Gorilla beringei graueri

(Gorilla gorilla graueri)

Status report

Document based essentially on
the gorilla report prepared by IRSNB for CMS in 2005,
the World Atlas of Great Apes and their Conservation (published in 2005),
and numerous other primary publications

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1. TAXONOMY AND NOMENCLATURE

1.1. Taxonomical remark

The taxonomy currently followed by CMS (Wilson & Reeder, 1993) recognises a single species of gorilla, *Gorilla gorilla,* with three subspecies. This comprised one western subspecies, *Gorilla gorilla gorilla* and two eastern subspecies, *Gorilla gorilla graueri* (eastern lowland gorilla) and *Gorilla gorilla beringei* (mountain gorilla).

Recently however, western and eastern populations have been widely recognised as separate full species, *Gorilla gorilla* and *Gorilla beringei* respectively. The eastern and western populations are separated by approximately 1,000 km (Garner & Ryder, 1996). Western and eastern populations can be distinguished based on external features (Groves, 2002) and clear geographic and morphological distinctions can also be seen (Garner & Ryder, 1996). Additionaly in the western group, the isolated Nigeria-Cameroon gorillas are now recognised as a subspecies, Cross River Gorilla *G. g. diehli*, of the Western Lowland Gorilla, *G. g. gorilla*, though there is much divergence even within this subgroup. The eastern group includes both the Eastern lowland *G.beringei graueri* and the two mountain populations of *G.b.beringei.* Following the newer taxonomic classification, among the mountain gorillas, the Bwindi mountain gorilla may form a third subspecies, *Gorilla beringei bwindi* (Sarmiento *et al.*, 1996) although the taxonomic status of the populations is as yet unclear (McNeilage *et al.*, 2001). Sarmiento *et al.* (1996) list a number of morphological and ecological differences between the gorillas of Bwindi-Impenetrable Forest and the Virunga volcanoes, and insist that Bwindi gorillas do not belong to *G. g. beringei* and so should not be called mountain gorillas. Stanford (2001) contests this and suggests that the evidence showing the Bwindi and Virunga gorillas to be taxonomically distinct is not well supported. Garner and Ryder (1996) found that the populations of mountain gorilla in the Virungas Volcanoes region and the Bwindi forest were indistinguishable using a particular mitochondrial DNA region.

The following document is a summarized conservation status report for Eastern Lowland Gorilla (or Grauer's Gorilla), *Gorilla beringei graueri*, recognised as a subspecies distinct from the Mountain gorilla since as long as 1914 (Matschie, 1914). It is an endemic taxon living only in eastern Democratic Republic of the Congo.

1.2 Nomenclature

The American physician and missionary Thomas Staughton Savage first described the Western Gorilla (he called it Troglodytes gorilla) in 1847 from specimens obtained in Liberia. The name was derived from the Greek word Gorillai (a "tribe of hairy women") described by Hanno the Navigator, a Carthaginian navigator and possible visitor (circa 480 BC) to the area that later became Sierra Leone.

1.2.1 Scientific name

Gorilla beringei graueri (Matschie, 1914)

In 1914, Paul Matschie, a mammalian taxonomist working at the Humboldt University Zoological Museum in Berlin described as a new species the gorilla inhabiting the lowlands of eastern Belgian Congo. Colin Groves in 1970 revised gorilla taxonomy and recognized (*Gorilla gorilla graueri*) the lowland population of eastern gorilla as a subspecies different to the Mountain Gorilla. Now eastern gorillas are recognised by most of the authors as a species (*Gorilla beringei*) different to the western ones, with two subspecies (*beringei* and *graeuri*), see taxonomical remark.

1.2.2 Synonyms

Gorilla graueri, Gorilla beringeri ?, Gorilla uellensis, Gorilla gorilla rex-pygmaeorum

1.2.3 Common names

English – Eastern Lowland Gorilla, Grauer's Gorilla
French – Gorille de plaine de l'Est, Gorille de Grauer
German – Grauer-Gorilla
Spanish - Gorila de Grauer

1.2.4 Description

The two gorilla species have numerous similarities. Both are very large, the largest living primates, barrel-chested ape with relatively even hair, a bare black face and chest and small ears. The bare shaped brows are joined and the nostril margins are raised. Females are much smaller than males. Adult males range in height from 165-175 cm (5 ft 5 in-5 ft 9 in), and in weight from 140-200 kg (310-440 lb). Adult females are often half the size of a silverback, averaging about 140 cm (4 ft 7 in) tall and 100 kg (220 lb). Occasionally, a silverback of over 183 cm (6 feet) and 225 kg (500 lb) have been recorded in the wild. Gorillas move around by knuckle-walking. The belly of wild gorillas is very much more massive than in captive specimens.

The eastern gorilla tends to be somewhat larger than the western. Differences between the two species include: longer, blacker hair for the eastern; the head hair to not tend to have red-chestnut tones like it is usually the case with adult males western; eastern has a more developed sagittal crest along the midline of the skull, indicative of a more powerful jaw musculature; the saddle of with hair tends to stand out more clearly against the darker hair and to be clearly delineated.

There are few if any absolute physical differences between the two recognised subspecies of Eastern Gorilla. The Mountain Gorilla tends to have very black and longer hair making him a densely furred Gorilla, with a broad face (larger cranium and wider facial skeleton), massive jaws as well as less rounded and more angular nostrils.

Mitochondrial DNA comparisons confirm genetic divergence of the two subspecies, but interpretation of the results is still subject to discussion. Nevertheless it is estimated that the two species diverged some 400000 years ago (Vigilant & Bradley, 2004).

2. BIOLOGY OF THE SUBSPECIES

2.1 General Biology

Gorillas are mainly terrestrial. The gorilla's large size and folivorous habits mean that the animals must spend long hours feeding everyday to maintain their body weight. Of all the great apes, the gorilla shows the most stable grouping patterns. The same adult individuals ravel together for months and usually years at a time. It is because gorillas are mainly foliage eating that they can afford to live in these relatively permanent groups. Foliage, unlike fruit generally and especially the ripe fruits that the ape gut require, comes in large patches than can in turn support large groups of animals.

In the East, fruit form a far lower proportion of the gorilla's diet than in West Africa. Correlated to that, in the East gorilla groups tend much less often to split into temporary subgroups such as they do in West Africa, as animals range far apart searching for the relatively scarce ripe fruit. Gorilla groups can include up to 30-40 animals, but more usually number 5-10.

2.1.1 Habitat

The Gorilla is a forest species. They inhabit tropical rain forests, swamp forests, forest edges and clearings, riverine forests, swamps, and abandoned cultivated fields.

Eastern Lowland gorilla has the widest altitudinal range of any of the gorillas, living in montane, transitional, and lowland tropical forests. They have been reported at a range of densities from 0.25/km² in Maïko NP,

0.55/km² at Mount Tshiaberimu to 1.03-1.26/km² in Kahuzi-Biega (Hall et al., 1998; Harcourt et al., 1981; Plumptre et al., 2003; Yamagiwa et al., 1993).

One of the best studied populations occupies the mountain region of Kahuzi-Biega. Here habitats vary from dense primary forest intermixed with bamboo stands, to moderately moist woodland, to areas of *Cyperus* swamp and peat bog, with alpine and subalpine grassland at higher altitudes, some patches of more open vegetation also occur at lower elevations.

2.1.2 Adaptation

Gorillas are closely related to humans and are considered highly intelligent.

The varied diet of the eastern lowland gorilla includes a wide range of plants, fruits, seeds, leaves, stems and barks as well as ants, termites and other insects. Seasonality in diet and habitat use is greater for Grauer's gorillas in low-altitude forests than for mountain gorillas. Grauer's Gorilla eats more fruit than Bwindi's mountain gorilla but not as much as western gorillas. When fruit are scarce, eastern lowland gorillas travel less and increase their consumption of herbaceous vegetation. Large quantities of bamboo shoots, as well as several types of fruits are eaten seasonally by eastern lowland gorillas of the upper altitudinal reaches of KBNP. These gorillas also occasionally feed on ants, but have not been observed eating insects as often as their congeners in lowland forests. Insects are never more than a minor part of the diet for any gorillas. The ant-feeding sites have all been found in primary or ancient secondary forest on ridges or slopes. Most plant parts are eaten on the ground, although leaves bark, and fruit are sometimes eaten in trees. Signs of feeding activity have more often been observed along gorilla trails in valleys and swamps.

2.1.3 Social behaviour

Much less is known about the social behaviour, feeding ecology, life history and demography of Eastern Lowland Gorilla, compare with the extensive data gathered on the Mountain gorilla.

As far as group structure is concerned, gorillas do form harem. It was once thought that gorilla groups contained only one adult male, but around one third of groups in both East and West Africa have been found to host two full-grown males. In Eastern Lowland Gorilla only about 10 percent of groups are multimale (Yamagiwa et al. 2003). Adult female in anyone silverbacks (dominant adult male) harem are mostly unrelated, and the social ties that exist between them are weak. In contrast to many other primates, it is the bond between each individual female and the silverback, rather than bonds between the females that hold the group together. Upon reaching maturity, both the males and females leave the natal group. The females usually join another group or a lone young adult male, whereas the males remain solitary until they can attract females and establish their own groups (Masicot, 2003). After emigration, some males may spend a large proportion of their time in their natal group's home range (Harcourt *et al.*, 1981). At least with Mountain gorilla, it is unusual for adult males to migrate into other groups (Yamagiwa, 1987). Of the 15 changes in the size and composition of the two main study groups between 1972 and 1974 listed by Harcourt *et al.* (1981), 11 were due to migrations.

Group size is variable among eastern gorillas; groups ranging from 2 to 53 have been observed (80, 189, 196). In general, median group size is similar for both eastern and western gorillas, across various habitat types and the different diets associated with them. In the highland sector of Kahuzi-Biega the mean group size is almost 10 (Inogwabini et al., 2000). But other studies indicate a mean group size of seven animals in Kahuzi-Biega but only three in the adjacent Kasese region (50 Hall et al., 1998b).

The sex ratio at birth is approximately 1:1. Upon reaching maturity, most males and females leave the group in which they were born. Males that emigrate usually remain solitary until they can attract females and establish their own groups; occasionally males form all-male groups. Both natal dispersal and secondary dispersal (subsequent transfer yet to another group) occur among female eastern gorillas. Female eastern lowland gorilla sometimes transfers with another female and their offspring. The absence of infanticide in

that population seems to be the key factor which influences the dispersal and female association. Th e structure and group cohesion seems to keep mainly to avoid predators (Yamagiwa & Kahekwa, 2001).

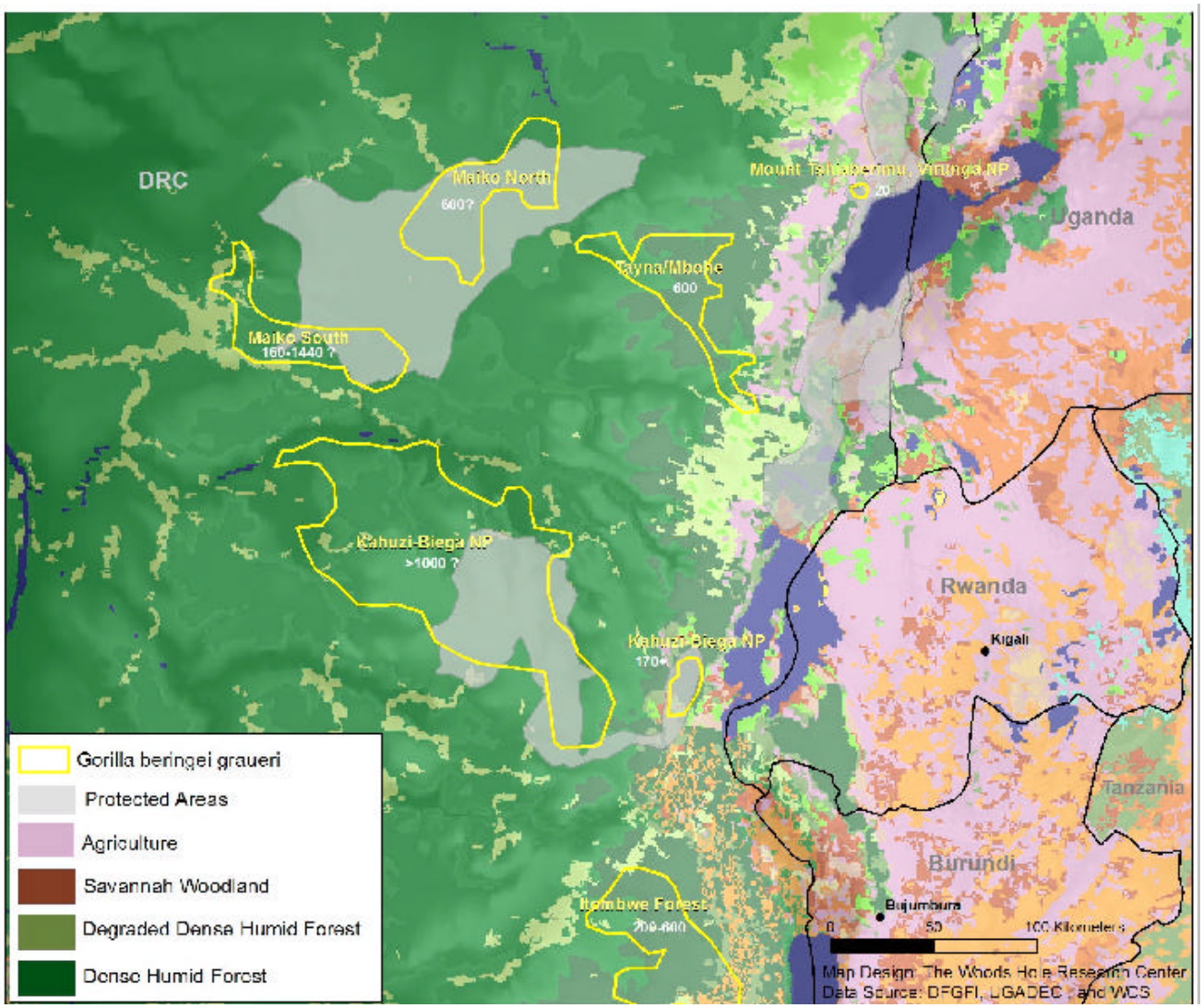
2.2 Distribution (current and historical)

The Eastern Lowland Gorilla occurs only in eastern RDC, between the Lualaba river and the Burundi-Rwanda-Uganda border.

Its distribution is limited to a relatively small area of about 90000 km², within which it is thought to occupy an estimated 15000 km² in five regions:

- the Kahuzi-Biega national Park and the adjacent Kasese region;
- the Maïko National Park and adjacent forest;
- the Itombwe Forest
- the Tayna
- the North Kivu Mbohe

Figure 1. The distribution of the Eastern Lowland Gorilla, *Gorilla beringei graueri*



The Kahuzi-Biega covers an area of 6000 km², ranging in altitude from 600 to 3400m. The Park is divided in two parts, a mountain sector (ca 600 km²) and a lowland sector (5400 km²), connected by a protected

forested corridor. Gorillas occur in both, in the region of Lake Kivu and Mount Kahuzi in the mountain sector, and the Kasese region of the Lowland sector.

Maïko National park and nearby forests are located in the upland region between the central Congo basin and the mountain ranges of the west side of the Rift. The park has an area of about 10800 km² and ranges in altitude from 700 to 1300m.

There are also several community reserves around the area of Maïko, Virunga and Kahuzi-Biega National Parks which host between 700 and 1400 gorillas. One of these community reserve encompasses the Itombwe Forest an area of montane, transitional and lowland tropical forest west of Lake Tanganyika. This nucleus covers an area of 11000 km² in which gorillas are found in four separate sub-populations.

Gorillas occur also in Tanya/Mboke community reserve, in the Masisi region in the North Kivu.

2.3. Evaluation and evolution of populations

Eastern Lowland Gorilla is probably isolated from Mountain gorillas since 400000 years and it is estimated that the two eastern taxa are separated from western counterparts since at least 2000000 years.

The total area known to be occupied by eastern lowland gorillas declined from about 21000 km² in 1963 to 15000 km² by the early 1990s. The overall geographic range calculated from historical locality data was 112000 km² (Butynski, 2001) to be compared to the estimated 90000 km² of today. This illustrates the degree of fragmentation of populations.

By the mid1990s there where estimated to be about 17000 (9000-25000) Eastern Lowland gorillas in at least 11 subpopulations, with ca 86 percent living in the Kahuzi-Biega and the adjacent Kasese region of RDC.

Estimated sizes of the 11 Grauer's Gorilla populations *G. g. graueri* in the mid 1990s (Jefferson S. Hall, Kristin Saltonstall, Bila-Isia Inogwabini and Ilambu Omari Summary of an article published in Oryx 32(2), April 1998*)*

Kahuzi-Biega Park lowland sector + Kasese	14,659
Kahuzi-Biega Park mountain sector	262 [1]
Maiko Park north	826
Maiko Park south	33 [2]
Itombwe Forest A	67
Itombwe Forest B	211
Itombwe Forest C	791
Itombwe Forest D	86
Lowa River	13
Mt. Tshiaberimu	16
Masisi (1988)	28
Total	16,902

More recent events in Kahuzi-Biega and the surrounding region, however, indicate that the taxon has undergone a substantial decline in numbers. Access to much of the gorilla range has been difficult in recent years, and is only just becoming possible again (Hart & Liengola, 2005). The available information is very limited, but there is consensus among field workers that a drastic decline in total population has occurred.

[1] 168 in 2004, after the war (John Hart & Innocent Liengola, 2005)

[2] Tentative estimate that 600 gorillas (including those individuals not making nests) are found within the survey region. Recent results show that populations corresponding to all those identified by Emlen & Schaller still persist in this region and that gorillas currently have a wider distribution and are more abundant than previously estimated. Authors believe that this area is an important and overlooked site for the conservation of Grauer's gorilla. (Stuart-Christopher Nixon, Emile-Emmanuel Ngwe, Kambale Mufabule, Francine Nixon, Didier Bolamba & Patrick Mehlman, 2005)

This is attributed to the combined effects of the rise in demand for coltan ore and the warfare that engulfed the whole of the eastern lowland gorilla range from the late 1990s onwards; armies, rebels, refugees and miners all lived off the land and consumed bushmeat (Pickrell, 2003; Redmond, 2001).

Even if the decline is not well documented, the best example is in the mountain sector of Kahuzi-Biega where only 130 gorillas remained in 1999 down from the 245-262 in the same location in 1996. A small recovery has been observed since with 168 individuals estimated in 2004 (Hart & Liengola, 2005).

The eastern lowland gorilla population in the lowland sector of Kahuzi-Biega is believed by the park wardens to have suffered even greater casualties, falling from a minimum estimated 8000 to perhaps as few as 1,000 individuals (Redmond, 2001). The conflict situation has prevented field surveys, but it is hoped that surveys can now be (or have been?) conducted and will offer a more solid estimate of remaining numbers.
Accurate population estimates for gorillas are often difficult to establish, because their hugely vast range has not yet been thoroughly surveyed. Population counts and estimates of gorillas are commonly carried out on the basis of nest or sleeping site counts (e.g. Inogwabini et al., 2000). Adults and immature weaned animals build new nests to sleep in each night. The nests are counted and any dung adjacent to each nest examined gives a reliable indication of group size as well as age of animal, particularly when the counts are repeated over several nights.

The Eastern lowland gorilla (*G. b. graueri*) (IUCN 2002, EN A2cd + 3cd + 4cd): in the mid 1990s the best available estimate for the eastern lowland gorilla indicates a total population over 10.500 animals, with two main populations in two large national parks, Kahuzi Biega and Maïko NP, in DRC. Its overall conservation status is "endangered", using the most recent IUCN criteria (Harcourt, 1996). In 2000, new evidence suggests that the total may have been reduced to as little as 2,000-3,000 which would be a 60-80% loss in only five years (Redmond, 2001).

More recent rough estimates suggest that the total is a little bit higher, with less than 5,000 Eastern Lowland Gorillas remaining. This recent population estimate is the best guess from experts that know the region well and is based on extrapolations of small surveys and information gathered from talking to local people.

2.4. Migrations - Ranging behaviour

The ranging behaviour of gorillas group is mainly determined by the distribution and abundance of fruit and herbaceous vegetation in the environment (Robbins & McNeilage 2003) which are intrinsically seasonal phenomenon. The ranging behaviour may also be influenced by social factors such as competitions for mates or the mate-guarding tactics of silverbacks (Watts, 1994).

Eastern lowland gorilla groups in montane forest (Higher part of Kauzi-Biega NP) have home ranges of 13-17 km² (Yamagiwa et al. 2003). Although the size of their home range in lower tropical forest is unknown they are maybe larger as they are known to have longer average day journeys in lowland forests than in montane forest.

3. CONSERVATION STATUS, BY PARTY

Democratic Republic of the Congo (Endangered): the Grauer's gorillas is a strict DRC endemic and its national conservation status is equivalent to the global one. Although no firm figures are available, the Eastern Lowland Gorilla seems to have been badly affected towards the end of the 20th century. Due to war and conflict large areas of forest previously occupied by gorillas were cleared and the high demand of fuelwood and food led to human/refugees incursions into protected areas. The high price of coltan (columbium and tantalum) ore led to a further invasion (estimated at 10,000 people), of Kahuzi-Biega the most important single site for Eastern Lowland Gorilla.

4. ACTUAL AND POTENTIAL THREAT

The major threats affecting or having affected Eastern Lowland gorilla populations are (1) habitat loss or modification (e.g. through deforestation, wood extraction, infrastructure development, human settlement and agricultural crops (IUCN, 2002)) and forest encroachment (Muruthi *et al.*, 2000), (2) direct killing (for the bushmeat trade), or hunting (for live animals trade), (3) effects of war and political unrest, disease (4) is a potential threat

4.1 Degradation and decline of habitats

Throughout the gorilla's range, the forests on which it depends for survival are being cut down for timber and to make way for agriculture. Habitat loss is a major threat to gorillas as forests are rapidly being lost to commercial logging interests and subsistence agriculture.

It has been suggested that the rate of habitat loss for the Eastern Lowland Gorilla is the highest of any of the gorilla subspecies (Wilkie et al., 2000). It now occupies only about 13 percent of its geographic range, which at least reflects the extent of the fragmentation of the population involved.

The eastern Lowland Gorillas live at close proximity to (and is sometimes surrounded by) some of the densest rural human populations in Africa, with up to 300-600 per km² and a correspondingly high demand for land and food. As a result, gorillas are increasingly confined to more isolated forest. The increasing human population and the corresponding need for land is a serious and ongoing pressure (Hall et al., 1998). The boundaries of Kahuzi-Biega were altered in 1974, resulting in the loss of an important gorilla habitat. The small isolated Masisi and Mount Tshiaberimu populations are particularly vulnerable to extensive encroachment

The relative remoteness of prime timber areas and the country's poor transportation infrastructure mean that until now, only low-volume, selective logging has been profitable, and then only in limited areas along large rivers. As DRC becomes more stable, it is likely that commercial logging companies will quickly move into its forests. This could seriously impact eastern lowland forests and its gorillas.

4.2 Direct exploitation

Hunting has historically threatened the survival of gorillas. Gorillas are hunted for their meat, as specimens (particularly infants) for collections, and as trophies. The hunting of gorillas for sale as trophies (skins, heads, skulls, feet and hands) emerged in the mid-1970s, and continued until quite recently. Infant gorillas were sold to zoos, researchers, and people who want them as pets. The abduction of infants generally involves the loss of at least one adult, as members of a group will fight to the death to protect their young. Many adults have been killed while trying to protect their infants from this fate. The capture of infant gorillas was a serious threat in the 1970s although it declined greatly through the 1980s and the 1990s.

Various armies active in DRC were systematically exploiting natural resources either to finance themselves or to exchange for weapons. The most important resources were diamonds, copper, cobalt, gold and coltan. Cobalt, coltan and gold high values have attracted miners to locations in east DRC where they are abundant, including for coltan rivers in Kahuzi-Biega. Professional hunters joined the miners to provide meat for them, and the Eastern Lowland gorillas of Kahuzi-Biega were severely affected. Traditionally, gorillas were rarely eaten in the eastern Congo Basin, which has given the Eastern Gorilla a certain amount of protection. These tradition are weakest in areas inhabited by the Eastern Lowland Gorilla and, as seen in KBNP, are fast becoming a thing of the past.

4.3 Impact of Conflict

The early 1990s saw the outbreak of fighting in Rwanda, which by April 1994 had expanded into DRC and resulted in a stream of refugees pouring into gorilla habitat. Indeed, approximately 50% of Rwanda's civilian population were displaced during this conflict, of which 860,000 refugees were concentrated in the vicinity of Virunga National Park (Dudley *et al.*, 2002) and a further 332,000 having fled into DRC near Kahuzi-

Biega. Shortly after the influx of Rwandan refugees in 1994/1995 into DRC, came the 1996 war between the armed forces of DRC and the rebel movement of Kabila, backed by Angola, Rwanda and Uganda.

Subsequently fighting again broke out in 1998 between Rwandan and Ugandan troops and the DRC army. The streams of refugees that were displaced during these conflicts led to uncontrolled firewood harvesting, and increased poaching. Hunting for gorilla meat in Kahuzi-Biega has increased as a result of war and displacement (Plumptre et al., 2003; Redmond, 2001).

In addition to the influx of refugees, the forests that are home to gorillas have served as hiding places and retreats for rebel forces leading to disturbance and hunting. This is a common phenomenon at times of war in forests close to international borders.

The long-term impact of the recent wars in eastern DRC are unclear. The lowland protected areas of DRC , where most of the Eastern Lowland Gorillas occurred during the 1990s remain inaccessible to researchers so it is difficult to assess their status. The population of large mammals in the area around Tshivanga in Kahuzi-Biega was relatively stable between 1990 and 1996 but since then two rebellions have occurred and large number of gorillas have been killed. Over just 4 years the highland sector of Kahuzi-Biega lost more than 95 percent of its elephant population and an estimated 50 percent of its gorilla population.

Conflict have also deterred international conservation organizations, aid agencies and governments from investing in affected areas, leading to frozen budgets, withdrawal of staff, reduction in antipoaching efforts and closure of projects. Protection of the gorillas in many areas has proved extremely difficult and often hazardous in war time. Ten staff members of ICCN (Institut Congolais pour la Conservation de la Nature), for example, were murdered by militiamen who had been hiding in DRC after the genocide in Rwanda, while surveying Kahuzi-Biega boundaries to re-establish the park limits. These are not the first and the only park employees to be kidnapped or killed while they were attempting to protect the area and its wildlife. In all 92 Congolese park staff are reported to have been killed between 1996 and 2004 (IGCP, 2004; Inogwabini et al., 2000; Iyomi & Schuler, 2002; Iyomi & Schuler, 2003).

4.4 Diseases

Another potential general threat to gorillas is exposure to human diseases (e.g Graczyk *et al.*, 2001a; Graczyk *et al.*, 2001b) particularly for habituated gorillas that come into contact with humans, in areas of gorilla tourism (UNEP-WCMC and WWF, 2001). Gorilla tourism exposes gorillas to humans and hence to any diseases that humans may be carrying, some of which the gorillas may never have been exposed to before. At present, this threat is limited for the Eastern lowland gorilla, but habituated group for tourism exist (or at least existed) in the highland sector of Kahuzi-Biega.

Williamson (1999) reported that in Volcanoes National Park the most serious threat to the gorillas may be the acquisition of human parasites and disease and recently a number of gorillas in this Park have died of an unknown illness (UNEP-WCMC, 2003c). An outbreak of a respiratory disease, with the possibility of measles as the primary infection, in the Parc National des Volcans in Rwanda claimed six gorilla lives, and 27 other gorillas were successfully treated (Wallis and Lee, 1999). However, there are few data on the impacts of disease, particularly outside the Virungas (Plumptre *et al.*, 2003). In Rwanda, strict rules are in place to regulate tourist visiting times and the number of tourists per group (Plumptre *et al*, 2003). Other measures are in place and include limiting the approach of humans to 5 m, burying human excrement deeper than 30 cm and chasing gorillas from private lands surrounding the parks (Kalema-Zikusoka *et al.*, 2002).

Beside severe impacts on human populations, several outbreaks of the Ebola virus since 2000 might have claimed thousands of great apes in Africa. The first, in 2000 and 2001, was centred in Uganda, the second outbreak occurred in 2001 and 2002 in Uganda and the Republic of Congo. Ebola hemorrhagic fever is a severe, often-fatal disease that affects humans and non-human primates, such as monkeys, gorillas and chimpanzees. Many scientists believe the disease is spread through the butchering and handling of primate bushmeat. The disease has been confirmed in six African nations: the Democratic Republic of Congo, the Republic of Congo, Gabon, Sudan, Ivory Coast, and Uganda. Up till now Eastern Lowland gorillas had not suffered from outbreaks of the Ebola virus but this could change.

4.5. Other threats

International trade in live gorillas and gorilla parts, which used to be a threat, has declined since the gorilla was listed in Appendix I of CITES.

Accidental entrapment in wire snares used to trap other wild animals is also a threat to gorillas. The impact of this threat needs to be assessed in eastern lowland gorilla area. In 1998, in the highland sector of KBNP, at least one individual in each of the then habituated gorilla group had lost a hand to snares (Yamagiwa, 2003). Occasionally individuals that raid the crops of local people are killed.

5. Regulatory provisions

5.1 International

CMS: Gorilla gorilla is registered in the Annex I of the CMS since 2005.
CITES: Gorilla is on the Annex I of the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) in 1975.
ACCNNR: The Gorilla is also enumerated in A class of the African Convention for the Conservation of Nature and Natural Resources in 1969.

5.2 National

National laws for the control of hunting and catching exists in all the countries where we find gorillas populations, but the lack of funds and the inaccessibility made the strict application of that legislation infrequent.

DRC ratified or acceded to the Convention on Migratory Species in 1990, the Convention on Biological Diversity in 1994, the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) in 1976, the UN Convention to Combat Desertification in 1997, the African Convention on the Conservation of Nature and Natural Resources in 1976, and the World Heritage Convention in 1974. There are five World Heritage Sites: Garamba NP, Kahuzi-Biega NP, Salonga NP, Okapi Faunal Reserve and Virunga NP. All are listed as World Heritage Sites in Danger to human pressures. DRC also participates in UNESCO's Man and Biosphere (MAB) Programme.

The Ministry of Environment, Nature Conservation, and Tourism is the government body responsible for nature conservation.

6. Conservation measures

6.1 Taking prohibition

The taxon is legally protected in the six range states.Nevertheless, illegal takings are an important problem in a part of it.

6.2 Habitat conservation

Table 1. Priority Populations for Eastern Lowland Gorillas (*G. b. graueri*) (All the populations are in DRC)

Population Name	Pop. Size	Area km2	Habitat Type(s)	Habitat or Biogeographic Uniqueness	Land Use Status	Scientific Importance	Other Important Conservation Features	Major Threats	Rationale for Prioritization

Kahuzi-Biega NP Lowland + Kasese & Walikale	unknown (prob >1000) (large prewar)	~12,000 km2 (with fragmentation)	Congo Basin Forest	Still relatively intact forest block	National Park and developing Community Managed Nature Reserves	Scientific studies of metapopulation dynamics in large area	Endemic primate And possibly bird Spp; sympatric with *P.t.schweinfurthii* elephants	Mining, *local* bushmeat trade; agricultural conversion, illegal animal trade	Major pop of *G. b. graueri* , protected area, sympatric with chimpanzees
Tayna	600 (367 - 1169) ***	~1300	Afromontane to transitional forests (1100-2000 m)	Transition: Congo Basin forests to higher altitude Afromontane habitat	DRC - Recognized Community managed Nature Reserve	Long term gorilla research- Tayna and DFGFI staff	Endemic primate and bird spp; sympatric with P.t.schweinfurthii elephant, okapi	Subsistence hunting, Agricultural Conversion, illegal animal trade, small Mining activity	Major Population ,protected area, research, sympatric with chimpanzees
Maiko South	600 (418-1737) ***	>= 2125	Congo Basin forest and mountainous - quite steep topography	Lower altitude but rugged mountainous Congo Basin forests with bais and swamp areas	Includes National Park, and Developing Community nature reserves projects outside boundaries	microhabitat use and biogeographic barriers	okapi, elephant pop crashed, but still other fauna for recovery; sympatric with chimpanzees	Mining and Accompanying local bushmeat trade; Park controlled by rebel group, illegal animal trade	Major pop of *G. b. graueri* (contiguous with Maiko North populations?) protected area, sympatric with chimpanzees
Maiko North	unknown (160-1440 pre-war)	1600	Congo Basin Forest some steep topography	Large intact forest block	National Park	microhabitat use and biogeographic barriers	Sympatric with *P.t.schweinfurthii* and forest elephant, okapi	Mining and accompanying *local* bushmeat trade; Park controlled by rebels	Large intact forest block; protected area; sympatric with chimpanzees
Itombwe Forest	200-600 **	1000-1200	Afromontane and Transitional Forests	Western edge of Albertine Rift, southermost population of Grauer's	Communities Interested in Establishing Community Nature Reserve	High biodiversity area- transition between Basin & Albertine Rift	High local bird endemism; sympatric with P.*t.schweinfurthii*	Armed poaching, snaring,no legal protection of area, mining	Sympatric with chimpanzees, area of high biodiversity and endemism
Kahuzi-Biega NP Highland	170+	300	Afromontane and bamboo forests	Important highland area of Albertine Rift	National Park	High altitude gorilla population and Albertine Rift endemics	Endemic bird spp; sympatric with *P.t.schweinfurthii*	Ilegal wood cutting, invasive plants, fire, subsistence hunting	High altitidue pop of *G. b. graueri*, protected area, sympatric with chimpanzees
Mt. Tshiaberimu Virunga NP	20	60 km²	Montane and bamboo forests; geographic outlier	High altitude and forms part of Albertine Rift	National Park	Long-term research on dynamics of small, isolated populations	Montane and bamboo forests -- Albertine Rift	Subsistence hunting of mammals, agricultural conversion, illegal animal trade	Protected area, sympatric chimpanzees?

1 Accuracy of population estimate is scored as follows: ***indicates the estimate from good transect surveys spread over areas or habitats of population; **indicates estimate based on adequate set of transects from one location, and estimate extrapolated to the rest of the areas/habitats of population; *no scientific estimate of ape density from any location

6.3 Reduction of the obstacles for the migrants

By the actual state of hyabitat preservation the problem is maybe yet real (isolated population). The creation of a network of protected areas near enough, numerous and wide or of corridors, may, at medium term, insure the appropriate security of moves for that species.

Strengthen existing laws for the protection of great apes and improvement of the awareness amongst agencies responsible for its application and amongst the courts.

Readjusment of the Maiko NP has been identified as one of the most pressing actions to take to protect an important western lowland gorillas (and chimpanzees) population.

Preservation efforts should concentrate on the low altitude sector of the Kahuzi Biega and Kasese. The maintaining of a forest corridor between the populations of low altitudes and those of Kahuzi Biega NP heights has also been considered as essential.

The Itombwe forest has also been recommended as needing a particular attention for the preservation of western lowland gorillas.

6.4 Regulation concerning other harmful factors

Implementation of recommendations from International Primatology Society, concerning Ebola epidemies

6.5 Other measures

7. Additional Remarks

8. References

Anon. (2002) International Gorilla Conservation Programme. Programme Profile, November 2002. http://www.awf.org/documents/IGCPProgramProfile1102.pdf Downloaded 27 may, 2003.

AWF (2003) Mountain gorilla poachers jailed in Rwanda. African Wildlife Foundation http://www.awf.org/wildlives/149 Downloaded 27/10/2003.

Barnes, R.F.W. (1990). Deforestation trends in tropical Africa. *Afr. J. Ecol*., 28, 161-173.

Bermejo, M. (2004) Home-range use and intergroup encounters in western gorillas (Gorilla g. gorilla) at Lossi Forest, North Congo. American Journal of Primatology 64, 223-232.

Binyeri, D. K., Hibukabake, D. M and Kiyengo, C. S. (2002) The Mikeno gorillas. *Gorilla Journal*, 25: 5-7.

Blake S., M. Rogers, J. Fay, M. Ngangoue & G. Ebeke. 1995. Swamp gorillas in the northern Congo. Afr J Ecol 33:285-290.

Butynski, T. M. (2001) Africa's Great Apes. In: *Great Apes and Humans: The ethics of Coexistence*. Beck, B., Stoinski, T. S., Hutchins, M., Maple, T.L., Norton, B., Rowan, A., Stevens, E. F. and Arluke, A. (eds). Smithsonian Institution Press, Washington D.C. Pp.3-56.

Byrne, R. W. and Byrne, J. M. E. (1993). Complex leaf gathering skills of mountain gorillas (*Gorilla g. beringei*): Variability and standardization. *American Journal of Primatology*, 31: 241-261.

Doran, DM & A. McNeilage. 1998. Gorilla ecology and behavior. Evol Anthropol 6:120-131.

Doran, DM & A. McNeilage. 2001. Subspecific variation in gorilla behavior: the influence of ecological and social factors. In: Robbins MM, Sicotte P, Stewart KJ, editors. Mountain gorillas: three decades of research at Karisoke.

Doran, D. M., D. Greer, P. Mongo & D. Schwind. (2004) Impact of ecological and social factors on ranging in western gorillas. American Journal of Primatology 64, 207-222.

Dudley, J. P., Ginsberg, J. R., Plumptre, A. J., Hart, J. A.&Campos, L. C. (2002). Effects of war and civil strife on wildlife and wildlife habitats. *Conservation Biology*, 16 (2); 319-329.

ECOLEX (2003) ECOLEX – A gateway to environmental law. http://www.ecolex.org/SPECIES/search/FA_search.htm Downloaded 28/07/2003.

Fay, JM, M. Agnagna, J. Moore & R. Oko. 1989. Gorillas (Gorilla gorilla gorilla) in the Likouala swamp forests of north central Congo: preliminary data on population and ecology. Int J Primatol 10:477-486.

Garner, K. J.&Ryder, O. A. (1996). Mitochondrial DNA diversity in gorillas. *Molecular and Phylogenetic and Evolution*, 6 (1): 39-48.

GRASP (2004) http://www.unep.org/grasp/Fact_gorilla.asp

Graczyk, T. K. & Cranfield, M. R. (2003) Coprophagy and intestinal parasites: Implications to human-habituated mountain gorillas (*Gorilla gorilla beringei*) of the Virunga mountains Bwindi Impenetrable Forest. *Primate Conservation*, 19: 58-64.

Graczyk, T. K., Cranfield, M. R., & Eilenberger, U. (2001a) Hyperkeratotic mange caused by *Sarcoptes scabiei* (Acariformes: Sarcoptidae) in juvenile human-habituated mountain gorillas (*Gorilla gorilla beringei*). *Parasitol. Res.*, 87: 1024-1028.

Graczyk, T. K., DaSilva, A. J., Cranfield, M. R., Nizeyi, J. B., Kalema, G. R. N. N. & Pieniazek, N. J. (2001b) *Cryptosporidium parvum* Genotype 2 infections in free-ranging mountain gorillas (*Gorilla gorilla beringei*) of the Bwindi Impenetrable National Park, Uganda. *Parasitol. Res.*, 87: 368-370.

GROMS (2002) Species Fact Sheet – Gorilla gorilla. http://www.biologie.uni-freiburg.de/data/zoology/riede/groms/Species_HTMLs/Ggorilla.html Downloaded on 30 April 2003.

Groves, C. (2002) *Primate Taxonomy*. Smithsonian Institute Press, Washington and London.

Hall, J.S., Saltonstall, K., Inogwabini, B.I., Omari, I. (1998a) Distribution, abundance and conservation status of Grauer's gorilla. Oryx 32 (2): 122–130.

Hall, J.S., White, L.J.T., Inogwabini, B.I., Omari, I., Morland, H.S., Williamson, E.A., Saltonstall, K., Walsh, P., Sikubwabo, C., Bonny, D., Kiswele, K.P., Vedder A., Freeman, K. (1998b) Survey of Grauer's gorillas (Gorilla gorilla graueri) and eastern chimpanzees (Pan troglodytes schweinfurthi) in the Kahuzi-Biega National Park lowland sector and adjacent forest in eastern Democratic Republic of Congo. *International Journal of Primatology* 19 (2): 207–235.;

Hamilton, A., Cunningham, A., Byarugaba, D. & Kayanja, F. (2000) Conservation in a region of political instability: Bwindi Impenetrable forest, Uganda. *Conservation Biology*, 14(6): 1722-1725.

Harcourt, A.H., 1996. Is the Gorilla a threatened species? How should we judge? Biological Conservation 75. 165-186.

Harcourt, A. H., Fossey, D. & Sabater-Pi, J. (1981) Demography of *Gorilla gorilla*. *Journal of Zoology, London*, 195: 215-233.

Hart J. & Liengola I. (2005) Post-Conflict Inventory of Kahuzi-Biega National Park, Gorilla Journal 30, June 2005

Inogwabini, B., Hall, J. S., Vedder, A., Curran, B., Yamagiwa, J. & Basabose, K. (2000) Status of large mammals in the mountain sector of Kahuzi-Biega National Park, Democratic Republic of Congo, in 1996. *African Journal of Ecology*, 38: 269-276.

IGCP (2004) DRC Crisis in PNVi: Encroachment of Mikeno Sector. http://www.berggorilla.de/igcpmikeno. doc. Accessed December 3 2004

IPS, International Primatology Society. 2004. http://www.ips2004.unito.it/about.html.

Inogwabini, B., Hall, J. S., Vedder, A., Curran, B., Yamagiwa, J., Basabose, K. (2000) Status of large mammals in the mountain sector of Kahuzi-Biega National Park, Democratic Republic of Congo, in 1996. African Journal of Ecology 38: 269–276

IUCN (1982) *The conservation status of the great apes*. The World Conservation Union.

IUCN (1996) *African Primates. Status survey and conservation action plan.* Revised edition. IUCN, Gland, Switzerland, 88 pp.

IUCN (2002) 2002 IUCN Red List of Threatened Species. http://www.redlist.org Downloaded on 30 April 2003.

Iyomi Iyatshi, B., Schuler, C. (2002) Developments in the Kahuzi-Biega Park. Gorilla Journal 25. http://www.berggorilla.de/english/gjournal/texte/25kahuzi.html. Accessed July 12 2004.

Iyomi Iyatshi, B., Schuler, C. (2003) Kahuzi-Biega National Park (PNKB) Update Aug 2003. Born Free. http://www.bornfree.org.uk/primate/kahuzi0308.shtml. Accessed July 12 2004.

Kaiza, D. (2001) Bushmeat: Trade in endangered species threatens apes in Uganda. *The East African Business*, September 3-9, 2001.

Kalema-Zikusoka, G., Kock, R.A. & Macfie, E. J. (2002) Scabies in free ranging gorilla (*Gorilla beringei beringei*) in Bwindi Impenetrable National Park, Uganda. *The Veterinary Record*, 150: 12-15.

Kalpers, J., Williamson, E. A., Robbins, M. M., McNeilage, A., Nzamurambaho, A., Lola N. & Mugiri, G. (2003) Gorillas in the crossfire: population dynamics of the Virunga mountain gorillas over the past three decades. *Oryx*, 37 (3): 326-337.

Kemf, E. & Wilson, A. (1997) *Great apes in the wild – 1997 WWF Species Status Report*. WWF – World Wide Fund for Nature.

Magliocca F. , S. Querouil, A. Gautier-Hion. 1999. Population structure and group composition of western lowland gorillas in north-western Republic of Congo. Am J. Primatol 48:1-14.

Mahaney, W. C., Watts, D. P. & Hancock, R. G. V. (1990) Geophagia by mountain gorillas (*Gorilla gorilla beringei*) in the Virunga Mountains, Rwanda. *Primates*, 31 (1): 113-120.

Masicot, P. (2003) Animal Info http://www.animalinfo.org/species/primate/gorigori.htm

McNeilage, A., Plumptre, A. J., Brock-Doyle, A. & Vedder, A. (2001) Bwindi Impenetrable National Park, Uganda: gorilla census 1997. *Oryx*, 35 (1): 39-47.

Mudakikwa, A. (2001) An outbreak of mange hits the Bwindi gorillas. *Gorilla Journal*, 22. http://www.berggorilla.de/english/gjournal/texte/22scabies.html Downloaded 06/11/2002.

Muruthi, P., Proce, M. S., Soorae, P., Moss, C. & Lanjouw, A. (2000) Conservation of Large Mammals in Africa. What lessons and challenges for the future? In: *Priorities for the Conservation of Mammalian Diversity: Has the Panda had its Day?* EdsA. Entwhistle & N. Dunstone. Conservation Biology 3.

Nellemann & Newton (eds) (2002) The Great Apes – the road ahead. A Globio perspective on the impacts of infrastructural developments on the Great Apes. United Nations Environment Programme. http://www.globio.info/download.cfm?File=region/africa/GRASP_5.pdf

Nishihara T. 1995. Feeding ecology of western lowland gorillas in the Nouabale-Ndoki National Park, Congo. Primates 36:151-168.

Nowak, R. (1995) Uganda enlists locals in the Battle to save the Gorillas. *Science*, 267: 1761- 1762.

Nowak, R.M. (1999) *Walker's Mammals of the World*. 6th Ed. The Johns Hopkins Univ. Press, Baltimore.

Parnell RJ. (2002). Group size and structure in western lowland gorillas (Gorilla gorilla gorilla) at Mbeli Bai, Republic of Congo. Am J Primatol 56:193-206.

Pickrell, J. 2003 Eastern Lowland Gorilla Numbers Plunge to 5,000, Study Says. National Geographic News. http://news.nationalgeographic.com/news/2004/03/0331_040331_easterngorillas.html. Accessed November 26 2004.

Plumptre, A. J.(1995) The Chemical-Composition of Montane Plants and Its Influence on the Diet of the Large Mammalian Herbivores in the Parc- National-Des-Volcans, Rwanda. Journal of Zoology 235:323-337.

Plumptre, A. J. & Harris, S. (1995) Estimating the biomass of large mammalian herbivores in a tropical montane forest: a method of faecal counting that avoids assuming a 'steady state' system. *Journal of Applied Ecology*, 32: 111-120.

Plumptre, A. J., Bizumuremyi, J. B., Uwimana, F. & Ndaruhebeye, J. D., (1997) The effects of the Rwandan civil war on poaching of ungulates in the Parc National des Volcans. *Oryx*, 31(4): 265-273.

Plumptre, A. J., McNeilage, A., Hall, J. S. & Williamson, E. A. (2003) The current status of gorillas and threats to their existence at the beginning of the new millennium. In: *Gorilla Biology, A Multidisciplinary Perspective* (Taylor & Goldsmith, ed.s). Cambridge University Press.

Redmond, I. (2001) Coltan Boom, Gorilla Bust. Report for the Dian Fossey Gorilla Fund (Europe) and Born Free Foundation. http://www.bornfree.org.uk/coltan.)

Robbins, M. M. (1995) A demographic analysis of male life history and social structure of mountain gorillas. *Behaviour*, 132 (1-2): 21-47.

Robbins, M. M. (1996) Male-male interactions in heterosexual and all-male wild mountain gorilla groups. *Ethology*, 102: 942-965.

Robbins, M. M. (1999) Male mating patterns in wild multimale mountain gorilla groups. *Animal Behaviour*, 57: 1013-1020.

Robbins, M.M., McNeilage, A. (2003) Home range and frugivory patterns of mountain gorillas in Bwindi-Impenetrable National Park, Uganda. *International Journal of Primatology* 24 (3): 467–491

Sarmiento, E. E., Butynski, T.M. & Kalina, J. (1996) Gorillas of Bwindi-Impenetrable Forest and the Virunga volcanoes: Taxonomic implications of morphological and ecological differences. *American Journal of Primatology*, 40: 1-21.

Sarmiento, E. E. & Oates, J. F. (2000) The Cross River gorillas : a distinct subspecies, Gorilla gorilla diehli Matschie 1904. *American Museum novitates* , n° 3304.

Sicotte, P. (1995) Interpositions in conflicts between males in bimale groups of mountain gorillas. *Folia Primatol*., 65: 14-24.

Stanford, C. B. (1999) Bwindi-Impenetrable Great Ape Project: Progress Report for 1999. http://www.anthro.ucdavis.edu/gcn/g13bwindi.htm Downloaded 14/05/03.

Stanford, C. R. (2001) The subspecies concept in primatology: The case of mountain gorillas. *Primates*, 42 (4): 309-318.

Tamale, E. S. (1996) Incentive measures for the conservation and sustainable use of biological diversity in Uganda; A case study of the 'Development Through Conservation' Project in communities around Bwindi National park. Presented at a Workshop on Incentives for Biodiversity: Sharing Experiences, Montreal, Canada, 20 August –1 September 1996.

Taylor, D., Marchant, R.A. & Robertshaw, P. (1999) A sediment-based history of medium altitude forest in central Africa: a record from Kabata Swamp, Ndale volcanic field, Uganda. *Journal of Ecology*, 87: 303-315.

Uganda Wildlife Division (2002a) Uganda National Report to CMS (2002) Prepared by Wildlife Division, (in the) Ministry of Tourism, Trade and Industry, - P.O. Box 4241, Kampala, Uganda. http://www.unep-wcmc.org/cms/cop7/proceedings/pdf/national_reports/national_report_uganda.pdf Downloaded 30/10/2003.

Uganda Wildlife Authority (2002b) http://www.uwa.or.ug/research.html Downloaded 26 May, 2003.

UNEP (2002) The Great Apes Survival Project partnership (GRASP): Strategy. United Nations Environment Programme.

UNEP-WCMC (2001) Gorilla – Species sheet. http://www.wcmc.org.uk/species/data/species_sheets/gorilla.htm Downloaded 16 May, 2003.

UNEP-WCMC (2003a) World Conservation Monitoring Centre Protected Areas Database. http://www.wcmc.org.uk/protected_areas/data/wh/bwindi.html Downloaded 16 May, 2003.

UNEP-WCMC (2003b) World Conservation Monitoring Centre Protected Areas Database. http://www.wcmc.org.uk/protected_areas/data/wh/virunga.html Downloaded 16 May, 2003.

UNEP-WCMC (2003c) World Conservation Monitoring Centre Protected Areas Database. http://www.unep-wcmc.org/protected_areas/data/sample/0360p.htm Downloaded 16 May, 2003.

UNEP-WCMC (2003d) World Conservation Monitoring Centre Protected Areas Database. http://www.unep-wcmc.org/protected_areas/data/sample/0238p.htm Downloaded 16 May, 2003.

UNEP-WCMC & WWF International (2001) Gorillas. Threatened Species Account. World Conservation Monitoring Centre and World Wildlife Fund for Nature, International. http://www.panda.org/resources/publications/species/threatened/downloads/GORILLs1.doc Downloaded 15 May, 2003.

UNESCO (1994) United Nations Educational, Scientific and Cultural Organization, Convention concerning the Protection of the World Cultural and Natural Heritage, World Heritage Committee, Eighteenth session, Phuket, Thailand, 12-17 December 1994. http://whc.unesco.org/toc/mainf4.htm Dpwnloaded 16 May, 2003.

Vedder, A. L. (1984) Movement patterns of a group of free-ranging mountain gorillas (*Gorilla gorilla beringei*) and their relation to food availability. *American Journal of Primatology*, 7: 73-88.

Vesperini, H. (2002) Poachers kill two mountain gorillas in bungled raid. *Times*, 15 May 2002. http://abcnews.go.com/sections/science/DailyNews/gorillas990305.html

Vigilant, L., Bradley, B.J. (2004) Genetic variation in gorillas. *American Journal of Primatology*, 64: 161–172.

Wallis, J. & Lee, D. R. (1999) Primate conservation: the prevention of disease transmission. *International Journal of Primatology*, 20 (6): 803-826.

Watts, D. P. (1984) Composition and variability of mountain gorilla diets in Central Virungas. *American Journal of Primatology*, 7: 323-356.

Watts, D. P. (1994) The Influence of male mating tactics on habitat use by mountain gorillas (*Gorilla gorilla beringei*) *Primates*, 35 (1): 35-47.

Watts, D. P. (1997) Agonistic interventions in wild mountain gorilla groups. *Behaviour*, 134: 23-57.

Watts, D. P. (1998) Long term habitat use by mountain gorillas (*Gorilla gorilla beringei*). I. Consistency, variation, and home range size and stability. *International Journal of Primatology*, 19 (4): 651-680.

Whitfield, J. (2002) Gorillas go into virtual reserve: computer model of mountain forest to keep track of threatened apes. *Nature, Science Update*, http://www.nature.com/nsu/021104/021104-18.html

Wilkie, D., Shaw, E., Rotberg, F., Morelli, G., Auzel, P. (2000) Roads, development, and conservation in the Congo Basin. Conservation Biology 14 (6): 1614–1622.

Williamson, L. (1999) Report from the Karisoke Research Centre, Rwanda. *Gorilla Conservation News*, 13, May 1999.

WWF (2002) Gorillas Under Threat. World Wildlife Fund for Nature. http://www.panda.org/downloads/species/Gorillas_Final.pdf Downloaded 26 May, 2003.

WWF (2003) Flagship Species: Eastern Gorillas. World Wildlife Fund for Nature. http://www.panda.org/about_wwf/what_we_do/species/what_we_do/flagship_species/great_apes/eastern_gorilla/index.cfm . Downloaded 26 May, 2003.

Yamagiwa, J. (1987) Intra- and inter-group interactions of an all-male group of Virunga mountain gorillas. *Primate*, 28 (1): 1-30.

Yamagiwa, J. (1999) Socioecological factors influenzing population structure of gorillas and chimpanzees. *Primates*, 40 (1): 87-104.

Yamagiwa, J. (2003) Bushmeat poaching and the conservation crisis in Kahuzi-Biega National Park, Democratic Republic of the Congo. Journal of Sustainable Forestry, 16: 115–135.

Yamagiwa, J., Kahekwa, J., Basabose, A.K. (2003) Intra-specific variation in social organization of gorillas: implications for their social evolution. *Primates* 44: 359–369.

Yamagiwa, J., Mwanza, N., Spangenberg, A., Maruhashi, T., Yumoto, T., Fischer, A., Steinhauer, B.B. (1993) A census of the eastern lowland gorillas Gorilla gorilla graueri in Kahuzi-Biega National Park with reference to the mountain gorillas G. g. beringei in the Virunga region, Zaire. *Biologial Conservation* 64: 83–89.).