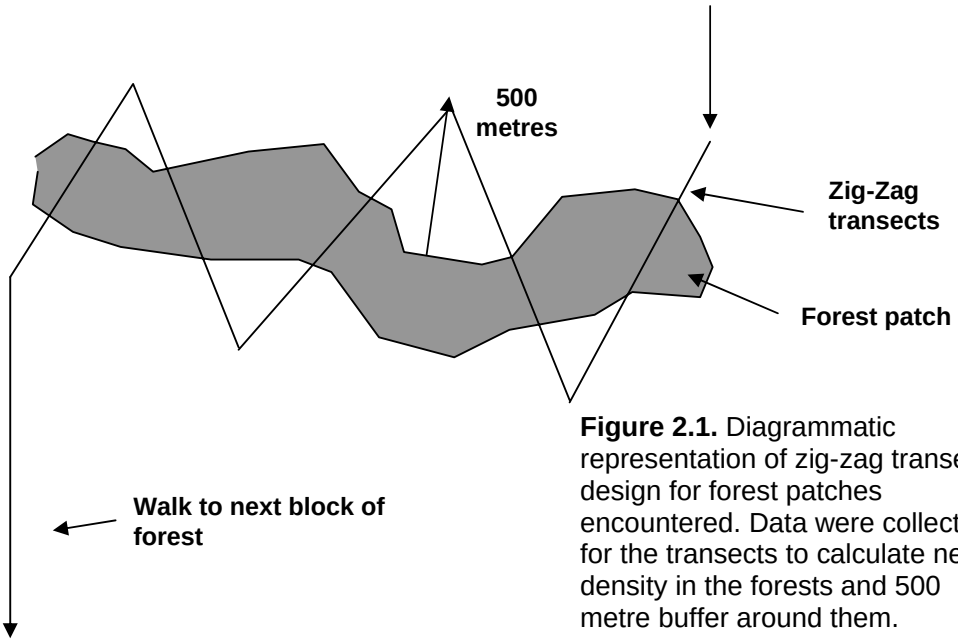


Figure 2.1. Diagrammatic representation of zig-zag transect design for forest patches encountered. Data were collected for the transects to calculate nest density in the forests and 500 metre buffer around them.

At each camp site a transect or reconnaissance walk was made each day following a compass direction where possible but deviating when the terrain became impassable or if in gallery forest. Much of the Misotshi-Kabogo forest consists of very steep hillsides which have been cut by fast running rivers. Many of the rivers have cliffs along their course making traversing them very difficult. We therefore used reconnaissance walk methods whenever we reached a point that was impassable and then selected a new compass direction.

GPS positions were taken for any sighting of an animal or its signs (nest or dung of elephant, buffalo and pigs) and also every 250 metres a GPS position was taken with a description of the habitat type. This allowed us to map where teams had visited and also helped ground truth the satellite classifications.

Censusing chimpanzees

Chimpanzees are difficult to census directly because they tend to be shy and secretive and are often missed when walking through forest. They are also rare and live at low densities and so are not often encountered either. However, they make nests in which they sleep and we can use these nests to obtain an index of the population and with correction factors we can estimate the densities of chimpanzees (Plumptre and Reynolds, 1996, 1997; Plumptre, Cox and Mugume, 2002; Plumptre and Cox 2005). Each field team counted chimpanzee nests along the transects walked and measured the perpendicular distance between the centre of the nest and the transect. Where groups of nests occurred together, each individual nest was measured separately (Plumptre and Cox, 2005). In order to correct nest density to obtain an estimate of chimpanzee density we needed to correct for the production

rate of nests and the decay rate of nests. Only one study has measured the production rate of nests in wild chimpanzees which incorporated the construction of nests during the day as well as at night and the reuse of nests (Plumptre and Reynolds, 1997) and therefore we borrowed the value of 1.1 nests per day per nesting individual from this study. It was not possible to measure nest decay rates in this study because of the difficulty of keeping a team of people on site for long enough. We therefore opted to use a decay rate that had been measured for Mahale Mountains National Park across the lake in western Tanzania. Nest decay rates had been calculated by Ihobe for Mahale Mountains National Park (Ihobe, 2005).
Nests sighted on transects were assigned age classifications as follows:

1= Fresh: Leaves in cup of nest all green and cup solid
2= Dry: Leaves going brown (possibly some green) but nest cup still pretty much intact
3= Old: Nest cup disintegrating – most leaves lost and can mainly see gaps between leaves in cup
4= Decayed: No leaves left (less than 5%) – twigs left only.

Ihobe (2005) recorded a decay time of 131 days but his definition of point of decay included nests without leaves. If he used the same definition as we did above, his average time to decay was 49 days, a little longer than the decay rate of nests in Budongo Forest in Uganda (45 days – Plumptre & Reynolds, 1996).

Data analyses

Chimpanzee densities

Chimpanzee nest density was calculated using standard perpendicular distance techniques and the computer software DISTANCE (Buckland *et al.* 2001). Densities were calculated separately for the main forest block of Misotshi-Kabogo and for gallery forest/woodland.

Woods Hole Research Center are in the process of calculating the area of forest (block and gallery) in the region in and around the Misotshi-Kabogo area and which could potentially be protected in future from satellite imagery. They are also calculating the area of forest/woodland in the Muganja hills region. However because of the need to report on the work so far and move forward with the findings we have used estimates of forest cover from existing land cover data sets; particularly a biomass map produced to map woody biomass in Africa. Densities of chimpanzees where multiplied by forest area to obtain an estimate of total chimpanzee numbers in these two areas.

Results

Large mammal species known to occur in Misotshi-Kabogo

Interviews with local hunters and an assessment of skins and parts of hunted animals that villagers produced for us helped us to produce a list of 50 large and medium sized mammals for the Mistoschi-Kabogo forest and surrounding area of gallery forest and savanna grasslands (Table 2.1). We recorded those species we definitely confirmed as being present from sightings, skins, dung or skulls and also recorded Babembe names for the species as this helped us separate which animals were likely to be different species. We also tried to cross check identifications between hunters and query a species if only one hunter reported it (Table 2.1).

Table 2.1. List of large and medium mammals that we are fairly certain occur in the Misotshi-Kabogo region. Where we found certain evidence of the species (sighting, dung, skins, skulls) we have indicated in the table under 'confirmed'. The Babembe names are also given. Where we only had one hunter report the species it is noted.

Common name	Latin name	Confirmed	Babembe Name
Angolan Colobus	*Colobus angolensis prigoginei*	1	Eungu
Red Colobus	*Pilocolobus oustaleti foai*	1	Alokiyo
L'hoests guenon	*Cercopithecus lhoesti*	1	Mbise
Blue monkey	*Cercopithecus mitis*	1	Ema
Redtail monkey	*Cercopithecus ascanius*	1	Assonga
Dent's Monkey	*Cercopithecus denti*	1	Lubukyu
Vervet monkey	*Cercopithecus aethiops*		Ende
Grey-cheeked Mangabey	*Lophocebus albigena*	1	Ejogojogo
Owl-faced monkey?	*Cercopithecus hamlyni*		Only one hunter
Baboon	*Papio anubis*	1	Amba
Chimpanzee	*Pan troglodytes*	1	Soho
Bush pig	*Potamo*	1	Ngulube
Giant Forest Hog	*Hylochoerus meinertzhageni*	1	Senge
Bushbuck	*Tragelaphus scriptus*	1	Ulungu
Bongo	*Tragelaphus euryceros*	1	Mangala
Red duiker (Weyns?)	*Cephalophus (weynsi)*		M'mbale wa Bishilu
Black-fronted duiker	*Cephalophus nigrifrons*	1	M'mbale wa Pombo
Yellow-backed duiker	*Cephalophus*		Tundu
Blue duiker	*Cephalophus monticola*	1	Abuluku
Bush duiker	*Sylvicapra grimmia*		Swala
Klipspringer	*Oreotragus oreotragus*		Ehala
Buffalo	*Syncerus caffer*		Mboko
Elephant	*Loxodonta Africana*		
Sitatunga?	*Tragelaphus spekei*		Nzogu
Lion	*Panthera leo*		Tambwe
Leopard	*Panthera pardus*		Hangwe
Golden cat	*Felis aurata*	1	
Serval	*Felis serval*	1	M'bwabwa
Spotted Hyaena	*Crocuta crocuta*		Mlunga
Side-striped Jackal	*Canis adustus*	1	Elundu
African Wild Dog?	*Lycaeon pictus*		Ngalabi
Common genet	*Genetta genetta*	1	Mshimba
Blotched genet	*Genetta tigrina*	1	
Ratal	*Mellivora capensis*		Seele
Marsh Mongoose	*Atilax paludinosus*		Mimala
Banded Mongoose	*Mungos mungo*	1	
Slender Mongoose	*Herpestes sanguinea*	1	
African Palm civet	*Nandinia binotata*	1	Abulubulu

Spot-necked Otter	*Lutra maculicollis*		Eôha
Giant Pangolin	*Smutsia gigantea*	1	Aa
Tree Pangolin	*Phataginus tricuspis*	1	Abanga
Brush-tailed Porcupine	*Atherurus africanus*	1	Esese
Crested Porcupine	*Hystrix cristata*		Fumba
Marsh Cane Rat	*Thryonomys swinderianus*		Simbiliki
Red-legged Sun Squirrel	*Heliosciurus rufobrachium*	1	Esende
Carruther's Sun Squirrel	*Funisciurus carruthersi*	1	Akese
Lord Derby's Anomalure	*Anomalurus derbianus*		Membe Luuto
Chequered Elephant Shrew	*Rhynchocyon cirnei*		Lunda Lunda
Giant Otter Shrew?	*Potamogale velox*		Only one hunter
Western Tree Hyrax	*Dendrohyrax dorsalis*	1	Mbela

Elephants and buffalos have not been observed recently by most hunters but there are occasional reports that come back to the villages that make people believe some still occur in the forest. They may also be found west of the Misotshi-Kabogo massif in the savannas and gallery forest which is little visited by people from the fishing villages on Lake Tanganyika. This is also where wild dog, lions and hyaenas might be found. Interestingly nobody recognized any bushbabies, or potto or African civet, which are all species that might be expected to occur there.

Encounter rates of large mammals from transects/reconnaissance walks

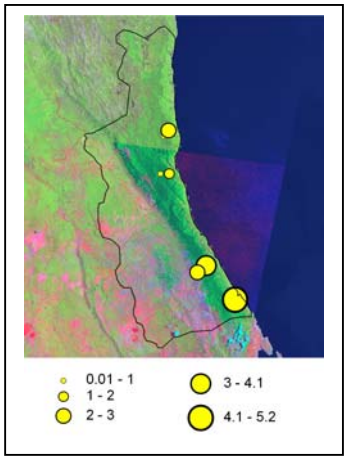
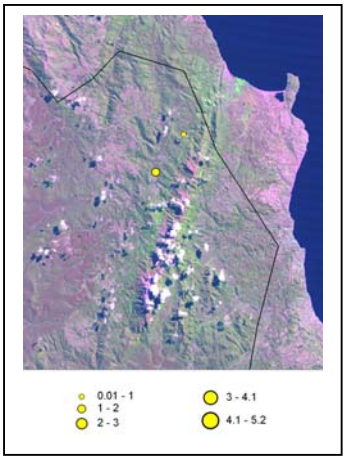
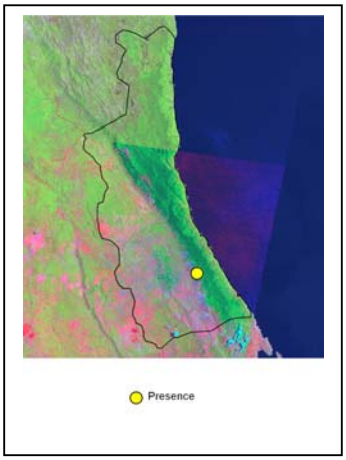
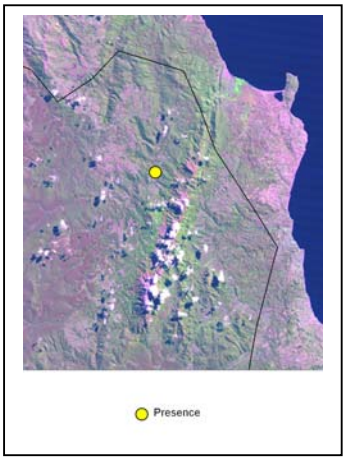
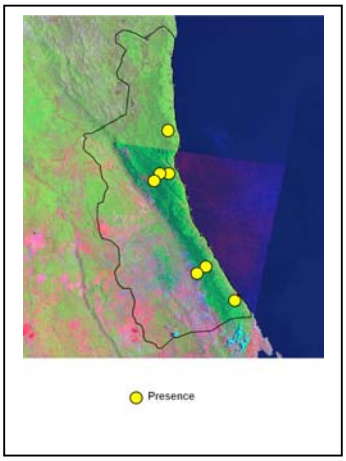
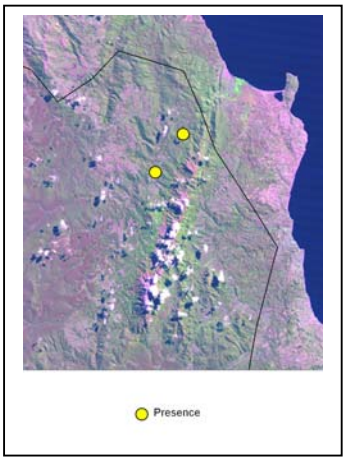
Sightings of mammals from transects and reconnaissance walks were few. It became clear that hunting of mammals with snares and guns had reduced their populations and caused them to be very fearful of people. When sighted they would flee silently, even those species that normally give alarm calls elsewhere in the Albertine Rift such as the guenons. Consequently for most species we recorded presence/absence at each camp in the forest rather than abundance. Chimpanzee nests were relatively abundant, however, partly because the Babembe have a taboo against killing them and also because nests can remain some time before decaying.

A total of 178 chimpanzee nests were observed on 133.40 km of transect/ reconnaissance walk over the whole study. Of this distance walked, 73.24 km was in the main Misotshi-Kabogo forest block (below 2,200 metres), 15.48 km above 2,200 metres altitude and 44.68 km in gallery forest. The density of chimpanzee nests varied between the main forest block and gallery forest (Table 2.2) but these differences were not significant when tested ($Z=0.80$, $P>0.05$).

Table 2.2. The density of chimpanzee nests in the two forest types and the density with combined data.

Forest type	**Density (no. km^{-2})**	**Standard error**	**95% limits**	**Number of nests**
Forest Block	65.5	16.9	39.0-109.8	134
Gallery Forest	38.7	27.9	9.2-161.5	44
All Forest	51.3	13.5	30.4-86.4	178

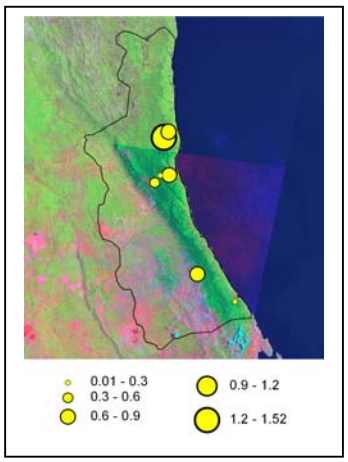
Figure 2.2 summarises the relative abundance of chimpanzees (from nest encounter rates), bushpigs (from dung) and presence/absence of other primates and large mammals.

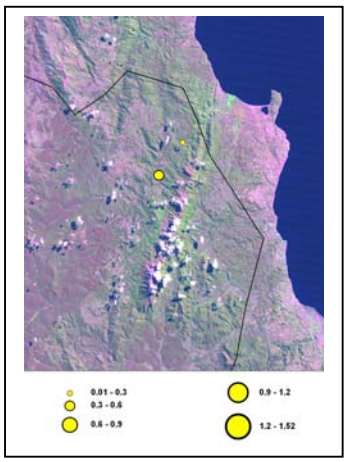
	Misotshi-Kabogo	Muganja Hills
Chimpanzee nest encounter rate per km walked		
Baboon presence		
Blue Monkey presence		

Misotshi-Kabogo

Muganja Hills

Bushpig dung encounter rate per km walked

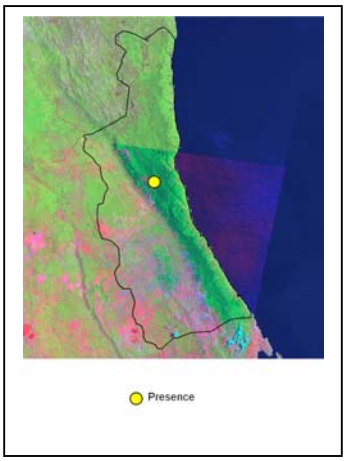


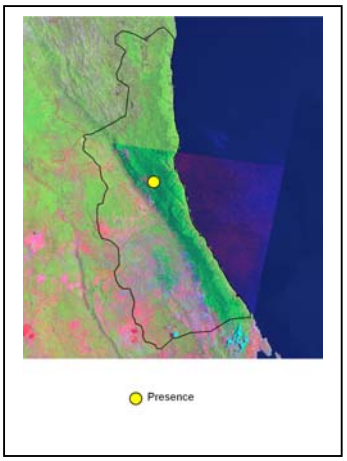


Misotshi-Kabogo

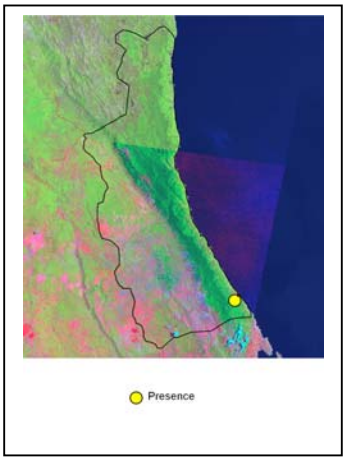
Misotshi-Kabogo

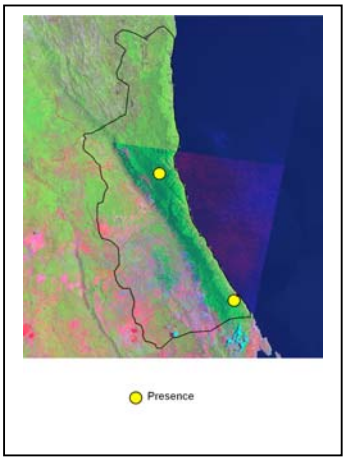
Bongo (left) and Giant Forest Hog (right) sign





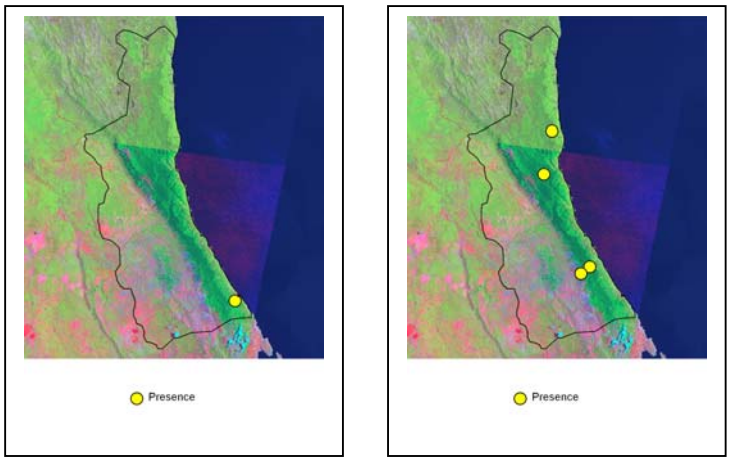
Dent's Monkey (left) and L'Hoest Monkey (right) presence





Misotshi-Kabogo

Grey-cheeked Mangabey (left) and Red Colobus (right) presence



Redtail monkey presence

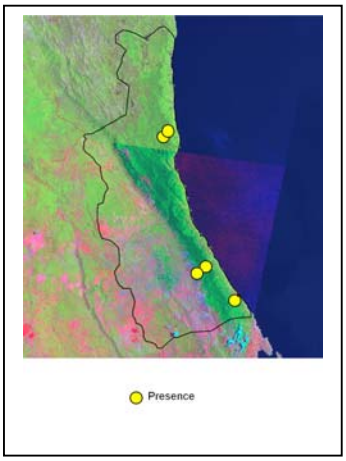


Figure 2.2. Locations of sightings of large mammal species giving presence/absence for monkeys, bongo and giant forest hog and encounter rates for chimpanzee nests and bushpig dung. Only blue monkey, baboon and chimpanzees were found at Muganja hills of the primates encountered.

Estimates of chimpanzee numbers.

The nest densities given in Table 2.2 can be converted to estimates of chimpanzee densities by dividing the nest densities by the nest production rate (1.1/day) and the nest decay rate (49 days) as explained in the methods. Therefore we estimate chimpanzee densities to be around 1.22 chimps per square kilometer in the main forest block of Misotshi-Kabogo and 0.72/km^2 in the forest galleries. These densities are comparable to chimpanzee densities found elsewhere in the Albertine Rift region.

A satellite image analysis was made using Landsat imagery and classifying the spectral reflectances into twenty five classes which were then allocated to seven vegetation classes, one of which was Forest (figure 2.3).

1. We calculated the area of the forest cover in the main forest block to be 804 km^2. Multiplying this area by the density of chimpanzees (1.22) gives us an

estimate of 977 (+/-252 SE) chimpanzees for the Misotshi-Kabogo forest block.

2. We also measured the area of gallery forest within the Potential protected area boundary but outside the main forest block from the satellite image classification. A total area of 834 km^2 was calculated giving an estimated 599 chimpanzees (+/- 432 SE) probably occur in the gallery forest to the west of the Misotshi-Kabogo forest block. A further estimate was made by eye of the forest cover in the Muganja Hills region and about 59 chimpanzees were calculated (+/- 20.5 SE) (estimating 3% forest cover).

It is clear therefore that the bulk of the chimpanzees that occur in this region are found in the main forest block of Misotshi-Kabogo. However the gallery forest extends further west than the boundaries we have delimited and could well contain more chimpanzees. We did not feel comfortable extrapolating much further though without survey data from these areas. The boundary we have produced for the MIsotshi-Kabogo region is where we believe it might be possible to create a new protected area and within this boundary we estimate about 1,576 chimpanzees (+/- 680 SE) occur.

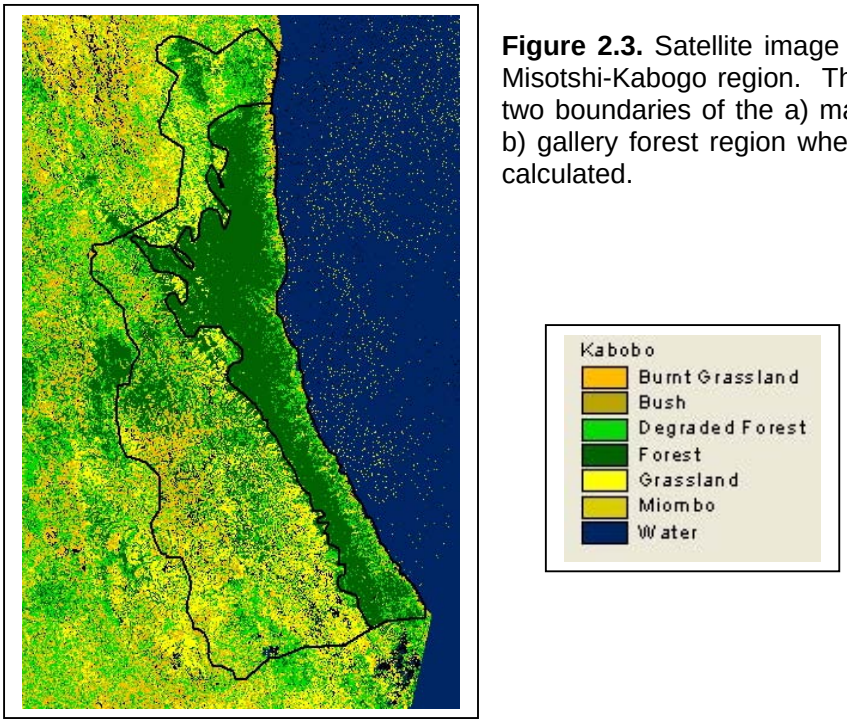


Figure 2.3. Satellite image classification of the Misotshi-Kabogo region. The image shows the two boundaries of the a) main forest block and b) gallery forest region where forest cover was calculated.

Discussion

Fifty species of large and medium sized mammals were identified as probably occurring in the Misotshi-Kabogo region. Combined with the 21 species of small mammal that were discovered (chapter 3) we therefore have a known list of 71 species of mammal for the region. This is probably a minimum estimate however, because bats were not collected systematically and few shrews were caught during

the surveys. The forest is relatively rich in primate species with 10 (or 11 if owl-faced guenons truly do occur here) and of these several are of conservation interest.

At least two of the primate species for this region are subspecies of those found further north in the main forest block of the congo basin. The Angolan colobus that is confined to the Misotshi-Kabogo region (*Colobus angolensis progoginei*) was not observed from transects or recce walks but was observed once at camp B1 by one of the botanists. It is clear that this species has been heavily hunted in the forest and is in danger of disappearing completely. The red colobus (*Pilocolobus oustaleti foai*) is also only found from this part of south eastern Congo and was observed at several of the camps in the forest as well as in the gallery forest to the west of the main forest block. It seems to be faring better than the Angolan colobus.

We did find one sign of the Bongo that was reported in the 1950s to occur in this forest. Signs of this animal (tracks) were observed at high altitude (around 2,500 metres). The only other site where this species occurs at this altitude is in Kenya, where it is considered to be a separate subspecies to the type found in the low altitude forest of the Congo basin. We therefore believe that it would be worth investigating this animal in more detail in the Misotshi-Kabogo forest, as it might deserve sub-specific listing also.

Chimpanzees in this region are near the southern limits of their range, particularly in the Muganja Hills region. We tried wherever possible to collect hairs from nests to allow genetic analyses to be made. Unfortunately many of the nests we encountered were either old or inaccessible and we only managed to collect about 5 samples.

From a conservation perspective it is clear that the Misotshi-Kabogo region is of great interest and deserves further investigation, particularly looking at the taxonomy of some of the species that occur here in more detail. The number of mammal species found in this study also indicates that the forest is valuable for conservation and that it deserves some form of protection.

CHAPTER 3: Small Mammal Surveys of Misotshi-Kabogo

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Introduction

The forests of the Albertine Rift represent important habitats for the flora and fauna of the region. There are 402 mammal species that have been recorded in the Albertine Rift, of these 34 are endemic (Plumptre et al., 2003; 2007). Many of these endemics are small mammals, rodents, shrews or bats. The Misotshi-Kabogo region had been previously surveyed for birds and some large mammals (Prigogine, 1960). However, the diversity of the small mammal (rodent, shrew and bat) fauna has never been surveyed in this region of the Albertine Rift.

Methods

Between the 29th January and 24th February 2007 three camps within the Misotshi-Kabogo forest were accessed from two different fishing villages along the Lake Tanganyika shoreline. We established our first camp (5°28'45"S, 29°16'22"E) at an elevation of 1250 meters approximately 3 km west of Mizimu fishing village. The two remaining camps were established further north and were accessed from Talama fishing village that is located at the base of Misotshi. The second camp (4°59'29"S, 29°4'49"E) at an elevation of 1950 meters was established approximately 4 km southwest of Talama along the Mukungu River. The third camp (4°59'05"S, 29°5"34"E) at an elevation of 1600 meters was located approximately 2.5 km southwest of Talama.

Small mammals were sampled using a variety of techniques. Bats were sampled opportunistically utilizing the bird teams mist nets at one of the three camps. Rodents and insectivores were sampled using pitfall lines and trap lines consisting of Museum Special snap traps, Victor rat traps and Conibear traps. Pitfall lines were used to capture shrews and consisted of between fifteen and seventeen 5 liter buckets set 5 meters apart with a 25 cm high drift fence placed over the midline of the buckets. Trap lines consisted of between 30 to 60 traps; we ran either two or three trap lines depending upon the habitat. The majority of traps were placed on the ground but some were placed above ground on vines, tree limbs or fallen logs. We used a mixture of peanut butter and oatmeal as bait but occasionally also used some fish and corn kernels. All of the trap lines and pitfall lines were set up within 500 meters of their respective camps.

Data collected for all specimens included the microhabitat where each specimen was collected, sex, reproductive state as well as standard measurements, total length, tail length, ear length, hind foot length, forearm length for bats and weight. Specimens were prepared as study skins and skeletons or were preserved in 10% formalin with skulls removed these were later transferred to 70% ethanol. Tissue specimens were stored in the field in a saturated NaCl / EDTA buffer, upon returning from the field they were stored in an ultracold freezer at -70°C. Animals were handled in

accordance with American Society of Mammalogists guidelines (Animal Care and Use Committee, 1998). All specimens were deposited in The Field Museum, Chicago. Species accumulation curves were generated using the computer program EstimateS v8.0.0 (Colwell, 2005).

Results

A total of 122 specimens were captured during the sampling period, representing 21 species (Table 3.1). These consisted of twelve species of rodents, five species of shrews and 4 species of bats. No animals were captured in either of the two pitfall lines (0 captures in 143 bucket-nights) all shrews collected on this survey were caught in trap lines. Trap line success at camp 1 was 10.1% (82 captures in 833 trap-nights). Trap line success was lower at camps 2 and 3; at camp 2 trap line success was 2.2% (11 captures in 510 trap-nights) and at camp 3 the success was 3.8% (24 captures in 630 trap-nights). One species of rodent, *Praomys jacksoni*, made up the majority (50% of total captured) of our captures. We collected one species of bat belonging to the sub-order Megachiroptera and 3 species of the sub-order Microchiroptera. Nets to capture bats were used on an opportunistic basis and should not be interpreted to represent the extent of the bat diversity in this region. Additionally, one specimen of a brush-tailed porcupine was collected with a snare set out by one of our guides.

We collected individuals across all age groups, adults, sub-adults and juveniles. Almost all of the adult rodents and some shrew species showed signs of being reproductively active. None of the bats collected appeared to be reproductively active.

Table 3.1. List of small mammals collected in the Misotshi-Kabogo region during the survey period. The four new species are marked with an asterix.

Species	total
Insectivora	
Crocidura dolichura	1
Crocidura cf. lanosa	2
Crocidura olivieri	3
Crocidura spp. (1 nov.) *****	5
Myosorex sp. nov. *****	1
Chiroptera	
Stenonycteris lanosus	1
Rhinolophus sp. nov. *****	4
Hipposideros ruber	1
Pipistrellus cf. eisentrauti	1
Rodentia	
Hybomys lunaris	9
Hylomyscus sp. nov. *****	10
Lophuromys flavopunctatus	11
Lophuromys sp.	1
Mus minutoides	2
Mus triton	1
Mus sp.	1
Praomys jacksoni	61
Praomys degraaffi	3
Rattus rattus	1
Graphiurus cf. murinus	1
Atherurus africanus	1

The species accumulation curves for camps 1 (A), 2 (D1) and for the overall survey rise steeply and do not reach an asymptotic plateau (Figs. 3.1, 3.2). This would indicate to us that our sampling of the small mammal fauna of the Misotshi-Kabogo region is incomplete. The curve for camp 3 (D2) would seem to indicate that the diversity at this camp was fairly low. This may have been due to sampling effort, the drier conditions at this site and overall lower habitat quality. Future sampling will be needed to compile a more complete list of small mammals from this region.

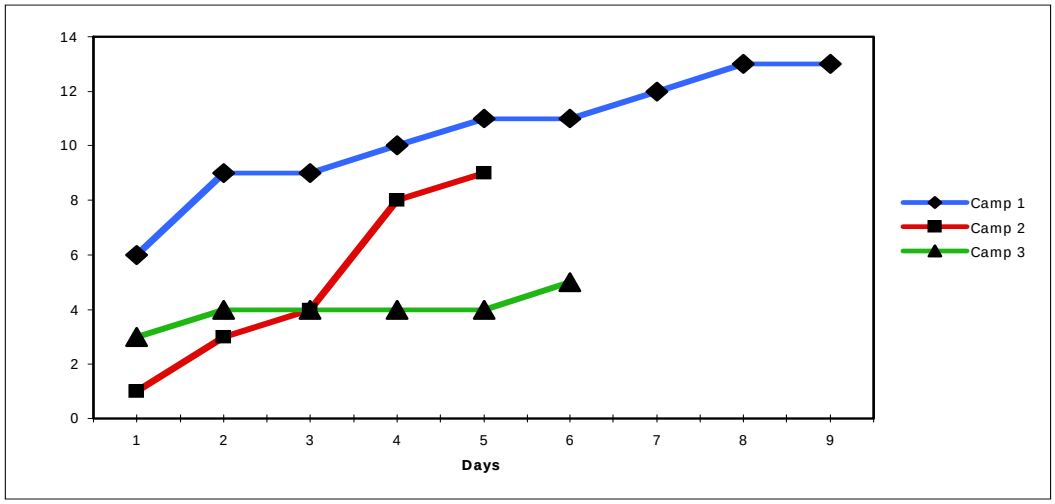


Figure 3.1. Species accumulation curves for small mammal species per days of collecting effort at each camp.

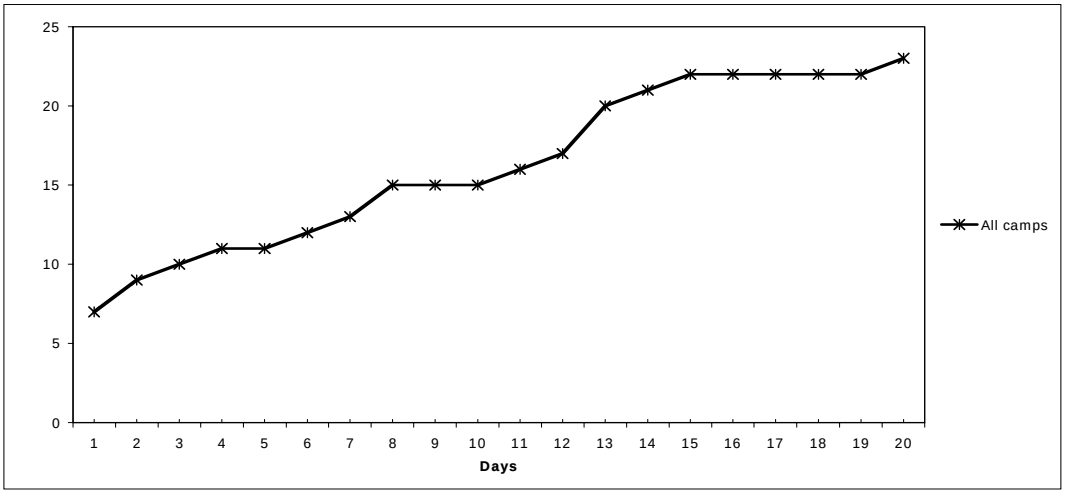


Figure 3.2. Species accumulation curve for small mammal species per number of days of collecting effort for the entire survey period.

Taxonomic work on the new species are being written up as scientific descriptions. It has been confirmed that four new mammal species were discovered as follows:

1. Crocidura nov. sp. (Soricidae, Soricomorpha) in prep
2. Myosorex nov. sp. (Soricidae, Soricomorpha) in prep
3. Rhinolophus nov. sp. (maclaudi group, Rhinolophidae, Chiroptera) in prep

4. Status confirmed by DNA and morphometrics: Hylomyscus nov. sp. (Muridae, Rodentia).

Discussion

The specimens collected in this survey represent the first collections of small mammals from one of the larger forest blocks remaining in the Albertine Rift. As such it represents a valuable resource for studies into the natural history, taxonomy and ultimately the conservation of Albertine Rift fauna. Due to limited sampling effort, particularly for shrews and bats, and the specific methodologies utilized the number of species represented in our survey most likely does not comprise the full diversity of the small mammal fauna in the Misotshi-Kabogo region. The lack of success utilizing pitfall lines was quite surprising since this method is usually more productive at capturing shrews than traditional snap traps. The low trap line success at our second and third camps was also unexpected when compared to the results from our first camp and from previous experience conducting other small mammal surveys in the Albertine Rift. Similar trapping effort on a recent survey of the Itombwe Massif located north of Misotshi-Kabogo resulted in a higher trap and pitfall line success rate than we achieved (unpublished data). The habitats of our camps were markedly different. The habitat at camp one could be described as transitional between lowland and montane forest and was close to the forest edge. Camp two was typical wet montane forest while camp three was drier forest on the eastern slope of the escarpment very close to the forest edge.

Praomys jacksoni is the most dominant species comprising 50% of the fauna captured. This appears to be typical when compared to 45-50% of rodent captures in the lower montane forest habitats of the Rwenzori Mountains (Kerbis Peterhans et al., 1998). Noticeably absent from our survey is the rodent *Lophuromys woosnami*, an Albertine Rift montane forest endemic found at low to medium elevations. This species was collected in the Itombwe Massif survey (Kaleme, pers. comm.) so we expected to collect it in Misotshi-Kabogo. It is possible that this species was unable to cross the Kilombwe River valley, the major barrier that separates Misotshi-Kabogo from Itombwe.

This preliminary survey highlights the need for additional work in the Misotshi-Kabogo region. Four of the species that were collected are new to science. The *Rhinolophus sp.*, *Myosorex sp.* one of the *Crocidura sp.* and the *Hylomyscus* sp. could not be attributed to any of the known species found in the Albertine Rift or elsewhere. These data presented here highlight the importance and uniqueness of this region to understanding the natural history of the small mammal fauna of the Albertine Rift.

Photo 3.1. The new species of *Rhinolophus* bat.

CHAPTER 4: Bird Surveys

H.Mugabe, B.Marks, C.Kahindo, D.Moyer, A. Masanga, A.J.Plumptre, D.Kujirakwinja and Elia Mulungu

Introduction

Birds are good indicators about the relative health and integrity of the forest. They are also readily identified, and good guides exist to help in their identification visually as well as their calls. There are 42 endemic birds associated with the Albertine Rift and associated Eastern Zairean lowlands (nowadays the two areas are combined in the Albertine Rift; Plumptre et al. 2007). Of these birds several are poorly known with no recordings of their calls and little known abut their ecology and habitat use. One, the Kabobo Apalis (*Apalis kaboboensi*), is only known from the Misotshi-Kabogo area but little else was known about it.

These surveys therefore aimed to collect some information on the birds of the Misotshi-Kabogo area as well as the Muganja Hills area. The region around the hill called Kabobo was surveyed in the 1950s by collectors sent by Prigogine (1960) in 1953, 1954, 1955 and 1957. Collections were made in October and November most years with some collecting in May 1955. A total of 146 species of bird were collected during this time for Kabobo hill and an additional 85 were recorded in the region surrounding the massif. It was at this time that the Kabobo Apalis was identified (Prigogine, 1960, 1985). However since then there has been some dispute about whether this Apalis should be a separate species or only a subspecies of the Chestnut-throated Apalis (*A. porphyrolaema*) (Urban, Fry and Keith, 1997). Eighteen Albertine Rift endemic species were recognised by Prigogine (1960) during these surveys, of which the Kabobo Apalis is one.

We know of no other surveys of birds since the 1950s because of the insecurity that occurred in this region.

Methods

A combination of identification and listing of species and point counts to provide more quantitative data were employed. Mist netting was used primarily to collect specimens for the Field Museum in Chicago but also to help increase the species lists at each site (Appendix 1). Three ornithologists (H.Mugabe, A. Masanga and D. Kujirakwinja) on the two teams had undertaken surveys in many other Albertine Rift Forests and knew the calls of most of the bird species. Elia Mulungu recorded the calls of many of the birds using a Marantz tape recorder, aiming in particular to record the calls of those species whose call had not been recorded before.

At each camp birds would be identified by sight and call and a daily species list built up to calculate the total numbers of species for the site and the relative accumulation curves for the sites. Point counts would be made at every 250 metres of transect and reconnaissance walk made by the large mammal teams (chapter 2). Mist nets were generally placed around the camp site or it's near vicinity and checked every 30 minutes.

Data were analysed in Biodiversity Professional for diversity measurements and rarefaction curves and Arcview 3.2a for geographical data.

Results

Total numbers of species per site

A total of 214 species of bird were observed at each of the camps in both the Misotshi-Kabogo Forest and the Muganja Hills. A total of 83 species were found for the Muganja Hills and 158 species for the Misotshi-Kabogo Forest. Of these 158 species, 74 were new species for the list that Prigogine had created for Kabobo (Prigogine, 1960). This brings the total list of birds for the Misotshi-Kabogo region to 305 species, making it the fifteenth richest site in the Albertine Rift region (Plumptre et al. 2003). However with more surveys it is likely more species will be discovered for this forest.

21 Albertine Rift Endemic Species were encountered of which 3 were new for the forest (Grauer's Warbler, *Graueria vittata*, Purple-breasted Sunbird, *Nectarinia perpureiventris*, and Rwenzori Double-collared Sunbird, *Cinnyris stuhlmanii*). In addition the Mountain Masked Apalis (*Apalis* personata) has been recognized as an Albertine Rift Endemic since Prigogine's paper. The only endemic species we did not encounter that was collected by Prigogine was the Dusky Crimsonwing (*Cryptospiza jacksoni*). There are therefore 22 known endemic species for the Misotshi-Kabogo Forest in total, making it the seventh richest site in the Albertine Rift for endemic birds.

The sites with greatest bird diversity (Fig. 4.1) were those at low to medium altitudes in Misotshi-Kabogo and in Muganja hills (B1, B2, C2, A1 and M1) when looking at accumulation of species per day of survey effort. Similar curves are produced when calculating rarefaction curves from point count data per number of individual birds seen (Figure 4.2). Site B2 is even richer in species compared with other sites probably because it consisted of montane and medium altitude forest as well as grassland. It is not clear why D1 had much less diversity but it may be due to little variation in available habitat types.

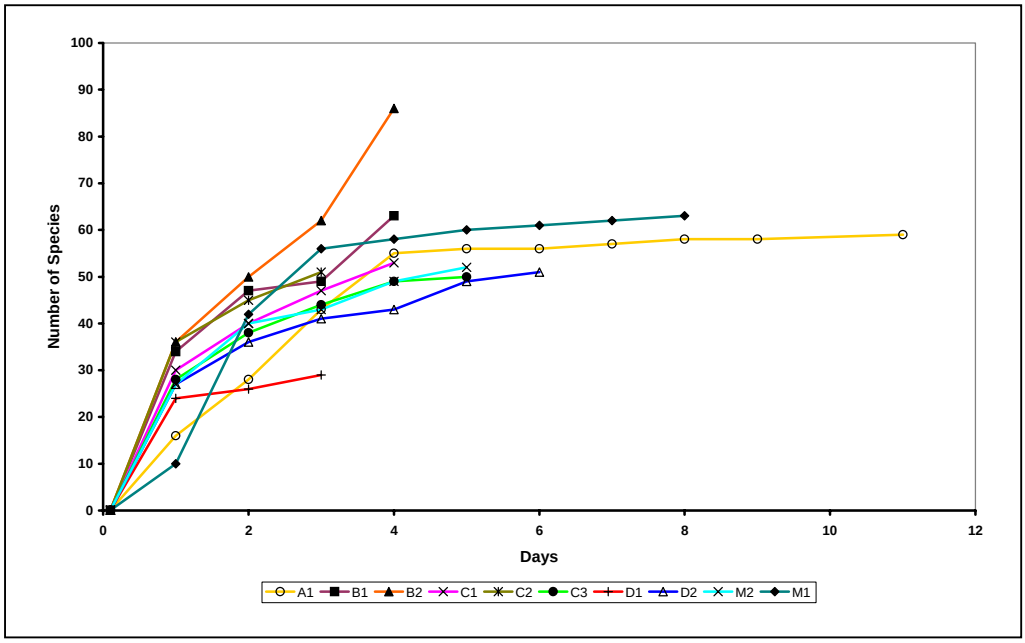


Figure 4.1. Species accumulation curves for sightings of species per days observation at each camp site.

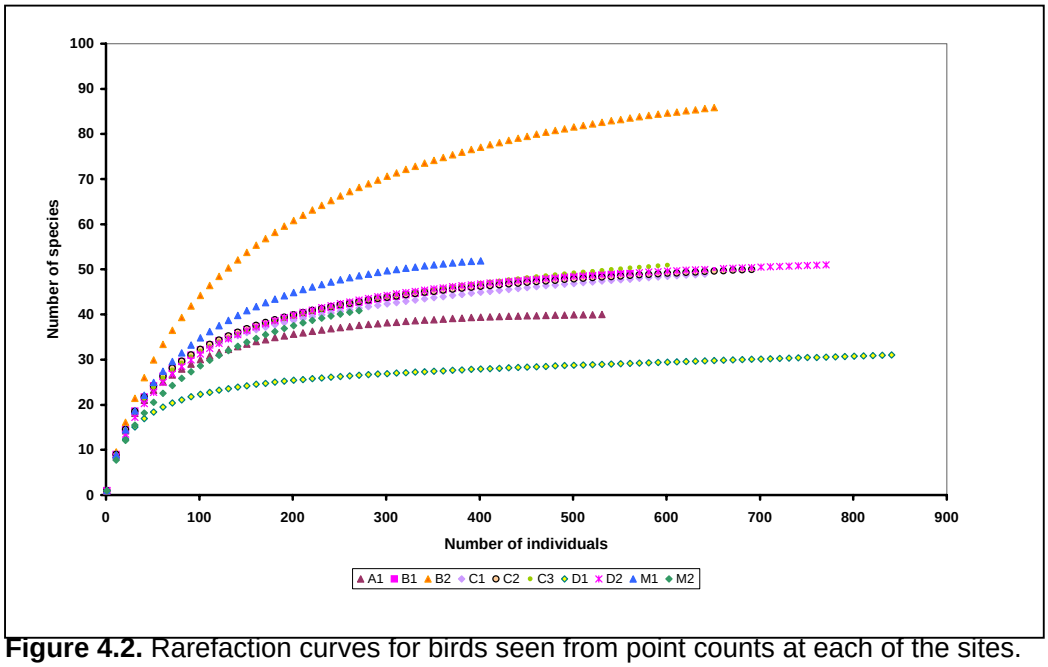


Figure 4.2. Rarefaction curves for birds seen from point counts at each of the sites.

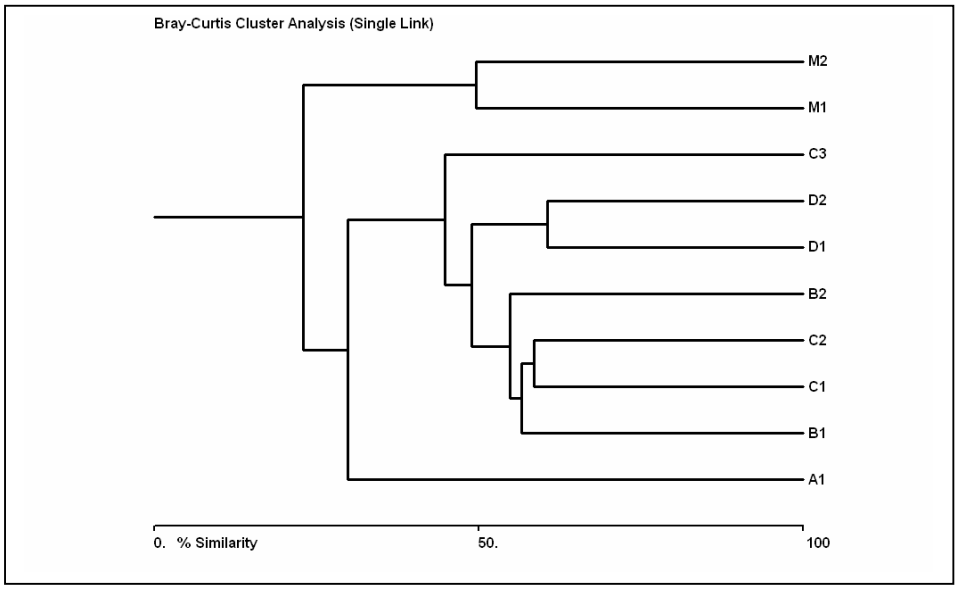
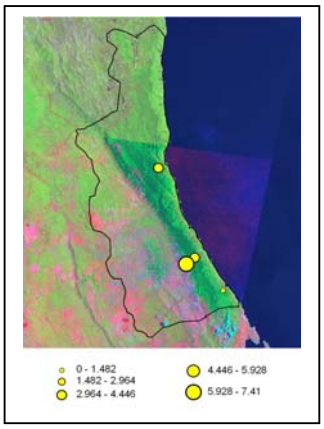


Figure 4.3. Cluster analysis of point count data showing similarity between birds observed at each of the camps.

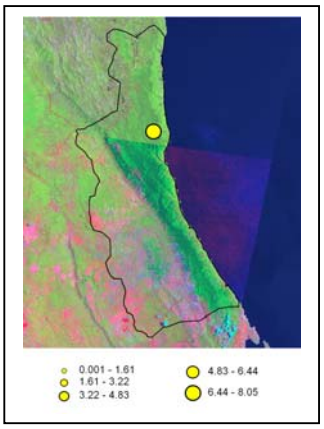
Cluster analysis of the point count data for each of the camps (figure 4.3) shows how different the two camps in the Muganja hills area are from the Misotshi-Kabogo camps (splitting at about 25% similarity). The lower altitude camp at A1 is also very different to the higher altitude camps.

Endemic bird species distributions

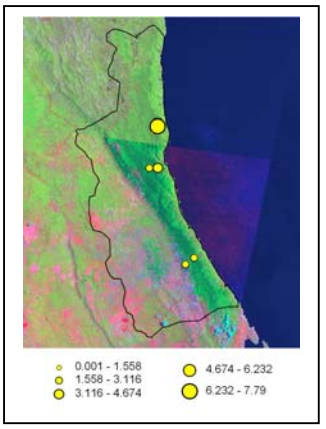
Distributions and relative abundance (encounter rate at point counts) of the Albertine Rift Endemic species seen at point counts are mapped in figure 4.4 (a and b).



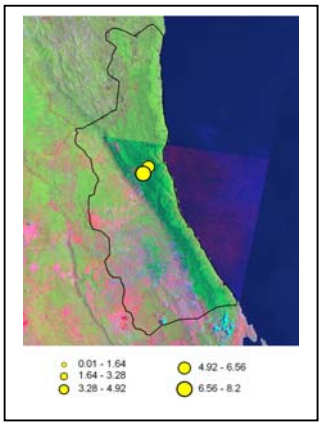
Blue-headed Sunbird



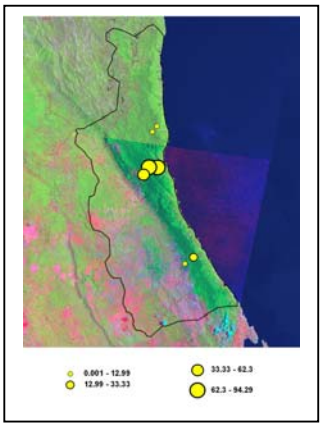
Collared Apalis



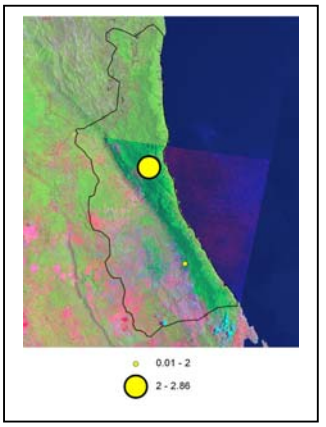
Grauer's Warbler



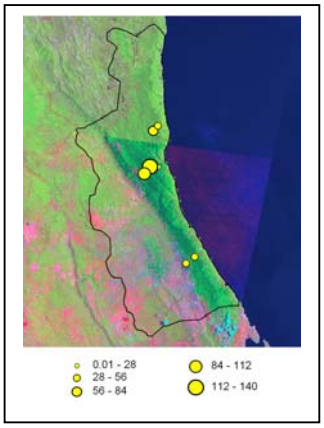
Handsome Francolin



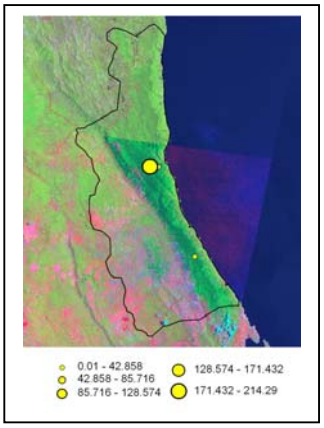
Kabobo Apalis



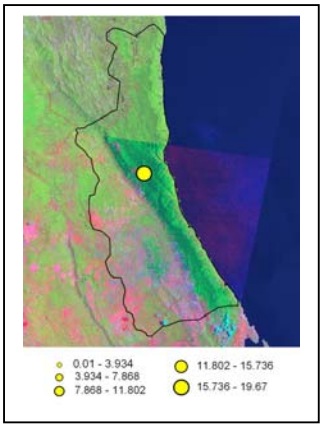
Kivu Ground Thrush



Mountain Masked Apalis

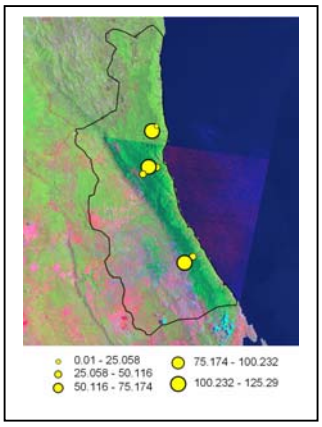


Purple-Breasted Sunbird

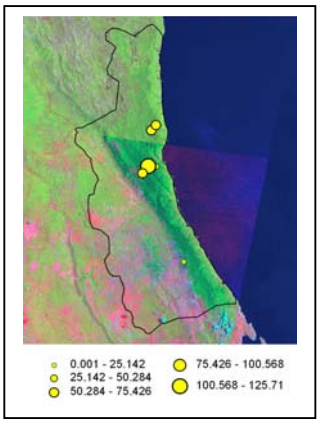


Red-collared Mountain Babbler

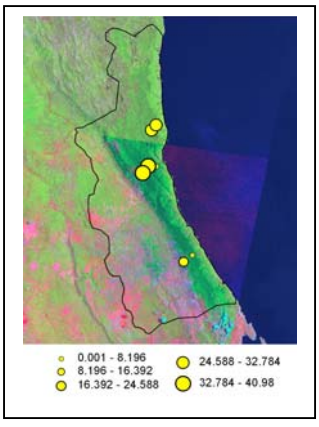
Figure 4.4 a. Distribution of sightings of endemic bird species at the various camp locations visited with relative abundance indicated by circle size.



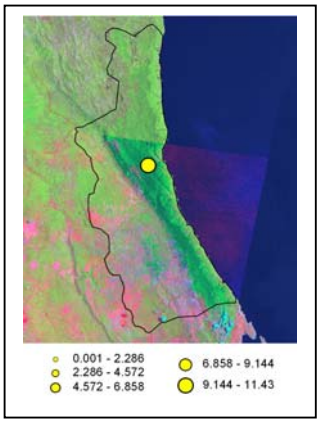
Red-faced Woodland Warbler



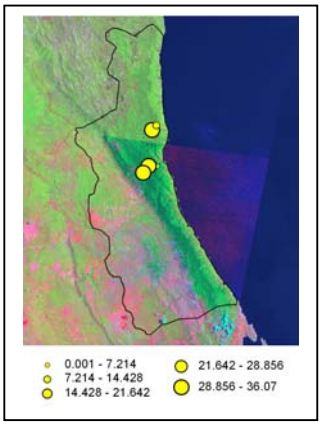
Regal Sunbird



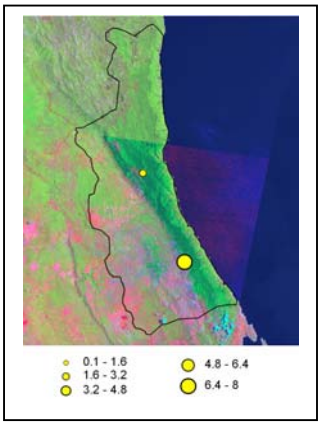
Rwenzori Apalis



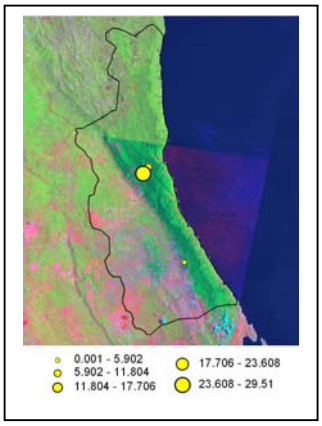
Rwenzori double-collared sunbird



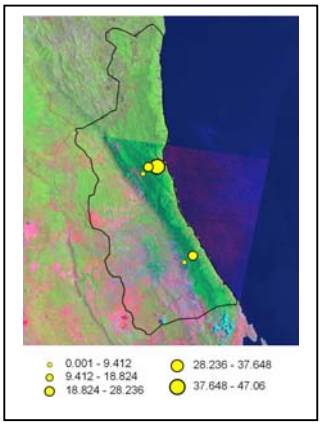
Rwenzori Tauraco



Strange Weaver



Stripe-breasted Tit



Yellow-crested Helmet Shrike

Figure 4.4 b. Distribution of sightings of endemic bird species at the various camp locations visited with relative abundance indicated by circle size.

Calls of selected bird species

Observations and sound recordings made during this survey were useful in clarifying the taxonomic status and ecological relationships for several species. In some cases, these data were hitherto unknown. Selected notes on these are presented below.

Kabobo Apalis, *Apalis porphyrolaema kaboboensis*

This very distinctive form was described by Alexander Prigogine in 1955. He considered it to be a distinct species, but most authors have treated it as conspecific with the Chestnut-throated Apalis (Hall & Moreau1970, Urban et al. 1997). It differs largely in the chestnut on the chin, throat, and upper breast being replaced by dark grey.

Kabobo Apalis was common in the canopy (from 1,602m up to 2,691m) and several recordings were made of its song by Elia Mulungu. Comparisons of the song of Kabobo Apalis were made with recordings of Chestnut-throated Apalis from Nyungwe Forest, Rwanda and the Aberdares in Kenya. Generally, these were quite similar, with the most isolated form, the Kabobo Apalis, being the most divergent.

The song of this species appears to be a duet, with one bird giving one or two chirp calls and the other giving a long trill. The timing for these two elements of the call is very precise. There is quite a bit of variation in the song structure within and between populations. However, in the field, it is immediately obvious that the Kabobo Apalis belongs to the Chestnut-throated group vocally. Variation within a population or region is at least as significant as that between populations (Figure 4.5).

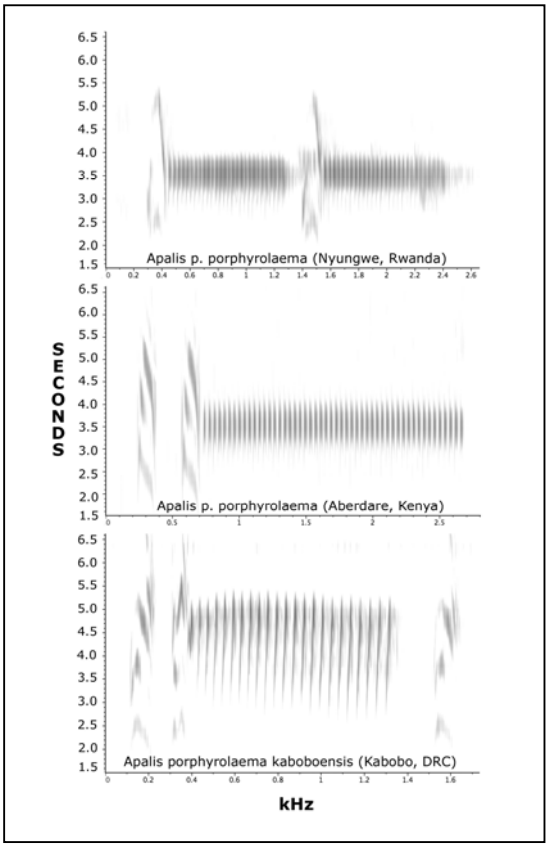


Figure 4.5. Spectrograph of the songs of Chestnut-throated Apalis *Apalis porphyrolaema* from 3 different sites

Variation in the song structure is largely in the sequence of the chirp notes and in the duration and number of elements in the trill. The calls recorded at Kabobo were most similar to the songs from the Aberdares, but the entire song phrase was shorter. Sequence and number of the chirps is also variable, both within and between populations. In Kabobo Apalis the song phrase is most often preceded by two chirps, then a trill and ended by a chirp. However, the second chirp and the trill run together so that the overall effect in the field sounds like a trill preceded and ended by a single chirp. In Nyungwe the trill is preceded by a single chirp, but then a second chirp/trill combination is given immediately. The song of the Aberdare form is more similar in structure to the Kabobo birds but the two chirps preceding the trill are clearly audible. In all populations, the trill is occasionally given by one bird with the other preliminary chirp notes given by the other.

Bocage's (Kabobo) Akalat, *Sheppardia bocagei (poensis) kaboboensis*

Moreau (1941) gave a description of a new robin (akalat) collected in Mahale at 2400 m on 8 August 1940. In deference to the opinion of Claude Grant, he described this as a subspecies of the Grey-winged Robin-chat, *Cossypha polioptera kungwensis*. This specific assignment was found to be in error because of the shorter tail and longer tarsus of *C. p. kungwensis*. Chapin thought it was a new subspecies of Alexander's Robin-chat, *Cossypha insulana kungwensis* but Moreau did not agree and named it the Kungwe Robin-chat, *Cossypha kungwensis,* pending clarification of its affinities (Moreau 1943, Chapin 1953). Macworth-Praed and Grant (1955) followed Chapin and listed it as a subspecies of Alexander's Robin-chat, *C. i. kungwensis* following the opinion of James Chapin, but later on, Moreau and Benson (1956) sunk *insulana* into *bocagei* along with *kungwensis*. Since then, most taxonomists have lumped all forms of *bocagei* and *insulana* into Bocage's Robin-chat (White 1962, Hall and Moreau 1970, Britton 1980, Keith *et al* 1992). More recently, taxonomists (Wolters 1983) have placed this complex into *Sheppardia*, the akalats, a change first suggested by Hall and Moreau (1970). When the genus *Sheppardia* is used, the name *poensis* (Alexander) supersedes *insulana* Grote*,* (Prigogine 1987, Keith *et al* 1992).

In the mid 1980s, Alexander Prigogine re-evaluated the *bocagei* complex of akalats and concluded that morphological evidence supported the treatment of the *insulana* and *bocagei* groups as separate species (Prigogine 1987). He still kept both groups within the robin-chats, *Cossypha*, hence his continued use of *insulana* for the northern "short-winged" montane forms. However, his opinion was not followed by the authors of the Birds of Africa (Keith *et al* 1992). Instead, they opted to follow Hall and Moreau (1970) by deferring the decision on whether to lump or split the *insulana*/*bocagei* group until more information on the biology of this species became available. They did however, use the genus *Sheppardia* for the *insulana*/*bocagei* (*poensis*) group

Recent fieldwork in Western Tanzania on both sides of the contact zone between Alexander's Akalat (the *poensis* / *insulana* group) and Bocage's Akalat, (the *bocagei* group), has contributed new ecological and bioacoustic information to the discussion (Moyer 2006, Moyer *et al* 2006). Bocage's Akalat, *Sheppardia bocagei ilyai* was found 60 km to the east of Mahale Mountains in the Sitebe-Sifuta Mountains. It was common in gallery and riverine forest at 1700 m (a habitat very similar to that preferred by *S. b. chapini* in northern Zambia) and recordings were made of its song. Recordings were also made of the song of *S. b. kungwensis* in montane forest at 2400m in Mahale Mountains National Park. During this survey, recordings were made of the song of *S. bocagei kaboboensis* on Kabobo Mt., by Elia Mulungu (Figure 4.6).

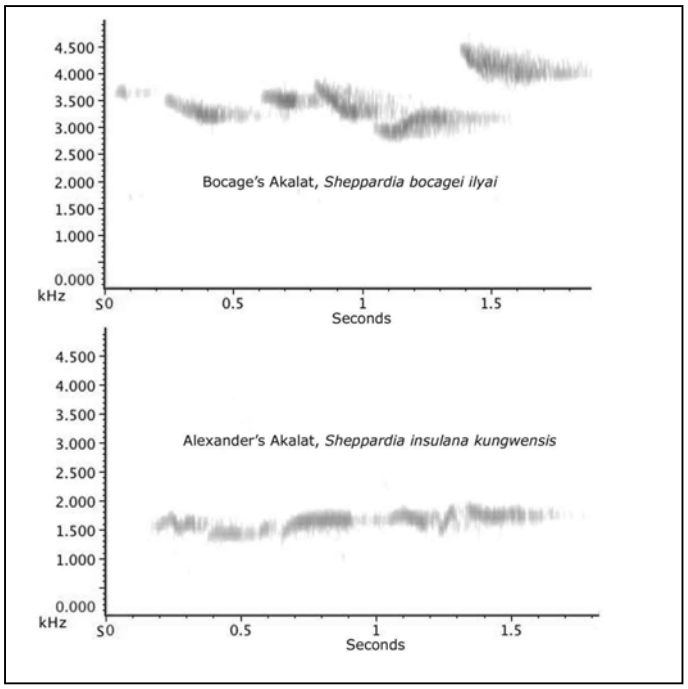


Figure 4.6. Spectrogram of the songs of Alexander's & Bocage's akalats.

Although all three forms differed only slightly in appearance, there were major differences in the songs and habitat preference between Bocage's and Alexander's akalats. The song of *S. b. kungwensis*, in the Alexander's Akalat group, is virtually identical to the song of *S. b. kaboboensis* from just across Lake Tanganyika, and to that of *S. b. granti* on Mt. Cameroon more than 2400 km away. (recorded by M. E. Gartshore (Chappuis 2000)). However, the song of *S. b. ilyai*, in the Bocage's Akalat group, was found to be identical to that of *S. bocagei chapini* from northern Zambia and southern Tanzania (recorded by R. Stjernstedt (Chappuis 2000)).

The fundamental frequency of the song phrase of Alexander's Akalat from Mahale is 1257 Hz and the highest frequency is1943 Hz. The fundamental frequency of Bocage's Akalat from just east of Mahale is 2715 Hz with the highest frequency at 4537 Hz. Claude Chappuis (*pers. comm., December 2005)* states that the difference in pitch alone is enough evidence to treat them as separate species.

These two forms are within 60 km of each other, yet each are more similar to distant forms in vocalizations and habitat choice than to each other. It is clear from this that they should be treated as separate species; Bocage's and Alexander's akalats. The subspecies of Bocage's Akalat in Ufipa (less than 100 km to the south of the nearest population of *ilyai*) is *chapini* (Moyer and Stjernstedt 1982). This same subspecies is found all over northern Zambia and SE Democratic Republic of Congo (Chapin 1953, Benson *et al* 1971, Keith *et al* 1992). It would appear then that the Karema Gap has been a major biogeographical barrier isolating *ilyai* from contact with *chapini* and allowing discernable morphological divergence to have taken place between the two

In spite of a long separation between *ilyai* and *chapini*, their songs are still virtually identical, just as in the songs of Alexander's akalat from Mahale, Kabobo and Mt. Cameroon. The latter similarity is all the more surprising because these forms are separated by much more significant biogeographical barriers. Therefore, divergence in the relatively simply songs of this group appears to be more conservative than morphological divergence. It is extremely unlikely that the vocal differences between *C. b. ilyai* and *C. b. kungwensis*, and by extension, between Bocage's and

Alexander's akalats, could have arisen over a short distance in western Tanzania with no significant ecological or biogeographical barriers.

Yellow-crested Helmet-Shrike, *Prionops alberti*

The Yellow-crested Helmet-Shrike is one of the lesser-known Albertine Rift endemics. The type specimen was found dead and mummified on the summit of Mt. Mikeno, one of the Virunga Volcanoes (Chapin 1954). It is known only from half a dozen sites and, up to now, its vocalizations remained unrecorded (Fry *et al* 2000). During this fieldwork this species was encountered in groups of between 3 and 8 individuals from 1,770 m to 2,474 m. Several recordings were made of its calls by Elia Mulungu (Figure 4.7). Although it is difficult to describe the complex calls of Helmet-Shrikes in words, the spectrograms above can be rather imperfectly described as follows:

A = Musical far-carrying double notes most characteristic of this species, with a second bird overlaying an oriole-like liquid bubbling type call in the middle of the sequence.

B= up slurred 'dzreeeeooo' repeated twice then a chattering call similar to that given by most of the other species of Helmet-Shrikes.

C=sharply down slurred 'zwerp', 'zwerp', then a nasal 'gurry-gurry', repeated 4 times followed by a piping that is vaguely reminiscent of one of the calls of the Dusky Long-tailed Cuckoo, *Cercococcyx mechowi*.

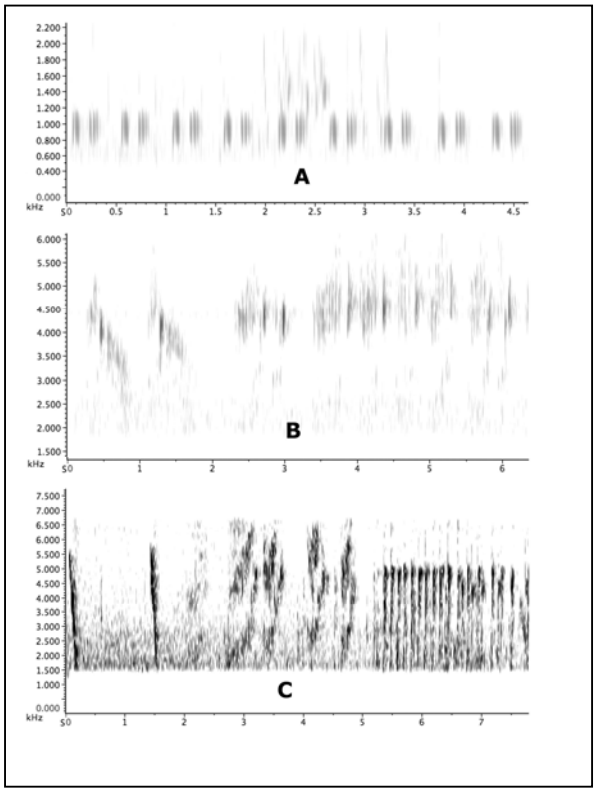


Figure 4.7. Spectrogram of the vocalizations of the Yellow-crested Helmet-Shrike, *Prionops alberti*

Discussion

The surveys we made increased the number of Albertine Rift endemic bird species from 18 to 22. However we have also thrown doubt on the taxonomy of the Kabobo Apalis which may need to be revised based on the recordings of its calls that we made. It may be better to classify it as a sub species of the chestnut-throated Apalis. This would reduce the number of endemic species to 21. Only six other sites have more Albertine Rift endemic bird species (Itombwe Massif, Kahuzi Biega Park, Nyungwe Park, Virunga Park, West of Lake Edward and Bwindi Impenetrable Park). Misotshi-Kabogo therefore ranks higher than most of the 33 sites where birds have been surveyed in the Albertine Rift.

In addition we have increased the total species list for the forest from 231 to 305 species making the place far more significant for bird conservation. Fifteen of the 33 sites in the Albertine Rift have more species recorded than Misotshi-Kabogo but most of these are in Uganda where the effort made in recording species is far greater. Previously bird surveys to this region had involved sending collectors to the forest, who collected specimens which were later identified to produce a species list. This was the first study for the region which provided quantitative data on relative species abundances (figures 4.4a and b) and allowed accumulation curves to be produced (figures 4.1 and 4.2). The accumulation curves indicate that we managed to survey a good majority of the bird species in the forest although there are still likely to be some other species to find. Most of the curves are leveling off for most of the sites. We therefore believe that the 305 species which now are listed for the region are probably a reasonable estimate but may increase to about 350-400 with longer term studies. Often the lists are augmented by occasional migrant species or unusual records (such as pelicans flying over a forest) and as a result total lists don't mean very much.

Of the species listed for the forest the Yellow-crested Helmet Shrike is listed as Vulnerable and the Kabobo Apalis as data deficient by the IUCN red list. All other species are not considered to be threatened. As such the forest is not particularly rich in threatened bird species. Kabobo Apalis was only observed above 1,600 metres and up to 2,750 metres a.s.l. (maximum altitude of forest block). It is unlikely therefore to occur in the gallery forest to the west of the main forest block which lies at about 1,500 metres a.s.l. As such it is probably confined to this forest unlike the Kungwe Apalis across the lake which is widespread around the Mahale Mountains National Park at lower altitudes (Moyer *et al.* 2006). If it remains a distinct species it probably deserves some form of threatened status based on the fact that the forest is unprotected as yet and that it is likely confined to this forest block.

We obtained the first recording of Kabobo Apalis and Yellow-crested Helmet Shrike calls and these will be posted on the WCS Albertine Rift web site (www.albertinerift.org) for any ornithologists to download freely. We hope this will help with the identification of these two species in future forest surveys and allow better records of their distributions to be made.

CHAPTER 5: Herpetological surveys

D.Moyer, E.Mulungu, J. Matunguru, M. Menegon, D. Meirte and A.Plumptre

Introduction

Reptiles and amphibians have been less frequently carried out in Albertine Rift Forests and these Herpetiles are therefore less well known from the region. It is known that about 119 amphibian species and 175 reptile species can be found in the Albertine Rift (Plumptre et al. 2003), of which 16 reptiles and 36 amphibians are endemic to the Albertine Rift (Plumptre et al. 2007). The Belgian herpetologist Laurent collected from the Kabobo region during the 1950s and his collection is housed at the Africa Museum in Tervuren and he published on some of the species he collected (Laurent 1952). With the help of Danny Meirte at this Museum the list of endemic species for the Albertine Rift was compiled in 2003. He identified seven endemic amphibian species and two endemic reptiles that occur in the Mistotschi-Kabogo region:

Amphibians:
1. Callixalus pictus
2. Hyperolius leucotaenius
3. Leptopelis fiziensis
4. Phrynobatrachus dalcqi
5. Schoutedenella hematogaster
6. Schoutedenella pyrrhoscelis
7. Xenopus wittei

Reptiles:
1. Atheris nitschei
2. Chamaeleo schoutedeni

However, a complete list for the forest has not been compiled to our knowledge. As part of these surveys we aimed to collect specimens of amphibians and reptiles and collate date on existing specimens held at the Africa Museum in Tervuren to start to create a list for the two sites; Misotshi-Kabogo and Muganja Hills.

Methods

Amphibians and reptiles were collected wherever they could be found during the surveys. Elia Mulungu and Joseph Matunguru would search around small rivers and streams at each camp site visited by one of the survey teams (Camps B1, B2, C1, C2, C3 in Misotshi-Kabogo and Camps M1 and M2 in the Muganja Hills). Reptiles and Amphibians were caught by hand or net and preserved in 10% formalin. On completion of the surveys the specimens were transferred to Tanzania for identification by David Moyer and Michel Menegon, with permits from the Centre de Recherche en Sciences Naturelles de Lwiro. Notes were made of the GPS position of the collection locations for the specimens and their distance to streams/rivers and habitat type where collected.

41 specimens of amphibian were collected in the Muganja hills and 85 specimens in the Misotshi-Kabogo Forest. Five snakes and 3 chameleons were also collected in the Misotshi-Kabogo Forest.

Danny Meirte, in the Herpetology Department at the Africa Museum in Tervuren, also compiled a list of species that had been collected in the past within the two areas delimited in figure 1.3.

Results

Species that had been collected from these two regions previously included 40 reptiles (Table 5.1) and 26 amphibians (Table 5.2).

Table 5.1. List of reptile species collected in the Misotshi-Kabogo and Muganja hills regions and located at the Africa Museum, Tervuren.

Species	Misotshi-Kabogo	Muganja Hills
Acanthocercus cyanogaster	1	1
Atheris nitschei	1	
Bitis arietans		1
Lamprophis lineatus	1	1
Boulengerina annulata stormsi	1	
Causus rhombeatus		1
Chamaeleo dilepis idjwiensis	1	
Chamaeleo dilepis dilepis		1
Chamaeleo gracilis gracilis	1	
Chamaeleo johnstoni	1	
Chamaeleo quilensis	1	1
Chamaeleo rudis rudis		1
Chamaeleo rudis schoutedeni	1	
Crotaphopeltis hotamboeia	1	1
Dasypeltis atra	1	
Dasypeltis scabra	1	1
Dipsadoboa shrevei shrevei	1	
Dipsadoboa unicolor viridiventris	1	
Dromophis lineatus		1
Duberria lutrix currylindhali	1	
Hemidactylus mabouia	1	
Kinixys belliana	1	
Lycodonomorphis bicolor		1
Lycophidion capense jacksonii	1	
Lygodactylus angularis paurospilus	1	
Lygodactylus picturatus gutturalis		1
Mabuya maculilabris		1
Mabuya striata		1
Naja nigricollis atriceps		1
Natriciteres fuliginoides		1
Natriciteres olivacea		1
Pelomedusa subrufa subrufa		1
Philothamnus heterodermus ruandae	1	
Philothamnus heterolepidotus	1	1
Philothamnus irregularis irregularis	1	
Philothamnus semivariegatus semivariegatus	1	
Psammophis sibilans		1
Python sebae	1	
Mochlus sundevalli		1
Typhlops angolensis adolfi		1

Table 5.2. List of amphibian species collected in the Misotshi-Kabogo and Muganja hills regions and located at the Africa Museum, Tervuren.

Species	Misotshi-Kabogo	Muganja Hills
Afrana angolensis	1	
Afrixalus wittei	1	1
Hydrophylax galamensis		1
Arthroleptis stenodactylus stenodactylus		1
Bufo regularis		1
Callixalus pictus	1	
Hemisus guineense katanganum	1	
Hemisus marmoratus		1
Hyperolius kivuensis		1
Hyperolius argentovittis		1
Hyperolius nasutus nasicus		1
Kassina senegalensis angeli	1	
Leptopelis anchietae		1
Leptopelis bocagii		1
Leptopelis lebeaui		1
Leptopelis kivuensis	1	
Leptopelis viridis	1	
Phrynobatrachus dalcqi	1	
Phrynobatrachus natalensis		1
Phrynobatrachus perpalmatus		1
Ptychadena bibroni		1
Ptychadena mascareniensis mascareniensis		1
Ptychadena oxyrhynchus		1
Ptychadena uzungwensis	1	
Xenopus laevis laevis		1
Xenopus wittei	1	

Species collected from Misotshi-Kabogo were identified by Michele Menegon. Several specimens are still in the process of being identified and the current list is given in Table 5.3. Amphibian taxonomy follows Frost et al. (2006). References consulted included Amiet (1973), Barbour and Loveridge (no date), Channing and Howell (2005), De Witte (1921), Drewes and Vindum (1994), Laurent (1952, 1956, 1958, 1974), Pitman (1974), Schiøtz (1975,1999), Spawls *et al.* (2002) and Vonesh (1998).

Table 5.3. List of amphibians and reptiles collected in Misotshi-Kabogo Forest.

Amphibia
Arthroleptidae
Arthroleptis sp.
Leptopelis kivuensis Ahl
Hyperolidae
Afrixalus laevis Ahl
Hyperolius argentovittis Ahl
Hyperolius sp. 1
Hyperolius sp. 2
Hyperolius sp. nov.
Hyperolius castaneus Ahl
Pyxicephalidae
Amietia angolensis (Bocage)
Phrynobatrachidae
Phrynobatrachus sp. nov.
Phrynobatrachus sp.
Reptilia
Chamaleonidae
Rhampholeon boulengeri Steindachner
Colubridae
Dipsadoboa unicolor Günther
Elapidae
Naja melanoleuca Hallowell
Viperidae
Atheris nitschei Tornier

Comments on the list of species collected:

Reptiles:
Atheris nischei and *Rhampholeon boulengeri* are Albertine Rift endemics and this adds an additional endemic reptile to the list for Misotshi-Kabogo. *Dipsadoboa unicolor* and *Naja melanoleuca* are Guineo-Congolian species.

Amphibians
The Identification of the species belonging to the genus *Arthroleptis* are always difficult because the species boundaries are very poorly defined. For some species groups revision based on DNA are ongoing. Care must therefore be taken when identifying this group and it takes time to identify them to species. Some *Hyperolius* are also hard to identify and as yet only two of the species have been identified.

Two specimens not fitting the description of any known species belong to an undescribed taxon. Further analyses are ongoing to assess their taxonomic status.

One of the specimens initially looked like a *Phrynobatrachus.* After further analysis, because of the apparent lacking of the tarsal tubercle that is diagnostic for *Phrynobatrachus*, it was tentatively assigned to the genus *Petropedetes* on the ground of some morphological features and also because there is some evidence of

the possible presence of an undescribed *Petropedetes* species in the albertine area based on some tadpoles collected by Drewes in the Impenetrable forest (Drewes & Vindum, 1994). However, after taking x rays of the terminal phalanges of the fingers of these frogs traces of the tarsal tubercles were found in some specimens and based on this evidence the final opinion is that the material collected belong to an undescribed large-sized *Phrynobatrachus* (thus not *Petropetedes*). Additional molecular analyses indicate also that this specimen is a *Phrynobatrachus*. The description of this species is currently being written up.

There are therefore likely to be at least two new amphibian species for science, one *Phrynobatrachus* and one *Hyperolius*.

Discussion

Eighty specimens of amphibians and five reptiles were collected in the Misotshi-Kabogo forest during a two month period of surveys. It appears that two of the amphibians are new to science. In addition four new amphibian species for the list for this region were added and two new reptile species.

Previous collections focused on the western side of the massif around the hill called Kabobo and to the west towards the road linking Kalemie to Uvira. The collections in this survey were made around the camps B, B2 and C1, C2 and C3 and therefore covered only a small area of the massif during only one season. It is very likely that with further collecting effort that more species would be identified for the forest as only a fraction of the list provided by the Africa Museum in Tervuren were found. We therefore believe that it is likely further new species for science could be found.

The data to date show that at least 14 amphibian species occur in the Misotshi-Kabogo forest block and 26 reptile species. Seven of the amphibians endemic to the Albertine Rift have been identified for this forest block with a possible two additional species to be added if they are proved to be new species. Two endemic reptile species are also known from the region. Only five other sites (Bwindi Impenetrable Park, Virunga Park, Itombwe Massif, Kahuzi Biega Park and Nyungwe Park) have more endemic amphibians. In addition one species that occurs here is endangered and four others vulnerable under IUCN threatened status criteria. It is probable that the two new species should deserve a threatened status. Misotshi-Kabogo therefore appears to be fairly important for amphibian conservation.

CHAPTER 6: Botanical Surveys

B. Kirunda, A.J.Plumptre, J.Kyamanywa and G. Bashonga

Introduction

Plants have been surveyed over large parts of the Albertine Rift Forests and hence are useful when wanting to make comparisons of the diversity between sites. Plants are also much more sessile and hence more likely to evolve into different species when isolated for long periods in geological history. It is thought that the Misotshi-Kabogo massif has been isolated from the Itombwe Massif to the north for at least 10,000 years (Progogine, 1960) and therefore we expected to find some interesting plant species in this region.

Although plants have been collected throughout eastern DR Congo and there are probably collections from the Misotshi-Kabogo and Muganja Hills regions the specimens are housed in museums and we do not know of any compiled lists for this area. As a result it is difficult to assess the importance of the region botanically.

We therefore created two teams of botanists to collect all flowering plants and ferns from the various camps visited in the two areas with the aim of creating species lists for the two sites.

Methods

Two methods were used to obtain both qualitative and quantitative data for plants at each camp. Firstly the botanical teams collected any plant that they encountered at each site and when working from the camps. The aim of this was to create a species list for each camp. Secondly plants were recorded and counted in plots situated at the same points every 250 metres along the transect/reconnaissance routes that were used by the large mammal, and the ornithology teams. All herbs were recorded in a 2 metre radius circular plot; all lianas over 1cm DBH, and all trees between 2.5-10.0 cm DBH recorded in a 5 metre radius plot; and all trees larger than 10.0 cm DBH recorded in a 20 metre radius plot in diameter categories. The aim of the second method was to provide quantitative data to identify the dominant species, and relative abundance of different species and also to allow comparisons with other forests in the Albertine Rift.

Two teams were formed that worked at all sites in the Misotshi-Kabogo Forest. It was not possible to keep these teams for the Muganja Hills region because of financial reasons and therefore this are was not surveyed for plants.

Over 1000 specimens were collected in the forest and are in the process of being identified to species level. This will take several months, but given the imperative of highlighting the conservation importance of this area we summarise the species numbers below. It has been possible to sort the specimens to calculate a total number of plant species for each camp site and this is what we present here.

Results

A total of 1,135 species of plant were recorded from 156 plant families in the whole Misotshi-Kabogo region (appendix2). This places Misotshi_kabogo as the fifth richest site for plants in the Albertine Rift region (Plumptre et al. 2003). The number of species by plant type are given in Table 6.1.

Table 6.1. The total number of plant specimens for each camp in various categories of plant type. Some species were not classified as a plant type and hence the total number of species exceeds the sum of the different plant types.

Plant type	A1	B1	B2	C1	C2	C3	D1	D2	Total
Fern	33	24	26	38	37	39	38	21	**119**
Grass	7	7	28	3	9	18	2	1	**44**
Herb	66	72	130	63	91	128	62	25	**351**
Liana	74	44	49	58	37	33	39	47	**189**
Shrub	70	81	94	83	45	57	30	49	**252**
Tree	141	57	68	67	50	34	60	76	**238**
Total	**391**	**285**	**395**	**312**	**269**	**309**	**231**	**219**	

The species accumulation curves show that camps B2, A1 and C1 are the more diverse sites (Fig. 6.1). A1 and C1 are lower altitude sites but B2 was a high altitude site which contained a mixture of forest and grassland.

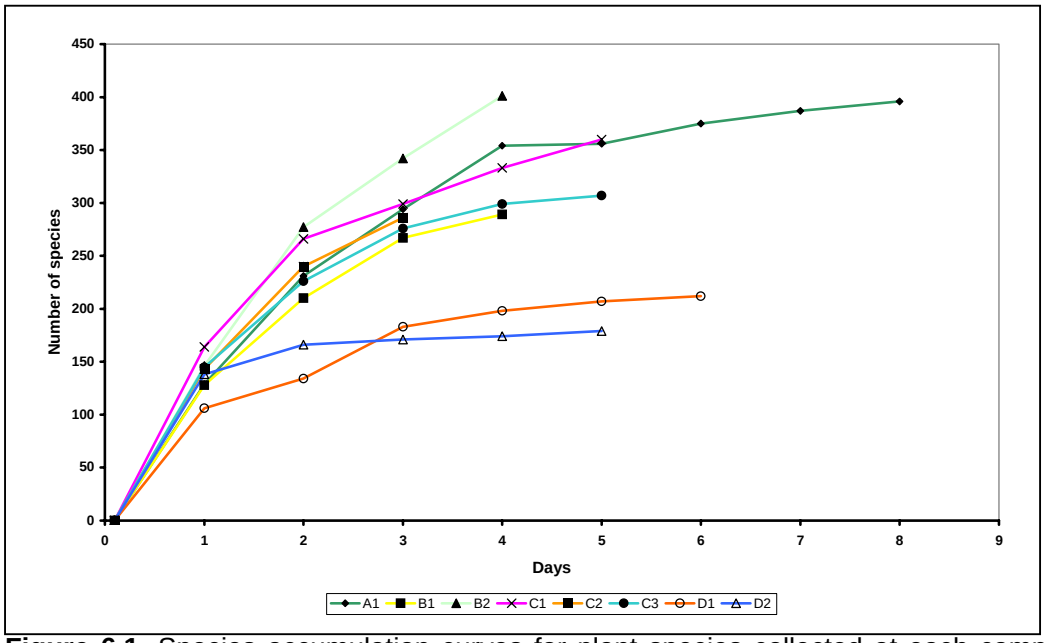


Figure 6.1. Species accumulation curves for plant species collected at each camp site using total list data.

The relative abundance of plant species is plotted in figure 6.2 and shows that plant diversity was high at low altitudes or where there were several major habitat types.

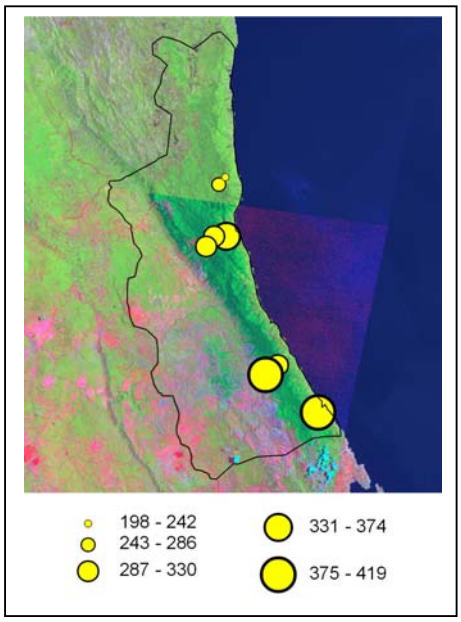


Figure 6.2. The relative abundance of plant species mapped for the MIsotshi-Kabogo forest block.

Discussion

The results presented here show that this forest is rich in plant species. Not many sites in the Albertine Rift have more than 1000 plant species. Given the diversity of birds, amphibians and mammals and that there are several species or subspecies in these groups from this area we expect to find new species of plant amongst the samples we have. The botanists who collected the specimens, and who have worked in most of the other forests in the Albertine Rift, found several species they could not identify immediately and we therefore believe that it is probable that there are new species. These will be identified in due course by experts in Europe or the USA.

CHAPTER 7: Impacts of man and the future conservation of Misotshi-Kabogo and Muganja Hills regions

A.J.Plumptre and D.Kujirakwinja

Introduction

It is clear from the biodiversity survey work and the estimate of chimpanzee numbers that the Misotshi-Kabogo region is of conservation importance. The Muganja hills was not so diverse from the bird and mammal surveys made there and may only be of conservation interest if the chimpanzees in this region proved to be different to those north of the Lukuga river. In this chapter we assess some of the threats to both regions surveyed and also the potential for developing any form of conservation area in the Misotshi-Kabogo region.

We wanted to measure the presence of people in the two regions to allow us to better assess the potential for conservation of these two sites. If the areas were heavily populated for instance it would be very difficult to establish a conservation area.

During the surveys we collected data on signs of human impact in the forest to provide a comparative assessment with other forests in the Albertine Rift. On the recce and transect walks any signs of human impact were noted and GPS positions taken. Human impacts included signs of hunting (snares and pitfall traps), logging (pitsawing sites, tree stumps), human use of the forest (huts, latrines, footpaths) and mining sites (gold mining disturbance). We calculated encounter rates for each type of human sign based on the measured distances walked (see chapter 2). The teams recording large mammal sightings and chimpanzee nests also recorded human sign as they traveled further than the other teams each day.

Results

Human impacts in general

Very little sign of human impact was observed in either region when compared with other areas in the Albertine Rift. Most of the human impacts occurred near the southern edge of the Misotshi-Kabogo region nearest to the town of Kalemie and from where people appear to be moving northwards to settle and cultivate. Most of the human impact in this region included timber harvesting (Figure 7.1). Deeper in the forest, artisinal gold mining was taking place, particularly at the highest altitudes. We interviewed miners and local villagers to obtain a better understanding of the mining activity as it was clear that this was one of the major threats to the Misotshi-Kabogo region. The results of these interviews are summarized below.

It was clear from the low density of primates and ungulate sign that hunting of large mammals was relatively common also. However, few signs of snares were found in the forest except near Misotshi mountain (camps D). Interviews with local people made it clear that there were a few hunters who regularly supplied the mining camps with meat using shot guns to hunt the mammals. Several of the people we hired to guide us in the forest were hunters and interviews with them indicated that they did not earn very much from hunting but mainly hunted to supplement what they obtained from their fields and fishing.

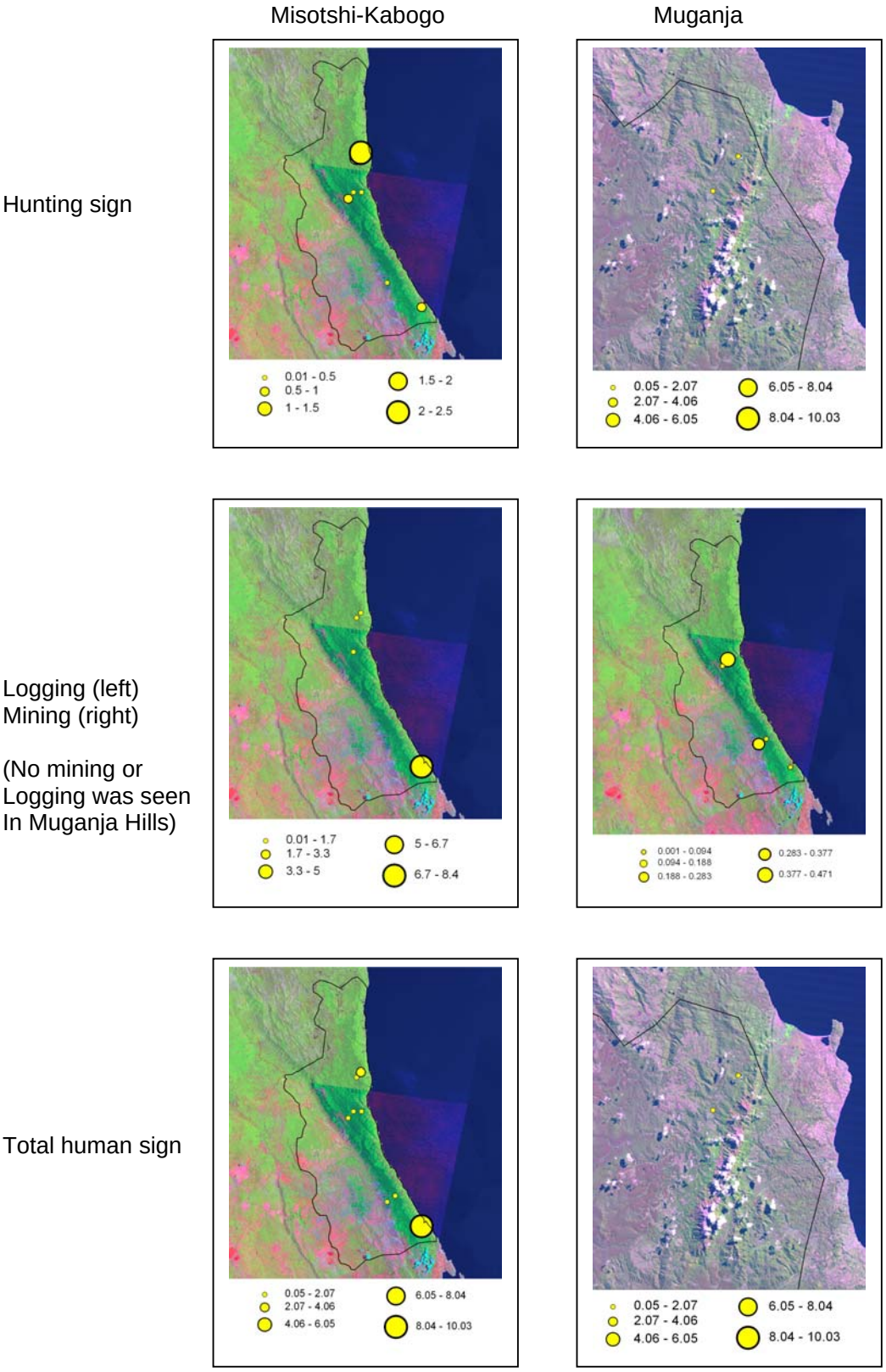


Figure 7.1 Relative encounter rates of different human sign in the Misotshi-Kabogo and Muganja Hills regions. Both maps are plotted to the same scale.

We were told that hunting of chimpanzees was a taboo in the Babembe culture which probably is why this species appears to be relatively abundant and occurs at densities similar to those at other sites in the Albertine Rift where hunting doesn't occur. However, other ethnic groups which are moving into the area to mine for gold were hunting this species occasionally and we were shown skins and body parts of chimpanzees at some villages.

There were no permanent villages or settlements that we could identify within either region, only temporary mining settlements and military camps. The only villages in the Misotshi-Kabogo region occurred along the lake shore and the people were mostly fishermen, fishing for themselves with little trade to other villages or towns.

Gold mining

Most of the miners operating in the forest came from Bukavu region and not from the villages along the lake shore. Historically the Belgians had explored this region in the 1950s and people remembered a Belgian man who camped in the forest near the higher altitudes and collected gold from various sites (hiding the gold in a pit under his tent which can still be seen today). Following independence in 1960 Laurent Kabila started a business of mining gold in the forest and exporting it to Tanzania to support his rebellion in the region. This mining continued throughout the 1960s and 1970s until he was ousted from the forest in 1980. As a result most of the people living in the fishing villages stated that there is little gold to be found these days and although several of the people we employed had tried mining at one time, they had given it up because the rewards were so poor. The miners from Bukavu stated that they walk from Bukavu to Misotshi-Kabogo (about a 4 day walk – 300 km in a direct line) because they have been robbed in the past when carrying gold. Some had been living in the forest away from their families for many years – one had been there for 20 years and still had not found a major strike. One of the reasons they mine in this region is because it is not a protected area and they are less likely to face problems from ICCN rangers (compared to miners in Kahuzi Biega Park which is close to Bukavu).

Many miners stated they sell the gold they collect to middle men who export the gold and probably make most of the profit. We met some of these middle men who hike up to the camps from the lake shore. Those we met came from Kalemie or Uvira. Those people who had given up mining stated that they only made about $20-40 per month from mining and that they didn't believe it was worth the hardship.

The village chiefs from the villages on the lake did not view the miners from Bukavu with any great fondness although all of them pay these chiefs to be allowed to mine in their sector of the forest. There is some local trade in fish and maize flour between the fishing villages and the mining camps which probably boosts the economy of the fishing villages to some extent also. However, this economy is likely to be small.

Conservation options

It is clear from the results of the biodiversity surveys that the Misotshi-Kabogo forest block is important globally for conservation. We believe we may have three new mammal species and two new frog species for the world after only a short survey period and hence it is possible that other species may occur here. Chimpanzees were relatively abundant in the forest and we estimate that a viable population still exists in the Misotshi-Kabogo region. Hair samples were collected for this species for genetic analyses and this may throw light on the relative differences that occur within *P.t. shweinfurthii* in this region. Unfortunately we were unable to collect any hair samples from the Muganja hills, despite our desire to obtain some samples because

these animals are found south of the Lukuga river. With follow-up visits to the region we hope we will be able to obtain some fresh hairs in future.

We believe therefore that the forest is worthy of some form of protected status. In DR Congo there are several protected area categories including National Park, Faunal Reserve and Community Reserves. At each of the fishing villages we visited we discussed the idea of possibly creating some type of protected area, but emphasizing that this would only be made with consultations with the local communities. In general most of the local chiefs were positive towards this idea, particularly if they were consulted as part of the process and several offered to try to stop hunting in the areas under their jurisdiction. When asked why they were positive they told us that they believed that a protected area would bring a 'spotlight' to their part of the world, which has been neglected for over 50 years, and that it could bring development possibilities in future.

We therefore believe that it is both important to create a protected area of some form in the Misotshi-Kabogo region but we are less sure that the Muganja Hills region deserves this. We also believe that it would be possible to obtain local support fairly easily given our discussions with people living around Misotshi-Kabogo. The main issue that would need to be resolved is the possibility of funding the conservation of this area on a longer term basis such that the local people obtain some benefits that would offset what they would lose through the loss of earnings from portering supplies and selling food to mining camps.

Access to the forest from the lake is very hard – at least a 4-5 hour hike on very steep hills for fit people and probably twice this for an average tourist. Once at the higher altitudes though the forest-grassland mosaic is very beautiful and has potential for tourism (Photo 3 – chapter 1). It may be possible to access this area from the Kalemie-Uvira road more easily, particularly if the old road to the Kabobo hill region was opened up. There might also be potential for horse riding safaris in the grassland-forest mosaic to the west of the massif and up the escarpment to the western side of the forest if an investor could be identified to invest in this. We observed chimpanzees, bushbuck, red forms of bush pig and signs of other large mammals using these areas despite relatively intensive hunting and with protection it could become a beautiful place to view wildlife. It might also be possible to develop a tourism circuit based on lake Tanganyika that would visit four main sites on the lake: Gombe Stream National Park, Mahale Mountains National Park (both to visit chimpanzees) and then across to the Misotshi-Kabogo region for trekking/horse riding safaris and up to Burton Bay where it is proposed to create a park on Lake Tanganyika. The diversity of fish makes snorkeling and diving a great possibility for this area.

Other options for funding the conservation of this forest that don't involve tourism could include avoided deforestation under a Carbon sequestration/credit scheme. Companies are looking for areas which might be deforested in the near future that they could obtain carbon credits from paying to prevent their deforestation and the Misotshi-Kabogo region could provide about 1,200 km^2 of forest for such a scheme.

The boundary we have used for the Misotshi-Kabogo region in this report is where we believe a protected area might be created. It avoids any permanent settlements that we know about or could identify on satellite imagery and extends up to the road in the west which could form an obvious boundary. More surveys over this region are needed to better define the boundary limits and also an assessment needs to be made about possible linkages to the Luama Game Reserve that lies to the west of Misotshi-Kabogo.

Follow up needs

If a protected area is to be created in the Misotshi-Kabogo region there needs to be some fairly rapid follow-up to these surveys. People are moving into the region from the south and north and over the next few years we would expect this to accelerate as peace comes to the region. It is clear that many of the local leaders viewed the potential of a protected area as a positive move and we believe that two main activities are now needed as follow up actions:

1. There is a need to bring together the local leaders from all the villages surrounding the potential protected area, provincial leaders from Kalemie, Lubumbasi and Uvira, and members from ICCN and Forest Department in Kinshasa to present the results of this survey and to discuss the idea of creating a protected area with everyone, and to allow their inputs and desires to be heard.

2. There is a need to survey the potential boundaries for a protected area and better delimit where it would occur on the ground in discussion with provincial authorities and local leaders. Initially it would be useful to map the region using aerial photography or high resolution satellite imagery to better identify where settlements occur in the region and to assess potential boundaries and natural features that could act as limits.

Once these are completed and provided that there is enough local support we believe it would be relatively easy to then proceed to create a protected area to conserve the rich biodiversity of this region.

Some funding from the US Fish and Wildlife Service and USAID have been provided to start the follow up to this work by undertaking a survey of local people's attitudes towards the creation of a protected area in this region. This socioeconomic survey will also help in the design of the reserve boundaries and will aim to create something that is supported by the local community as well as provincial and national authorities.

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Appendix 1. List of bird specimens collected by the Field Museum of Chicago and effort required to make the collections. Below are collecting localities, summaries of mist-netting effort and lists of specimens collected during our surveys of Kabobo Forest, D. R. Congo. Please refer to the Transect/point count section for more complete bird lists. For detailed vegetational site descriptions see the Botanical Surveys.

Camp 1: "Mizimu" Dem. Rep. of Congo, Katanga Province, Kabobo Forest, ca. 3km W Mizimu S 5° 28" 45'/E 29° 16" 42' 1250m.

Table 1. Mist-net sampling effort at Mizimu (Camp A).

Date	Hours	Nets	Net hours	Meter Net Hours
29 January 2007	6	12	72	864
30 January 2007	11.5	12	138	1656
31 January 2007	12	12	144	1728
1 February 2007	12	12	144	1728
2 February 2007	12.5	12	150	1800
	5	9	45	540
3 February 2007	11.5	9	103.5	1242
4 February 2007	12.5	9	112.5	1350
	6	12	72	864
5 February 2007	24	9	216	2592
	12	12	144	1728
6 February 2007	9	12	108	1296
	8.5	9	76.5	918
		TOTAL	**1525.5**	

Table 2. Bird voucher specimens collected at Mizimu (Camp A).

Scientific Name	Common Name	Male/Female (♂/♀)
Althe diademata woosnami	Fire-crested Alethe	1♀
Alethe poliocephala carruthersi/ufipae	Brown-chested Alethe	5♂, 5♀
Bleda syndactyla woosnami	Red-tailed Bristlebill	1♂, 1♀
Nectarinia olivacea vincenti	Olive Sunbird	6♂, 2♀
Phyllastrephus fischeri sucosus	Cabanis Greenbul	4♂, 3♀
Platysteira concreta	Yellow-bellied Wattle-eye	5♂, 6♀
Pycnonotus masukuensis kakamegae	Shelly's Greenbul	1♂
Pycnonotus virens virens	Little Greenbul	2♂, 4♀
Pycnonotus latirostris eugenius	Yellow-whiskered Greenbul	1♂, 7♀
Stizorhina fraseri	Frasers Ant-thrush	1♂
Trichastoma fulvescens ugandae	Brown Illadopsis	2♂, 1♀
Trichastoma albipectus	Scaly-breasted Illadopsis	1♂

Camp 2. "Talama 1" Dem. Rep. of Congo, South Kivu Province, Kabobo Forest, ca. 4km SW Talama. 1950m.

Table 3. Mist-net sampling effort at Talama 1 (Camp D1).

Day	Hours	Nets	Net Hours	
1	10	12	120	1440
2	12	12	144	1728
3	12	12	144	1728
	4	8	32	384
4	24	20	480	5760
5	24	20	480	5760
6	11	20	220	2640
		TOTAL	**1620**	

Table 4. Bird voucher specimens collected at Talama 1 (Camp D1).

Scientific Name	**Common Name**	**Male/Female (♂/♀)**
Alethe poliophrys kaboboensis	Red-chested Alethe	2♂, 8♀
Apaloderma vitattum	Bar-tailed Trogon	1♂
Batis diops	Rwenzori Batis	2♂, 1♀
Cercococcyx montanus	Barred Long-tailed Cuckoo	1♀
Cossypha bocagei kaboboensis	Bocage's Akalat	1♀
Cossypha roberti rufescentior	White-bellied Robin-chat	7♂, 1♀
Cossypha archeri kimbutui	Archer's Robin-chat	1♀
Nectarinia alinae kaboboensis	Blue-headed Sunbird	6♂, 4♀
Nectarinia regia kivuensis	Regal Sunbird	3♂, 1♀
Phyllastrephus flavostriatus olivaceogriseus	Yellow-streaked Greenbul	3♂. 2♀
Phylloscopus laetus schoutedeni	Red-faced WoodlandWarbler	2♂
Pogonocichla stellata ruwenzori	White-starred Robin	4♂, 2♀
Pycnonotus masukuensis kakamegae	Shelly's Greenbul	6♂, 3♀
Pycnonotus tephrolaemus kikuyuensis	Mountain Greenbul	7♂, 4♀
Pycnonotus latirostris eugenius	Yellow-whiskered Greenbul	7♂, 3♀
Sylvietta leucophrys chloronota	White-browed Crombec	1♂
Trichastoma pyrrhopterum pyrrhopterum	Mountain Illadopsis	2♂, 1♀
Trichastoma poliothorax	Gray-chested Illadopsis	2♂
Trochocercus albonotatus albonotatus	White-tailed Elminia	1♂, 1♀
Zoothera tanganjicae	Abyssinian Ground Thrush	1♂, 1♀

Talama 2: Dem. Rep. of Congo, South Kivu Province, Kabobo Forest, ca. 4km SW Talama. S 4^{o} 59" 05'/E 29^{o} 05" 34' 1600m.

Table 5. Mist-net sampling effort at Talama 2 (D2).

Day	Hours	Nets	Net Hours	
1	11.5	8	92	1104
2	11	8	88	1056
3	4	4	16	192
4	24	8	192	2304
5	23.5	4	94	1128
6	24	10	240	2880
7	6	10	60	720
		TOTAL	**782**	

Table 6. Bird voucher specimens collected at Talama 2 (Camp D2).

Scientific Name	Common Name	Male/Female (♂/♀)
Alethe poliophyrys kaboboensis	Red-chested Alethe	5♂, 3♀
Alethe poliocephala carruthersi/ufipae	Brown-chested Alethe	1♂, 2♀
Bleda syndactyla woosnami	Red-tailed Bristlebill	1♂, 1♀
Cossypha bocagei kaboboensis	Bocage's Akalat	3♂, 1♀
Cossypha natalensis intense	Red-capped Robin-chat	1♂♀
Nectarinia olivacea vincenti	Olive Sunbird	4♂, 1♀
Phyllastrephus flavostriatus olivaceogriseus	Yellow-streaked Greenbul	2♂, 2♀
Pycnonotus virens virens	Little Greenbul	1♂
Pycnonotus latirostris eugenius	Yellow-whiskered Greenbul	9♂, 6♀
Pycnonotus tephrolaemus kikuyuensis	Mountain Greenbul	7♂, 4♀
Zosterops senegalensis reichnovii	African White-eye	1♀

Appendix 2. List of plant species by collection site.

Family	Species	A1	B1	B2	C1	C2	C3	D1	D2
Acanthaceae	Acanthus montanus	1	1	1	1				1
	Acanthus pubescens	1						1	1
	Anisosepalum alboviolaceum	1							
	Brachystephanus africanus		1		1	1			
	Brillantaisia cicatricosa	1		1	1	1	1	1	1
	Brillantasia patula								1
	Hypoestes aristata			1					
	Hypoestes forskaolii	1							
	Hypoestes triflora							1	
	Isoglossa				1				
	Isoglossa punctata		1						
	Justicia			1					
	Mellera		1						
	Mendocia gilgiana				1				
	Metarungia pubinervia			1					
	Mimulopsis aborescens	1	1		1	1		1	1
	Mimulopsis runssorica	1							
	Mimulopsis solmsii	1	1	1	1	1			1
	Pseuderanthemum ludovicianum	1			1				
	Sclerochiton vogelii			1		1			
	Thunbergia	1							
	Thunbergia affinis				1				
	Thunbergia alata				1				
	Thunbergia erecta			1					
	Thunbergia mildbraediana	1						1	
	Thunbergia vogeliana	1							1
Adiantaceae	Afropteris repens	1							
	Doryopteris kirkii			1					
	Pityrogramma humbertii		1						
Alangiaceae	Alangium chinense	1					1	1	
Amaranthaceae	Achyranthes aspera	1							
	Amaranthus dubius	1							
	Celosia anthelminthica								1
	Celosia globosa		1		1	1			
	Celosia schweinfurthiana					1			
	Cyathula prostrata	1							
	Sericostachys scandens			1	1		1	1	
Amaryllidaceae	Scadoxus cinnabarinus	1							
Anacardiaceae	Lannea schweinfurthii	1							
	Lannea welwitschii	1							
	Pseudospondias microcarpa	1					1	1	
	Rhus ruspolii			1					
	Trichoscypha acuminata	1							
	Trichoscypha arborea	1		1	1				
	Trichoscypha ulugurensis ssp submontana	1	1	1	1	1			
Ancistrocladaceae	Ancistrocladus korupensis		1	1					
Annonaceae	Annonidium mannii var mannii	1			1	1			1
	Cleistopholis patens	1							
	Exellia scamnopetala	1							
	Isolona congolana		1	1					
	Monanthotaxis ferruginea	1		1					
	Monanthotaxis littoralis	1							
	Monanthotaxis lucidula								1
	Monanthotaxis orophila	1			1	1		1	

	Monanthotaxis schweinfurthii				1				
	Monanthotaxis trichocarpa	1							
	Monodora angolenseis	1							
	Monodora myristica	1					1		1
	Polyalthia suaveolens	1							
	Uvaria angolensis	1	1						1
	Uvaria welwitschii				1				1
	Xylopia cupularis	1							
	Xylopia rubescens				1				
	Xylopia staudtii	1	1						
Anthericaceae	Chlorophytum beniense			1					
	Chlorophytum comosum			1					
	Chlorophytum elgonense				1				
	Chlorophytum filipendulum		1						
	Chlorophytum spasiflorum				1				
Apiaceae	Agrocharis incognata					1			
	Centella asiatica					1	1		
	Cryptotaenia africana							1	
	Hydrocotyle mannii					1		1	
	Hydrocotyle sibthorpioides		1	1		1	1		
	Oenanthe mildbraedii							1	
	Oenanthe procumbens					1			
	Peucedanum aculeolatum				1	1	1		
	Sanicula alata	1			1	1	1	1	
	Thalictrum rhynchocarpum		1	1	1				
Apocynaceae	Ancylobotrys petersiana				1				
	Baissea leonensis	1	1	1	1				
	Clitandra cymulosa							1	
	Dictyophleba lucida	1							
	Funtumia elastica	1							
	Landolphia buchananii		1	1	1				1
	Landolphia dewevrei						1		
	Landolphia foretiana	1							
	Landolphia mannii				1				
	Landolphia owariensis	1		1					
	Motandra guineensis				1				
	Oncinotis tenuiloba								1
	Pleiocarpa pycnantha	1							1
	Rauvolfia mannii		1	1	1	1		1	1
	Tabernaemontana odoratissima							1	
	Tabernaemontana stapfiana	1	1	1	1	1	1	1	
	Tabernaemontana ventricosa							1	
	Tabernanthe iboga	1	1	1					
Aquifoliaceae	Ilex mitis		1	1		1	1	1	
Araceae	Amorphophallus abyssinicus				1				
	Anchomanes difformis		1		1	1			
	Anchomanes giganteus	1							
	Ariseama mildbraedii				1				
	Culcasia barombensis				1	1			
	Culcasia falcifolia	1	1	1	1			1	1
Araliaceae	Polyscias fulva	1	1	1	1	1	1	1	1
	Schefflera abyssinica	1		1	1			1	1
	Schefflera barteri		1	1					1
	Schefflera goetzenii	1				1	1		1
Asclepiadaceae	Brachystelma johnstonii			1					
	Gongronema angolense			1				1	
	Pentarrhinum insipidum	1							
	Rhynchostigma racemosum			1	1	1	1	1	

	Stomatostemma					1			
	Secamone africana		1		1				
	Secamone punctulata		1						
	Secamone			1					1
	Secamone stuhlmannii								1
	Tacazzea apiculata			1		1	1	1	
	Tacazzea conferta							1	1
Asparagaceae	Asparagus asparagoides			1			1		
Asphodelaceae	Kniphofia princeae						1		
Aspidiaceae	Tectaria gummifera		1						
Aspleniaceae	Asplenium	1							
	Asplenium abyssinicum		1			1			
	Asplenium aethiopicum			1	1		1		
	Asplenium concellatum						1	1	
	Asplenium dregeana		1	1	1	1		1	
	Asplenium elliottii	1	1	1	1	1	1		
	Asplenium erectum		1		1	1	1	1	
	Asplenium friesiorum		1		1	1	1		
	Asplenium gummiferum	1		1	1				
	Asplenium holstii						1		1
	Asplenium hypomelas		1		1			1	
	Asplenium inaequilaterale	1	1		1	1			
	Asplenium linckii						1		
	Asplenium lobatum							1	
	Asplenium loxoscaphoides		1						
	Asplenium lunalatum		1		1		1		
	Asplenium mannii		1	1	1	1		1	
	Asplenium megalura			1	1		1		1
	Asplenium mildbraedii		1	1			1		
	Asplenium monanthes			1		1			
	Asplenium obscurum	1			1				1
	Asplenium protensum								1
	Asplenium pseudoauriculatum	1		1	1	1	1	1	1
	Asplenium rutifolium			1	1		1	1	
	Asplenium sandersonii		1	1	1	1	1		
	Asplenium sertularioides			1					
	Asplenium stuhlmannii			1	1		1		
	Asplenium theciferum							1	
	Asplenium theciferum var concinnum			1		1	1		
	Asplenium unilaterale				1				
	Asplenuim sandersonii							1	
	Asplenuim varians	1							
Asteraceae	Acmella caulirhiza					1			
	Adenostemma viscosum		1	1	1	1	1	1	1
	Anisopappus chinensis sub sp africanus		1	1			1		
	Aspilia africana			1					
	Asteraceae	1		1					
	Bidens						1		
	Bothrocline fusca			1					
	Carduus leptacanthus					1	1		
	Conyza					1	1	1	
	Conyza aegyptiaca						1		
	Conyza gigantea						1		
	Conyza gouanii						1		
	Conyza newii			1					
	Conyza pyrrhopappa	1							

	Conyza schimperi						1		
	Conyza subscaposa						1		
	Conyza tigrensis						1		
	Crassocephalum montuosum			1		1	1		
	Crassocephalum vitellinum						1		1
	Dichrocephala integrifolia		1	1		1	1	1	
	Erigeron						1		
	Erlangea globosa						1		
	Erythrocephalum zambesianum			1					
	Gynura scandens						1	1	
	Helichrysum		1	1		1	1		
	Helichrysum foetidum					1			
	Helichrysum formosissimum			1					
	Helichrysum forskahlii		1				1		
	Helichrysum nandense			1					
	Helichrysum odoratissimum						1		
	Lactuca attenuata						1		
	Lactuca glandulifera						1		
	Microglossa densiflora	1				1	1		
	Mikania capense							1	1
	Mikania cordata	1	1	1	1	1	1		
	Mikaniopsis bambuseti		1	1					
	Mikaniopsis clematoides							1	
	Mikaniopsis tedliei			1		1			
	Psiadia arabica								1
	Senecio maranguensis						1	1	
	Senecio pammicrocephalus							1	
	Senecio ruwenzoriensis			1					
	Senecio subsessilis	1						1	
	Senecio syrinifolius		1		1		1		
	Senecio trichopterygius	1							
	Solanecio cydoniifolius							1	
	Solanecio mannii	1		1					
	Vernonia						1		
	Vernonia auriculifera		1						
	Vernonia brachycarlyx	1							
	Vernonia conferta	1	1				1	1	
	Vernonia kirungae						1		
	Vernonia wollastonii						1		
Balanophoraceae	Thonningia sanguinea	1			1				
Balsaminaceae	Impatiens						1		
	Impatiens apiculata			1			1		
	Impatiens bequaertii					1			
	Impatiens burtonii		1					1	
	Impatiens erecticornis		1			1		1	
	Impatiens ethiopica		1	1		1			
	Impatiens fischeri				1				
	Impatiens hochstetteri		1	1	1	1			
	Impatiens hoehnelii			1	1	1			
	Impatiens ioides					1			
	Impatiens irvingii	1				1	1		
	Impatiens miniatus							1	
	Impatiens niamniamensis		1	1	1	1	1		1
	Impatiens rubromaculata						1		
	Impatiens stuhlmannii		1			1		1	
	Impatiens ukagurensis					1	1		
Basellaceae	Basella alba								1
Begoniaceae	Begonia	1					1		

	Begonia coccinea					1			
	Begonia eminii	1	1	1	1				1
	Begonia haullevileana	1	1						
	Begonia meyeri-johannis	1				1	1	1	1
	Begonia oxyloba	1	1		1				
	Begonia poculifera				1				
	Begonia ricinifolia	1							
	Begonia scapigera	1	1			1		1	
Bignoniaceae	Kigelia africana	1			1				1
	Markhamia lutea	1							
	Spathodea campanulata							1	
Blechnaceae	Blechnum attenuatum	1	1			1	1		
	Blechnum tabulare						1		
	Stenochlaena tenuifolia		1			1			
Bombacaceae	Bombax buonopozense	1							
Boraginaceae	Cordia africana	1							1
	Ehretia cymosa				1				
Brassicaceae	Cardamine africana					1			
Burseraceae	Canarium schweinfurthii	1							
Campanulaceae	Trachelium rumeliunum			1					
	Wahlenbergia krebsii			1			1		1
Capparaceae	Ritchiea albersii		1	1	1			1	
Caryophyllaceae	Drymaria cordata			1			1		
	Stellaria	1							
	Stellaria mannii	1			1	1	1		
	Stellaria sennii						1		
	Uebelina kiwuensis						1		
Cecropiaceae	Musanga leo-errerae	1				1			
	Myrianthus arboreus		1		1				
	Myrianthus holstii	1							1
Celastraceae	Campylostemon sp								1
	Elaeodendron buchananii				1	1			
	Loeseneriella africana	1	1		1				
	Loeseneriella apocynoides				1	1		1	
	Maytenus acuminate	1	1	1	1	1		1	
	Maytenus arbutifolia			1					
	Maytenus fasciculate								1
	Maytenus senegalensis	1							
	Maytenus undata			1	1		1	1	
	Pristimera andongensis								1
	Reissantia indica							1	
	Salacia cerasifera				1				
	Salacia elegans	1	1		1	1			1
	Salacia erecta	1	1						
	Salacia kivuensis	1							
	Salacia ripicola	1							
Chrysobalanaceae	Magnistipula zenkeri				1				
	Parinari capensis			1					
	Parinari curatellifolia	1							
	Parinari excelsa	1	1	1	1	1		1	1
Clusiaceae	Allanblackia floribunda	1							
	Allanblackia kimbiliensis	1	1	1	1	1			
	Garcinia buchananii	1							1
	Garcinia kola		1						
	Garcinia livingstonei	1							
	Garcinia robsoniana	1							
	Garcinia smeathmannii	1	1		1	1			
	Garcinia volkensii	1	1	1	1	1	1	1	

	Pentadesma butyracea	1	1		1	1	1	1	
	Symphonia globulifera	1	1	1	1	1		1	1
Colchicaceae	Gloriosa superba	1			1				
Combretaceae	Combretum fuscum								1
	Combretum paniculatum					1			
	Combretum racemosum				1				
	Combretum sp				1				
Commelinaceae	Aneilema beniniense	1							
	Commelina africana var africana		1	1	1	1	1		
	Commelina benghalensis ssp hirsuta			1	1		1		
	Commelina capitata	1	1	1	1				1
	Commelina diffusa	1						1	
	Commelina erecta			1					
	Commelina subulata			1					
	Cyanotis barbata			1			1		
	Floscopa glomerata							1	
	Murdannia simplex			1					
	Palisota barteri								1
	Palisota mannii		1		1				
	Palisota schweinfurthii	1	1		1	1			1
	Pollia condesata								1
	Pollia mannii	1							
	Polyspatha paniculata							1	
	Stanfiediella imperforata	1							
Connaraceae	Agelaea pentagyna	1		1	1	1			1
	Connarus longistipitatus				1				
	Rourea thomsonii	1	1	1	1				1
Convolvulaceae	Ipomoea involucrata			1			1	1	
	Ipomoea obscura	1							
	Ipomoea polymorpha			1					
	Merremia								1
Cornaceae	Afrocrania volkensii					1		1	
Crassulaceae	Crassula alba			1			1		
	Crassula alsinoides					1	1		
	Crassula granvikii							1	
Cruciferae	Psychine palustris		1						
Cucurbitaceae	Coccinia mildbraedii							1	
	Diplocyclos palmatus				1				
	Kedrostis foetidissima	1							
	Lagenaria siceraria	1							
	Momordica charantia								1
	Momordica foetida				1			1	
	Momordica pterocarpa								1
	Oreosyce africana						1		
	Peponium vogelii			1		1	1		1
	Zehneria minutiflora			1	1				
	Zehneria scabra						1		
Cyatheaceae	Cyathea camerooniana		1	1	1				
	Cyathea manniana	1	1	1	1	1	1	1	
Cyperaceae	Abildgaardia			1					
	Abildgaardia boeckeleriana		1	1					
	Abildgaardia filamentosa			1					
	Abildgaardia pusilla			1			1		
	Bulbostylis barbata		1						
	Bulbostylis setifolia			1					
	Carex			1			1		
	Carex castanostachya		1						

	Carex chlorosaccua			1				1	
	Carex echinochloe						1		
	Carex johnstonii		1				1		
	Carex mannii						1	1	
	Carex petitiana		1			1	1	1	
	Carpha eminii						1		
	Cladium mariscus				1		1		
	Cyperus afroalpinus						1		
	Cyperus dereilema	1						1	
	Cyperus fischerianus			1	1				
	Cyperus kilimandscharicus			1					
	Cyperus renschii			1					
	Fimbristylis						1		
	Hypolytrum mauritiana			1					
	Hypolytrum testui	1							
	Isolepis costata			1					
	Isolepis fluitans						1	1	
	Isolepis fluitans var Major			1					
	Kyllinga appendiculata			1		1			
	Kyllinga brevifolia					1			
	Kyllinga odorata							1	
	Mariscus hemisphaericus						1		
	Mariscus sumatrensis			1					
	Mariscus sumatrensis			1					
	Pycreus aethiops	1							
	Pycreus intactus			1					
	Rhynchospora			1			1		
	Scleria distans		1	1			1		
	Scleria interrupta		1						
	Scleria lostephana	1						1	
	Scleria melanomphala						1		
	Scleria nyasensis						1		
Dennstaedtiaceae	Blotiella crenata	1	1	1	1	1	1	1	
	Blotiella glabra			1					
	Blotiella natalensis			1		1			
	Histiopteris incisa						1	1	
	Hypolepis sparsisora	1	1				1		
	Odontosoria africana	1		1					1
	Pteridium			1					
	Pteridium aquilinum	1	1	1			1		1
Dichapetalaceae	Dichapetalum arachinoideum	1							
	Dichapetalum fructuosum	1							
	Dichapetalum madagascariense		1		1	1			
	Dichapetalum rudatisii	1							
	Dichapetalum staudtii	1							
Dilleniaceae	Tetracera boiviniana		1		1				
	Tetracera potatoria	1							1
Dioscoreaceae	Dioscorea abyssinica						1		1
	Dioscorea dumetorum			1			1		
	Dioscorea quartiniana						1		
Dracaenaceae	Dracaena afromontana			1	1		1		
	Dracaena laxissima	1		1	1	1			1
	Dracaena mannii	1							
Droseraceae	Drosera burkeana			1			1		
Dryopteridaceae	Afropteris repens	1							
	Arachniodes foliosa				1				
	Didymochlaena truncatula	1	1		1			1	
	Dryopteris callolepis	1						1	

	Dryopteris inaequalis							1	
	Dryopteris kilemensis	1						1	1
	Dryopteris manniana		1		1	1	1		
	Dryopteris oppositifolia				1	1	1	1	
	Hypolepis sparsisora					1			
	Polystichum fuscopaleaceum				1	1	1		
	Polystichum setiferum							1	1
	Tectaria gummifera					1	1	1	1
Ebenaceae	Diospyros	1				1			
	Diospyros abyssinica	1	1	1	1			1	1
	Diospyros bipindensis		1		1				
	Diospyros gabunensis	1		1	1				
	Diospyros gracilescens				1				
	Diospyros grauciflorus	1							
	Diospyros soubreana		1	1	1	1			
	Diospyros zenkeri	1							
Ericaceae	Agauria salicifolia	1		1			1		
	Erica arborea	1		1			1		
	Erica johnstoniana		1	1			1		
	Erica trimera						1		
	Vaccinium stanleyi						1	1	1
Eriocaulaceae	Eriocaulon schimperi						1		
Escalloniaceae	Choristylis rhamnoides							1	1
Euphorbiaceae	Acalypha psilostachya			1					
	Acalypha racemosa						1		
	Alchornea	1							
	Alchornea cordifolia	1							
	Alchornea hirtella	1	1		1	1	1		
	Antidesma membranaceum	1		1					
	Antidesma vogelianum	1							
	Bridelia brideliifolia			1				1	1
	Bridelia mycrantha				1				
	Cleistanthus polystachyus		1						1
	Clutia abyssinica		1	1		1	1	1	
	Croton macrostachyus	1			1				1
	Croton megalocarpus			1					
	Croton sylvaticus	1			1				1
	Drypetes	1							
	Drypetes afzelii	1							
	Drypetes calvescens	1	1	1		1			1
	Drypetes gerrardii	1	1		1	1		1	1
	Drypetes ivorensis	1							
	Drypetes natalensis					1			
	Drypetes parvifolia				1	1			
	Drypetes principum				1				1
	Erythrococca atrovirens	1		1		1	1		
	Erythrococca trichogyne							1	1
	Euphorbia schimperiana							1	
	Macaranga capensis ssp kilimandscharica		1	1	1	1	1	1	1
	Macaranga monandra	1					1		
	Margaritaria discoidea	1							
	Neoboutonia macrocalyx	1	1	1	1	1		1	
	Phyllanthus			1					
	Phyllanthus nummulariifolius.	1							
	Phyllanthus odontadenius			1					
	Phyllanthus ovalifolius			1			1		
	Phyllanthus suffrutenscens			1			1		

	Pseudagrostistachys ugandensis	1							
	Ricinodendron heudelotii	1							
	Sapium ellipticum						1	1	
	Thecacoris lucida	1	1						
	Uapaca esculenta								1
Fabaceae	Abrus fruticulosus	1							
	Acacia pentagona	1							
	Albizia andianthifolia			1					
	Albizia ferruginea				1				
	Albizia gummifera	1							1
	Amphicarpaea Africana			1					
	Aphanocalyx cynometroides	1			1				
	Baphia wollastonii	1							
	Baphiopsis Parviflora	1							
	Cassia kirkii	1	1	1			1		
	Craibia grandiflora			1					
	Cytisus mildbraedii	1							
	Dalbergia lactea	1		1					
	Dalbergia malangensis	1							
	Dalbergia sp					1		1	1
	Desmodium adscendens								1
	Desmodium dregeanum			1					
	Desmodium repandum	1		1	1	1		1	1
	Dialium corbisier		1						
	Dialium excelsum	1							
	Eriosaema montanum		1	1					
	Eriosaema shirense.			1					
	Eriosema speciosum	1							
	Erythrina abyssinica			1				1	
	Erythrophleum suaveolens	1							
	Fabaceae			1					
	Hymenostegia gracilipes	1							
	Indigofera asparagoides			1					
	Indigofera atriceps			1					
	Indigofera emarginella		1						
	Julbernadia seletii	1							
	Kotschya africana								1
	Kotschya aeschynomenoides		1	1			1		
	Leptaulus holstii		1						
	Leptoderris congolensis		1						
	Leptoderris harmsiana				1				
	Leptoderris hypargyrea								1
	Millettia dura			1					
	Mucuna pruriens	1							
	Newtonia buchananii	1							1
	Parkia filicoides	1							
	Parochetus communis					1			
	Piptadeniastrum africanum		1	1	1	1			
	Pseudarthria hookeri			1					
	Psoralea corylifolia			1					
	Pterolobium stellatum	1		1	1				1
	Swartzia fistulbides				1				
	Tephrosia	1							
	Tephrosia villosa						1		
	Tephrosia vogeli								1
	Vigna multinervis			1					
	Vigna parkeri			1					
Flacourtiaceae	Camptostylus kivuensis		1						

	Casaeria battiscombei	1	1	1	1				1
	Casaeria engleri			1					1
	Dasylepis eggelingii				1				1
	Dasylepis racemosa	1	1	1	1	1		1	
	Dovyalis spinosissima	1							
	Dovyalis zenkeri	1		1				1	1
	Homalium stipulaceum								1
	Lindackeria bukobensis	1							
	Linderckeria schweinfurthii			1	1	1			
	Oncoba routledgei	1							
	Rawsonia lucida							1	1
	Scolopia rhamniphylla							1	
Gentianaceae	Swertia brownii				1		1		
Geraniaceae	Geranium arabicum			1		1	1	1	
Gesneriaceae	Schizoboea kamerunensis							1	
	Streptocarpus caulescens		1						
	Streptocarpus exsertus								1
	Streptocarpus glandulosissimus	1	1		1		1	1	
Gleicheniaceae	Dicranopteris linearis	1	1	1			1	1	
	Lycopodium clavatum			1					
	Sticherus flagellaris		1			1	1		
	Sticherus flagellaris ssp tomentosa							1	
Grammitidaceae	Grammitis flabelliformis						1	1	
	Grammitis nanodes						1		
Hamamelidaceae	Trichocladus ellipticus	1							
Hernandiaceae	Illigera pentaphylla	1			1		1		1
Huaceae	Afrostyrax kamerunensis		1						
Hymenophyllaceae	Crepidomanes radicans	1							
	Mecodium kuhnii				1	1			
	Meringium triangulare		1		1	1		1	1
	Sphaerocionium capillare						1		
	Trichomanes borbonicum								1
	Vandenboschia radicans				1	1			
Hypericaceae	Harungana madagascariensis		1						
	Harungana montana	1	1	1	1	1	1		
	Hypericum humbertii						1		
	Hypericum peplidifolium		1						
	Hypericum revolutum			1			1		
	Hypericum revolutum ssp keniense							1	
	Hypericum scioanum			1			1		
	Psorospermum febrifugum			1					1
Hypoxidaceae	Hypoxis angustifolia						1		
	Hypoxis kilimanjarica			1					
Icacinaceae	Apodytes dimidiata		1	1	1	1	1	1	1
	Rhaphiostylis beninensis	1	1		1				
Iridaceae	Anomatheca laxa						1		
	Aristea alata						1		
	Aristea ecklonii						1		
	Aristea			1					
	Gladiolus atropurpureus			1		1	1		
	Gladiolus laxiflorus			1					
	Hesperantha petitiana					1			
Irvingiaceae	Kleinodoxa gabonensis	1							
Ixonanthaceae	Ochthocosmus africana	1							
Juncaceae	Juncus dregeanus						1		
	Juncus effusus			1		1	1		
Lamiaceae	Achyrospermum carvalhoi				1				
	Achyrospermum micranthum					1			

	Aeollanthus densiflorus					1	1		
	Aoellanthus						1		
	Isodon ramosissimus				1				
	Leucas deflexa				1	1	1		
	Platostoma africanum					1		1	
	Platostoma denticulatum				1	1			
	Plectranthus edulis					1			
	Plectranthus luteus		1		1	1	1	1	
	Plectranthus punctatus						1		
	Plectranthus	1							
	Pycnostachys goetzenii		1	1			1		
	Satureja pseudosimensis						1		
	Solenostemon platostomoides					1	1		
Lauraceae	Beilschmiedia oblongifolia		1						
	Beilschmiedia ugandensis	1		1	1	1		1	
	Ocotea usambarensis	1	1		1	1	1		
Liliaceae	Asparagus asparagoides							1	
	Chlorophytum comosum							1	
	Scadoxine multiflorus				1				
Linaceae	Hugonia platysepala	1	1	1	1	1			1
Lobeliaceae	Lobelia baumannii					1	1	1	
	Lobelia giberroa			1	1		1		1
	Lobelia minutula						1		
	Lobelia petiolata						1		
Loganiaceae	Anthocleista grandiflora	1			1	1		1	1
	Anthocleista liebrechtsiana		1	1		1	1		
	Anthocleista schweinfurthii							1	
	Anthocleista vogelii		1						
	Nuxia								1
	Nuxia congesta	1	1	1		1	1		
	Nuxia floribunda								1
	Strychnos	1							1
	Strychnos asterantha					1			
	Strychnos congolana	1							1
	Strychnos dale	1							
	Strychnos innocua			1					
	Strychnos johnsonii		1						
	Strychnos lucens	1	1		1				1
	Strychnos spinosa		1						
Lomariopsidaceae	Bolbitis gemmifera	1							
	Elaphoglossum aubertii					1			
	Elaphoglossum rhodesianum		1		1	1	1		
	Elaphoglossum volkensii	1	1						
	Lomariopsis warneckei	1	1		1	1		1	
Loranthaceae	Englerina							1	
Lycopodiaceae	Huperzia saururus			1			1		
	Lycopodium cernua						1	1	
	Lycopodium clavatum							1	
Malpighiaceae	Flabellaria paniculata		1	1					
Malvaceae	Hibiscus berbaridifolius						1		
	Hibiscus cannabinus		1						
	Hibiscus diversifolius			1					
	Pavonia kilimandscharica					1			
	Pavonia urens					1			
	Sida ovata					1			
	Sida rhombifolia			1					
Marantaceae	Marantachloa leucantha	1							
Marattiaceae	Marattia fraxinea	1	1	1	1	1	1	1	

Melastomataceae	Cincinnobotrys oreophila		1		1			1	1
	Cincinnobotrys speciosa	1				1			
	Dinophora spenneroides		1						
	Dissotis senegambiensis		1	1					
	Dissotis								1
	Disssotis trothae			1					
	Melastomastrum capitatum			1	1	1			
	Memecylon myrianthum								1
	Tristemma leiocalyx					1			
	Tristemma mauritianum	1	1						
	Warnackea bequaertii		1						
	Warnackea cinnamonoides		1						
	Warneckea guineense	1						1	
	Warneckea memecyloides				1				
Meliaceae	Carapa procera	1	1	1	1	1		1	
	Entandrophragma excelsum				1				1
	Guarea cedrata								1
	Leplaea mayombensis	1							
	Lepidotrichilia volkensii				1				1
	Trichilia dregeana							1	
	Trichilia rubescens	1							
	Turraea holstii	1							
	Turraea vogelii	1		1	1				
	Turraea vogelioides			1					
	Turraeanthus africanus	1			1				1
Melianthaceae	Bersama abyssinica ssp abyssinica			1				1	
	Bersama abyssinica ssp paulinoides				1	1	1	1	1
Menispermaceae	Cissampelos mucronata			1	1			1	1
	Syrrhonema welwitschii				1				
	Stephania abyssinica			1		1	1	1	
	Tiliacora bequaertii	1							1
	Tiliacora funifera			1					
	Tiliacora latifolia				1				
	Tiliacora laurentii		1	1	1				
	Tinospora caffra		1			1			
	Triclisia sacleuxii	1							
Monimiaceae	Xymalos monospora	1	1	1	1	1	1		
Moraceae	Antiaris toxicaria	1							
	Dorstenia hildebrandtii			1					
	Dorstenia nyungwensis	1							
	Dorstenia	1							
	Ficus asperifolia			1	1				1
	Ficus barteri	1							
	Ficus conruai		1						
	Ficus craterostoma		1	1	1				1
	Ficus cyathistipula		1	1	1	1			
	Ficus densistipulata		1						
	Ficus dryepondtiana	1							
	Ficus exasperata								1
	Ficus lingua	1							
	Ficus oreodryadum			1	1			1	
	Ficus ottoniifolia			1				1	
	Ficus sansibarica		1	1	1			1	1
	Ficus sur	1		1	1				1
	Ficus thonningii	1							
	Ficus vallis-choudae	1							1
	Morus mesozygia	1							
	Trilepisium madagascariense	1					1		1

Myristicaceae	Cephalosphaera usambalensis	1							
	Pycnanthus angolensis	1							
	Staudtia kamerunensis							1	
Myricaceaea	Myrica salicifolia		1	1					
Myrsinaceae	Ardisia kivuensis		1	1	1	1		1	1
	Embelia schimperi			1			1	1	
	Maesa lanceolata		1		1	1	1		1
	Maesa welwitschii						1		
	Rapanea melanophloeos		1		1	1	1	1	
Myrtaceae	Syzygium cordatum	1					1		
	Syzygium germainii	1	1	1	1	1		1	1
	Syzygium guineense	1	1	1	1	1	1	1	
	Syzygium guineense ssp parvifolium							1	1
Nephrolepidaceae	Nephrolepis delicatula		1						1
Ochnaceae	Rhabdophyllum arnoldianum	1	1				1		
	Campylospermum densiflora				1				
	Campylospermum flavum							1	
	Campylospermum hiernii	1		1	1	1	1		1
	Campylospermum mannii		1						
	Ochna afzelii	1				1		1	1
	Ochna holstii				1	1		1	
	Ochna schweinfurthiana	1		1					
Olacaceae	Strombosia scheffleri	1			1	1			
Oleaceae	Chionanthus africanus				1				
	Jasminum abyssinicum		1			1	1	1	
	Chionanthus mildbraedii	1							1
	Jasminum bakeri					1			
	Jasminum schimperi		1	1					1
	Olea capensis			1	1				
	Olea capensis ssp hochstetteri							1	
Oleandraceae	Arthropteris orientalis	1	1	1	1	1	1	1	1
	Oleandra distenta			1	1	1	1	1	
Onagraceae	Epilobium stereophyllum						1		
Orchidaceae=	Ancistrorhynchus ovatus				1				
	Angraecum sacciferum				1	1			
	Brachycorythis inhambanensis		1						
	Calanthe sylvatica	1				1		1	
	Cyanotis barbata		1						
	Cynorkis anacamptoides							1	
	Cynorkis kassneriana sub sp tenior			1					
	Diaphananthe pulchella					1			
	Diaphananthe rutila				1				
	Disa						1		
	Disperis anthoceros			1					
	Disperis dicerochila					1	1		
	Disperis kilimanjarica						1		
	Disperis reichenbachiana			1					
	Epipactis africana				1		1		
	Eulophia guineensis						1		
	Habenaria			1		1	1	1	
	Liparis bowkeri			1					
	Malaxis prorepens			1					
	Nervilia bicarinata	1							
	Polystachya adansoniae				1				
	Polystachya angustifolia				1				
	Polystachya mildbraedii	1		1					
	Polystachya spatella			1					
	Rangaeris muscicola				1				

	Tridactyle nigrescens					1			
	Tridactyle virgula						1		
	Zeuxine elongata				1				
Osmundaceae	Osmunda regalis							1	
Oxalidaceae	Biophytum helenae	1							
	Biophytum umbraculum			1					
	Oxalis corniculata					1			
Palmaceae	Calamus deerratus	1							
Passifloraceae	Adenia bequaertii	1		1	1			1	
	Adenia cissampeloides	1							
	Adenia reticulata	1	1	1		1			1
	Adenia rumicifolia var rumicifolia								1
Phytolaccaceae	Phytolacca dodecandra								1
Piperaceae	Peperomia abyssinica	1		1		1	1	1	1
	Peperomia blanda		1						
	Peperomia fernandopoiana			1					
	Peperomia retusa var mannii		1						
	Peperomia tetraphylla	1			1	1			
	Piper capense	1						1	
	Piper guineense	1	1	1	1				1
	Pothomorphe umbellata	1	1	1	1	1			1
Pittosporaceae	Pittosporum abyssinicum								1
	Pittosporum spathicalyx								1
	Pittosporum viridiflorum			1			1		
Plantaginaceae	Plantago palmata					1			1
Poaceae	Agrostis producta					1			
	Andropogon schirensis			1			1		
	Aristida			1					
	Aristida hordeacea			1					
	Brachiaria scalaris			1					
	Bromus leptoclados			1		1			
	Coelachne africana						1		
	Ctenium somalense		1	1			1		
	Eragrostis						1		
	Eragrostis hispida						1		
	Eragrostis olivacea		1	1			1		
	Eragrostis racemosa					1	1		
	Exotheca abyssinica						1		
	Hyparrhenia			1					
	Hyparrhenia rufa			1					
	Leptaspis zeylanica	1							
	Loudetia flavida	1							
	Loudetia simplex			1			1		
	Melinis minutiflora			1					
	Microchloa kunth			1					
	Olyra latifolia	1							
	Oplismenus hirtellus	1		1	1	1			
	Panicum			1					
	Panicum adenophorum					1			
	Panicum breviflorium	1		1		1	1		
	Panicum calvum	1		1	1	1	1		
	Panicum chionachne		1						
	Panicum coloratum			1					
	Panicum hochestetteri						1		
	Panicum nervatum							1	
	Panicum poaeoides			1			1		
	Panicum pusillum			1					
	Panicum trichocladum	1	1	1			1		

	Pennisetum unisetum			1					
	Poa schimperana					1	1		
	Pseudechinoleana polystachya			1			1		
	Rhytachne rottboellioides		1	1					
	Sateria megaphylla		1	1	1			1	1
	Sateria sphacelata			1					
	Sehima nervosum			1					
	Sinarundinaria alpina					1	1		
	Trichopteryx elegantula						1		
	Trichopteryx marungensis			1					
	Trichypogon spicatus			1					
Podocarpaceae	Podocarpus madagascariensis	1							
	Podocarpus usambarensis			1			1		
Polygalaceae	Atroxima afzeliana							1	
	Polygala backeriana	1		1					
	Polygala filicaulis			1					
	Polygala ruwenzoriensis	1	1			1	1		
	Polygala stenopetala			1					
	Securidaca welwitschii					1			1
Polygonaceae	Polygonum			1					
	Polygonum nepalense		1	1		1	1		
	Polygonum setosulum	1				1	1		
	Rumex bequaertii						1		1
Polypodiaceae	Drynaria laurentii			1	1				1
	Lepisorus excavatus			1					
	Loxogramme abyssinica		1		1	1	1	1	1
	Microgramma lycopodioides								1
	Phymatosorus scolopendria							1	
	Pleopeltis microcarpa			1	1		1		
Primulaceae	Anagallis serpens						1		
	Ardisiandra sibthorpioides						1	1	
	Lysimachia ruhmeriana			1		1			
Protaceae	Faurea rochetiana		1	1					
	Faurea saligna	1	1	1			1		1
	Protea caffra							1	
	Protea caffra ssp kilimandscarica			1			1		
	Protea gaguedi	1	1	1					
	Protea madiensis		1						
Pteridaceae	Pteris								1
	Pteris acanthoneura				1				
	Pteris atrovirens		1	1		1	1		
	Pteris burtonii				1	1	1		
	Pteris catoptera	1	1	1		1		1	
	Pteris dentata	1			1				
	Pteris intricata			1					1
	Pteris preussii	1			1	1	1	1	
	Pteris pteridioides			1				1	
	Pteris togoensis			1					
Ranunculaceae	Clematis hirsuta								1
	Clematis simensis			1	1		1	1	
	Ranunculus multifidus	1				1	1		
	Thalictrum rhynchocarpum	1					1		
Rhamnaceae	Gouania longispicata	1	1						1
	Maesopsis eminii	1							
	Rhamnus prinoides					1	1		
	Ventilago africana	1							
Rhizophoraceae	Cassipourea congoensis	1	1	1			1	1	
	Cassipourea gummiflua	1			1	1		1	

	Cassipourea ruwensorensis	1							
Rosaceae	Alchemilla kiwuensis			1		1	1		
	Rubus apetalus	1	1			1	1		
	Rubus keniensis						1		
	Rubus pinnatus	1	1	1	1	1	1		
	Rubus steudneri						1		
	Rubus volkensii			1			1		
Rubiaceae	Aidia micrantha	1	1	1					
	Anthospermum herbaceum	1							
	Aornanthe nalaensis	1							
	Aulacocalyx diervilleoides					1			
	Bertiera pauloi				1	1			
	Bertiera racemosa	1							
	Calycosiphonia spathicalyx		1		1				
	Chassalia		1		1	1			
	Chassalia cristata					1			
	Chassalia discolar		1	1					
	Chassalia subochreata		1		1			1	1
	Coffea canephora	1							
	Coffea euginioides			1					
	Coffea liberica	1							
	Cramespora triflora		1		1	1			1
	Craterispermum schweinfurthii	1							
	Cremaspora triflora		1					1	
	Cuviera latior	1			1				
	Dictyandra arborescens	1							
	Fadogia cienkowskii		1	1					
	Gaertnera paniculata						1		
	Galiniera saxifraga	1	1	1	1	1	1	1	
	Galium chloroionanthum						1		
	Galium simense						1	1	
	Geophila repens	1							
	Hallea rubrostipulata							1	1
	Hallea stipulosa				1				
	Hymenodictyon floribundum		1						1
	Ixora burundiensis	1		1	1			1	
	Ixora mildbraedii				1				
	Keetia angustifolia						1		
	Keetia gueinzii	1	1	1		1	1	1	
	Keetia purseglovei			1					
	Keetia venosa			1	1	1	1		
	Lasianthus		1						
	Lasianthus kilimandscharicus		1		1	1	1	1	
	Lasianthus seseensis	1					1		
	Leptactina platyphylla		1				1		
	Heinsenia diervilleoides	1			1				1
	Musaenda microdonta				1				
	Mussaenda arcuata	1							
	Otiophora pauciflora		1				1	1	
	Otomeria			1					
	Oxyanthus pyriformis	1							
	Oxyanthus speciosus		1	1	1	1			
	Oxyanthus troupinii		1	1	1	1	1	1	1
	Pauridiantha viridiflora	1							
	Pausinystalia lane-poolei	1	1	1	1	1		1	1
	Pavetta	1	1	1					1
	Pavetta bagshawei		1	1				1	
	Pavetta pierlotii	1		1	1				

	Pavetta ruwenzoriensis			1	1	1			
	Pavetta stenosepala				1				
	Pavetta urundensis	1	1	1	1	1			
	Pentanisia			1					
	Pentas decora		1	1					
	Pentas ionolaena				1				
	Pentas zanzibarica	1		1					
	Phellocalyx vollesenii								1
	Pseudosabicea arborea	1						1	
	Psychotria	1							
	Psychotria chalconuera			1			1		
	Psychotria faucicola							1	
	Psychotria lauraceae				1	1		1	
	Psychotria mahonii	1		1	1	1	1		
	Psychotria parvistipulata			1	1				
	Psychotria peduncularis		1	1	1		1	1	
	Psychotria schweinfurthii		1	1					
	Psychotria succulenta			1					
	Psydrax parviflora				1				
	Psydrax parviflora ssp melanophengos						1		
	Psydrax subcordata							1	1
	Randia				1				
	Rothmania hispida								1
	Rothmania urcelliformis	1							1
	Rubia cordifolia			1					
	Rubiaceae						1	1	1
	Rutidea dupuisii		1					1	
	Rutidea fuscescens						1		
	Rutidea orientalis		1		1	1		1	
	Rutidea smithii					1	1	1	
	Rytigynia	1		1					
	Rytigynia bagshawei	1				1		1	
	Rytigynia beniensis		1					1	
	Rytigynia bridsoniae	1		1	1	1	1	1	1
	Rytigynia bugoyensis			1					
	Rytigynia kiwuensis		1				1		
	Rytigynia monantha				1				
	Rytigynia neglecta								1
	Rytigynia usambarensis		1		1		1		1
	Rytigynia verruculosa				1				
	Sabicea dinklangei		1						
	Sabicea calycina			1		1			
	Sabicea ferruginea	1							
	Sabicea orientalis		1	1	1		1		
	Spermacoce princeae	1	1	1	1	1	1		
	Tarenna pavettoides		1	1					1
	Tarenna rwandensis			1					
	Tricalysia	1				1	1		
	Tricalysia aciculiflora		1						
	Tricalysia bagshawei	1		1	1				
	Tricalysia coriacea						1		
	Tricalysia kivuensis		1		1				
	Tricalysia macrophylla		1						
	Tricalysia pallens					1	1	1	
	Tricalysia vanroechoudtii						1		
	Uncaria africana	1							
	Virectaria major	1		1					

Rutaceae	Citropsis articulata	1							
	Clausena anisata	1		1	1				1
	Oricia renieri		1	1	1	1			
	Oricia suaveolens	1	1						1
	Toddalia asiatica	1		1	1				
	Vepris nobilis	1	1	1	1				1
	Vepris verdoorniana				1	1			
	Zanthoxylum gilletii		1	1	1				1
	Zanthoxylum mildbraedii	1						1	1
	Zanthoxylum rubescens	1							
Samydaceae	Byrsanthus brownii	1							
Santalaceae	Thesium brachyanthum			1					
	Thesium fastigiatum			1					
Sapindaceae	Allophylus abyssinicus	1		1	1				
	Allophylus africanus			1	1	1	1		
	Allophylus chaunostachys							1	1
	Allophylus congolanus				1				1
	Allophylus dummeri		1						
	Allophylus kiwuensis								1
	Allophylus macrobotrys	1		1	1		1		1
	Allophylus subcoriaceus		1						
	Allophylus welwitschii			1					
	Cardiospermum halicacabum	1					1		1
	Deinbollia fulvo-tomentella								1
	Dodonaea angustifolia			1					
	Dodonaea viscosa								1
	Haplocloelum foliolosum	1							
	Pancovia harmsiana						1		
	Pancovia pedicellaris	1							
	Paullinia pinnata	1							
	Zanha golungensis	1						1	
Sapotaceae	Chrysophyllum albidum	1	1		1	1			1
	Chrysophyllum africanum	1						1	
	Chrysophyllum gorungosanum		1	1					1
	Chrysophyllum murense								1
	Chrysophyllum perpulchrum	1	1	1	1	1			1
	Chrysophyllum pruniforme	1							
	Englerophytum megalismontanum	1	1		1				
	Englerophytum oblanceolatum	1			1				
	Manilkara dawei	1							
	Pouteria adolfi friedericii		1	1		1			1
	Pouteria altissima	1							1
	Synsepalum cerasiferum	1						1	
	Synsepalum msolo	1							
	Synsepalum subcordatum							1	
	Synsepalum cerasiferum			1					
Schizaeaceae	Mohria nudiuscula			1					
Scrophulariaceae	Arectra sessiliflora						1		
	Lindernia diffusa.					1			
	Lindernia nummulariifolia					1	1	1	
	Lindernia subracemosa			1				1	
	Sopubia sp.					1	1		
	Sopubia manii			1					
	Thunbergianthus ruwenzoriensis	1		1	1				
	Veronica abyssinica					1	1		
Selaginellaceae	Selaginella kraussiana	1	1	1		1	1	1	
Smilacaceae	Smilax kraussiana	1	1	1	1	1		1	
Solanaceae	Discopodium penninervium					1			

	Solanum anguivii		1						
	Solanum capsicoides						1		
	Solanum dasyphyllum				1				
	Solanum humile		1		1				
	Solanum incanum		1	1	1		1		
	Solanum nigrum	1							
	Solanum	1							
	Solanum terminale	1		1		1			
	Solanum welwitschii					1			
Sterculiaceae	Cola bracteata	1							
	Cola sp.			1					
	Dombeya goetzenii			1					
	Leptonychia mildbraedii	1							1
	Leptonychia pubescens		1		1				
	Octolobus spectabilis	1							
	Sterculia dawei								1
Theaceae	Ficalhoa laurifolia	1	1	1	1	1	1		1
	Melchiora schliebenii	1	1	1	1	1	1	1	1
Thelypteridaceae	Christella hispidula	1							
	Cyclosorus interruptus								1
	Cyclosorus pulcher	1				1	1	1	
	Menisorus paciflorus			1					
	Nephrodium bergianum				1				
	Pneumatopteris unita			1					
	Thelypteris fadenii	1							
	Thelypteris madagascariensis	1							
Thymelaeaceae	Craterosiphon beniense	1	1	1	1				
	Peddiea rapaneiodes	1	1	1	1	1	1		1
	Struthiola thomsonii					1	1		
Tiliaceae	Desplatsia dewevrei	1							1
	Desplatsia mildbraedii	1							
	Grewia mildbraedii		1	1	1	1			
	Grewia floribunda	1							
	Sparmannia ricinocarpa			1					
	Triumfetta cordifolia	1							
Turneraceae	Stapfiella claoxyloides	1		1	1	1	1	1	1
	Stapfiella lucida	1							
	Stapfiella ulugurica							1	
Ulmaceae	Celtis africana								1
	Celtis gomphophylla	1			1				1
	Trema orientalis	1	1	1	1				
Urticaceae	Boehemeria macrophylla	1		1	1				1
	Droguetia iners						1	1	
	Elatostema monticola	1	1		1	1	1	1	
	Elatostema welwitschii	1		1	1	1	1	1	
	Hydrocotyle mannii	1							
	Laportea aestuans					1			
	Laportea alatipes		1		1	1	1		
	Laportea ovalifolia							1	
	Parietaria debilis							1	
	Pilea						1		
	Pilea angolense								1
	Pilea bambuseti		1					1	1
	Pilea johnstonii		1	1		1	1	1	
	Pilea rivularis			1	1	1	1		
	Pilea rivularis var stepulata							1	
	Pocris crenata	1					1	1	
	Pouzolzia denudata					1			

	Urera hypselodendron	1	1			1	1		
	Urera tranervis		1		1				1
	Urtica massaica						1		
Verbenaceae	Clerodendrum			1					
	Clerodendrum capitatum				1				
	Clerodendrum myricoides							1	
	Clerodendrum formicarum	1	1		1	1			
	Clerodendrum fuscum		1					1	
	Clerodendrum johnstonii			1	1	1	1	1	
	Clerodendrum schweinfurthii		1	1	1	1			
	Clerodendrum silvanum			1					
	Clerodendrum umbellatum							1	
	Vitex fischeri		1		1				
	Vitex strickeri		1						
	Vitex welwitschii	1	1		1			1	1
Violaceae	Rinorea angustifolia								1
	Rinorea brachypetala	1							1
	Rinorea dentata	1							
	Rinorea oblongifolia		1	1	1				
	Rinorea prasina								1
	Viola eminii						1		
Vitaceae	Ampelocissus africana			1					
	Cissus humbertii	1							1
	Cissus oliveri		1		1				
	Cissus petiolata			1	1				1
	Cissus planchoniana		1		1				
	Cissus polyantha	1			1				
	Cyphostemma adenocaule		1	1	1				1
	Cyphostemma bambuseti							1	1
	Cyphostemma cyphopetalum				1	1			
	Cyphotemma kilimandscharicum			1					
	Leea guineensis	1		1	1		1		1
Vittariaceae	Anthrophyum mannianum		1						1
	Vittaria guineensis		1	1	1	1	1		
	Vittaria isoetifolia	1						1	
Xyridaceae	Xyrix capensis			1				1	
	Xyrix valida					1			
Zingiberaceae	Aframomum	1	1						1
	Aframomum mildbraedii		1	1	1	1			
	Aframomum uniflorum		1						
	Costus lucanusianus			1					
	Renealmia congolana		1	1	1	1			1

The Wildlife Conservation Society (WCS)
The Wildlife Conservation Society is dedicated to saving wildlife and wildlands to assure a future for threatened species such as elephants, gorillas, chimpanzees, cheetahs, tigers, sharks or lynx. That mission is achieved through a conservation program that protects some 50 living landscapes around the world, manages more than 300 field projects in 60 countries, and supports the largest system of living institutions in the USA – the Bronx Zoo, the New York Aquarium, the Wildlife Centres in Central Park, Queens and Prospect Park, and the Wildlife Survival Centre on St Catherine's Island, Georgia. We are developing and maintaining pioneering environmental education programmes that reach more than three million people in the New York metropolitan area as well as in all 50 United States and 14 other countries. We are working to make future generations inheritors, not just survivors.

WCS has been a driving force in conservation in Africa since the 1920s when the Bronx Zoo's first president, William Hornaday, initiated a programme to save the white rhinos of South Africa. Since this time the WCS Africa Programme has been characterised by pioneering conservation work such as the first field studies and census of the mountain gorillas by George Shaller in Congo (1959), creation of the Nouabale-Ndoki national park in Congo Republic (1993), Masoala park in Madagascar (1996), and Nyungwe National Park in Rwanda (2001). WCS focuses on the use of scientific information to manage conservation areas and as such has more field scientists on the ground than any other conservation organisation in the world. Currently the WCS Africa Programme works in 14 countries protecting a range of spectacular and diverse ecosystems across the continent. While Africa has some of the richest landscapes of the natural world it also faces extreme challenges of poverty, high human population growth and rapidly changing political systems. WCS Africa programme recognises these challenges and the subsequent pressures on biodiversity. Throughout its field-based programmes WCS works with governments, national institutions and local communities to conserve Africa's natural heritage for both Africans and the world at large.

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The Misotshi-Kabogo region and the Marungu Massif of eastern Democratic Republic of Congo (DRC), formerly called Mt Kabobo, has not been visited by any survey team since the late 1950s. As a result of rebel activity the Misotshi-Kabogo region has been impossible to visit for over 50 years and it is only recently that a survey such as the one described here has become feasible. The Wildlife Conservation Society led a team of researchers from the WCS Uganda and DRC, The Field Museum in Chicago, ICCN and WWF to survey this large forest block that was known to occur on the escarpment above Lake Tanganyika north of the town of Kalemie. This forest was visible from satellite imagery and is 800 km2 in size. The focus of the surveys was on chimpanzees but the opportunity was also made to collect data on other species and human impacts because of the long time period since this forest had last been visited by any scientist.

Initial aerial surveys were made of the two regions and it was soon obvious that the Marungu Massif had been almost totally converted to pastureland and agriculture. There was nowhere that was worth surveying left that we could find. However, to the north of Marungu was a large area of Miombo woodland and riverine forest around the Muganja Hills. The aerial survey showed the Misotshi-Kabogo region to be very promising. As a result field teams surveyed this area and the Muganja Hills area.

The findings of the surveys are summarized here and provide estimates of chimpanzee numbers and distribution, large and small mammals that can be found in the forest, birds, frogs and reptiles and plant species. These findings show that the Misotshi-Kabogo Forest and the region of gallery forest and woodland around it is extremely rich in species, and contains many endemic species. Four mammal species were discovered that were new to science and an additional two frog species are new. Plant species number over 1,100 which is high for the Albertine Rift region, making Misotschi-Kabogo the fifth richest site in the Albertine Rift. It ranks as seventh richest site in terms of endemic birds also.

Human impacts have been relatively minor, artisanal gold mining being the most threatening to the biodiversity of the forest. Most of the gold mining is carried out by migrants from Bukavu and Uvira as the local people do not feel that they can obtain enough from the mining to make it worth their while. Consequently the returns on the mining are minimal. It would be relatively easy to stop the mining if any protected area were created in the region. Many of the village chiefs and elders in the villages we visited thought that creating a protected area would be a positive step for their region, bringing a focus to their region and possible development impacts also as a result. There is certainly a potential for tourism in the Misotshi-Kabogo region although access to the forest is hard.

We believe that conservation of the Misotshi-Kabogo region is important and that some form of conservation area should be gazetted. This should be made in collaboration with the local communities who live in the area to minimize any conflict and to look at ways they could benefit from the creation of such an area.

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